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SAFETY CONTROL AND IGNITION APPARATUS FOR FUEL BURNERS

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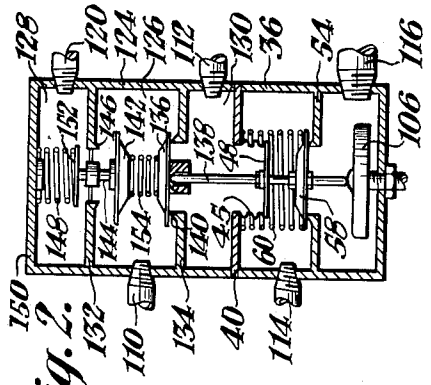


Fig. 2.

Fig. 1.

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SAFETY CONTROL AND IGNITION APPARATUS FOR FUEL BURNERS

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This invention relates to control systems for gaseous fuel burners and more particularly to ignition and safety control systems therefor. The invention is particularly but not exclusively applicable to oven burners in gas ranges with so called "single point" ignition systems.

Single point ignition systems have been proposed comprising a pilot burner adjacent a main oven burner, a main fuel valve or cock for controlling the supply of fuel to the main and pilot burners, a flash tube extending between such pilot burner and a constant burning pilot burner located at a point remote from the main burner, and a safety shut-off device responsive to the presence of flame at the pilot burner for controlling the flow of fuel to the main burner. In the operation of such systems, opening of the main fuel cock admits fuel to the pilot burner which is ignited through the flash tube by the constant burning pilot, and when the thermal element of the safety device becomes sufficiently heated, fuel is admitted to the main burner. When the cock is moved to the closed position, fuel supply to the pilot burner and to the main burner is cut off and the flame at each is immediately extinguished. However, the safety device does not immediately act to prevent flow of fuel to the main burner should the main fuel cock be once again opened since, in thermal devices now known in the art, there is a time lag during which the thermal element must cool sufficiently to cause actuation of the safety valve mechanism.

Thus, if the main fuel cock is turned to the "Off" position and back to the "On" position before the thermal element has had time to cool sufficiently to actuate its shut-off valve mechanism, fuel will be admitted to both the main burner and the pilot burner and unburned fuel will escape from the main burner until the flash tube has become charged with a combustible mixture sufficient to cause ignition of the pilot burner. Such escape of unburned fuel in the confined space of an oven is necessarily accompanied by serious danger of explosions.

It is a principal object of this invention to provide an ignition and safety control system which will not be subject to the aforementioned disadvantage.

It is a further object of this invention to provide an ignition and safety control system wherein instant reignition is assured in rapid "Off-On" operation.

The present invention provides an ignition and safety control system for a main burner including a standby pilot burner which will continue to burn as long as the safety shut-off control for the main burner is in a position to permit flow of fuel to the main burner. This feature is due to the standby pilot burner being provided with a supply of fuel independent of that of the main burner and controlling such supply by means cooperable with the safety shut-off device of the main burner.

The present invention further provides a safety control and single point ignition system wherein unnecessary flashing between an oven pilot burner and a constant burning pilot burner is precluded and accomplishes the same by providing a flash pilot burner disposed in igniting relation with the pilot burner and having its supply of fuel controlled by a thermally responsive safety device which also controls the flow of fuel to the main burner. The control of the fuel supply to the flash pilot burner is such that fuel will be supplied to the flash pilot burner only when the main burner safety device is in a position to prevent flow of fuel to the main burner.

Other objects and advantages will appear hereinafter as the description of the invention proceeds.

The novel features of the invention and how the objects are attained will appear more fully from this specification and the accompanying drawings showing two embodiments of the invention and forming a part of this application.

In the drawing:

Fig. 1 is a diagrammatic showing of a safety control and ignition apparatus for an oven burner embodying this invention with a portion thereof shown in section on an enlarged scale; and

Fig. 2 is a sectional view of an alternative form of valve mechanism for an oven burner control apparatus as shown in Fig. 1.

Referring to Fig. 1 of the drawing, the control apparatus herein illustrated as embodying this invention is shown in connection with a cooking range having the usual oven burner **10** and top pilot burner **12** located remotely from the oven burner **10**. As is customary in equipment of this nature, the various burners receive fuel from a conduit **14** connected to a source of fuel supply. As here shown, the top pilot burner **12** is connected by a pipe **16** to the conduit **14** and is of the constant burning type.

Disposed in the vicinity of and in igniting relation with the oven burner **10** are an auxiliary pilot burner **18** and a standby pilot burner **20** and located in igniting relation with the auxiliary burner **18** is a flash pilot burner **22**. A flash tube **24** of any suitable shape extends between the constant burning pilot burner **12** and the flash pilot burner **22** to conduct a flame therebetween in a manner well known in the art.

The flow of fuel to the oven burner **10**, the standby pilot burner **20**, and the flash pilot burner **22** is under the control of a valve mechanism **26** arranged to be actuated by means responsive to the flame of the auxiliary pilot burner **18** as will more fully appear. Flow of fuel to the oven burner **10** and to the flash pilot burner **22** is also under the control of a main fuel cock **28**, the cock **28** also controlling the flow of fuel to the pilot burner **18**. The main fuel cock **28** may also embody the usual thermostatic control device adjustable together with the cock and being responsive to temperatures in the oven where the oven burner **10** is located. As combined fuel cocks and thermostatic devices are well known, further description is deemed unnecessary, it being understood that the thermostatic device is capable of controlling the flow of fuel to one of a plurality of outlets independently of the cock when the latter has once been opened.

The valve mechanism **26** for controlling the supply of fuel to the oven burner **10**, standby pilot burner **20** and flash pilot burner **22** may comprise a casing **30** made up of three aligned sections here referred to as an upper section **32**, a middle section **34** and a lower section **36**. A plate **38** is disposed between the upper and middle sections **32, 34** to form a partition therebetween and similarly, a plate **40** is disposed between the middle and lower sections **34, 36** to form a partition therebetween. The three sections **32, 34, 36** of the casing **30** and the plates **38, 40** may be clamped together by any suitable means (not shown). Each of the plates **38, 40** is provided in its central portion with an aperture **42** and means for transmitting mechanical movement through the aperture while preventing flow of fluid therethrough. As here shown, flexible, corrugated, bellows-type walls **44, 45** are respectively secured at one end to the plates **38, 40** immediately adjacent the periphery of the apertures **42** and at the other end to movable plates **46, 48**.

The lower section 36 of the casing 30 is provided with an inlet opening 50 and an outlet opening 52 separated by a ported partition 54 provided with a suitable valve seat 56 adapted to cooperate with a valve member 58 in the usual manner to interrupt flow between the inlet and the outlet openings 50, 52. A valve stem 59 is secured to the valve member 58 to extend on either side thereof with the upper end of the stem 59 abutting the lower surface of the movable plate 48. A spring 60 acts between the plate 40 and the valve member 58 to bias the valve member 58 toward the seat 56.

The middle section 34 of the casing 30 is provided with an inlet opening 62 and an outlet opening 64 separated by a ported partition 66 provided with a suitable valve seat 68 cooperable with a valve member 70 in the usual manner to interrupt flow between the inlet opening 62 and the outlet opening 64. The valve member 70 may have a centrally disposed boss 72 formed on its underside and provided with an axially extending recess 74 for the reception of a valve stem 76. The valve stem 76 may be threaded into the movable plate 48 and locked in position relative thereto by a lock nut 78. A rod 79 extends from the upper face of the valve member 70 and abuts the lower side of the movable plate 46.

The upper section 32 of the casing 30 is provided with an inlet opening 80 and an outlet opening 82 separated by a ported partition 84 having a suitable valve seat 86 cooperable with a valve member 88 to interrupt flow between the inlet opening 80 and the outlet opening 82. The valve member 88 is carried on one end of a valve stem 90 journaled in a bearing 92 and carrying on its other end a plate 94. A spring 96 interposed between the plate 94 and the end wall 98 of the upper section 32 of the casing 30 acts to bias the valve member 88 away from the seat 86 and a spring 100 acting between the valve member 88 and the movable plate 46 biases the valve member 88 toward the seat 86.

The thermostatic element for operating the valve mechanism consists, in this embodiment, of the usual bulb 102, capillary tube 104 and an expansible element 106 mounted in the end wall 108 of the lower section 36 of the casing 30. The bulb 102 is disposed adjacent the auxiliary pilot burner 18 to be heated by a flame emanating therefrom and the expansible element 106 engages the lower end of the valve stem 59.

The inlet 50 of the lower section 36 of the casing 30 is connected to the main fuel cock 28 by a conduit 110 and the outlet 52 of the lower section 36 is connected to the oven burner by a conduit 112. Communication is maintained between the inlet 62 of the middle section 34 of the casing 30 and the conduit 14 by a pipe 114 and a pipe 116 connects the outlet 64 of the middle section 34 with the standby pilot burner 20. The inlet opening 80 of the upper section 32 of the casing 30 is connected to the main fuel cock 28 by a pipe 118 and the outlet 82 of the upper section 32 is connected to the flash pilot burner 22 by a pipe 120. Fuel may be supplied to the auxiliary pilot burner 18 by means of a pipe 122 connected thereto and to the pipe 118.

The operation of the apparatus is as follows: The main fuel cock 28 is first manually operated to the open position to admit fuel to the lower section 36 and the upper section 32 of the casing 30 and to the pilot burner 18 through pipes 110, 118 and 122 respectively. With the bulb 102 in an unheated condition, the valve mechanism 26 would be in the position shown in Fig. 1, the valve member 58 being seated on the seat 56 to prevent flow of fuel to the main burner 10 and the valve member 88 being unseated to permit flow of fuel to the flash pilot burner 22. Thus fuel will flow to the flash pilot burner 22 and, upon flowing therefrom, will enter the flash tube 24 and be ignited from the constant burning pilot burner 12. The flame so created will then be conducted back through the flash tube 24 and will ignite the fuel flowing from the flash pilot burner 22, the flame at the flash pilot burner 22 in turn being effective to ignite the fuel flowing from the auxiliary pilot burner 18. The flame emanating from the pilot burner 18 will heat the bulb 102 to cause expansion of the expansible element 106 and consequent upward movement of the valve stem 59 and associated valve member 58 to permit fuel to flow between the inlet 50 and outlet 52 of the lower section 36 of the casing 30, through the conduit 112 to the oven burner 10 where it is ignited from the pilot burner 18.

Upward movement of the valve stem 59 will cause upward movement of the movable plate 48 and its associated valve stem 76 which in turn causes the valve member 70 to be moved away from its seat 68 to permit fuel to flow between the inlet 62 and outlet 64 of the middle section 34 of the casing 30, through the pipe 116 to the standby pilot burner 20 where it is ignited from the oven burner 10. Upward movement of the valve member 70 will cause the rod 79 to move the movable element 46 upward, compressing the spring 100 and moving the valve member 88 against the bias of the spring 96 into engagement with the seat 86 to cut off the supply of fuel to the flash pilot burner 22. The apparatus is now in condition for steady state operation.

If the main cock 28 is now manually operated to the closed or "Off" position to cut off the supply of fuel to the pilot burner 18, the upper section 32 of the casing 30 and the lower section 36 of the casing 30, the flames at the pilot burner 18 and at the oven burner 10 will be immediately extinguished, however, since the supply of fuel to the standby pilot burner 20 is independent of the main cock 28 the flame at the standby pilot burner 20 will continue to burn until the bulb 102 has cooled sufficiently to cause the expansible element 106 to contract permitting the valve members 70, 58 to move into engagement with their seats.

It will be apparent that if the main cock 28 is returned to the "On" position before the bulb 102 has had an opportunity to cool sufficiently to close the valve 56, 58 which controls the flow of fuel to the oven burner 10, fuel will be admitted to the oven burner 10 and be immediately ignited from the standby pilot burner 20 since the expansible element will maintain the valve element 70 in a position to permit a flow of fuel to the standby pilot burner 20 as long as the valve member 58 is in a position to permit flow of fuel to the oven burner 10. It will also be apparent that unnecessary flashing in the flash tube will be precluded since the operative connection between the valve member 70 and the valve member 88 will hold the valve member 88 on its seat 86 to prevent flow of fuel to the flash pilot burner 22 as long as the valve member 70 is in a position to supply fuel to the flame at the standby pilot burner 20.

The modified construction illustrated by Fig. 2, in which like numerals designate corresponding parts, is a departure from that shown in Fig. 1 in that only two casing sections are used and a double valve controls the flow of fuel to the flash pilot burner 22 and the main burner 10 permitting flow of fuel to either in the alternative.

The upper section 124 of the casing of the valve mechanism of Fig. 2 is provided with an inlet chamber 126 separated from outlet chambers 128, 130 by ported partitions 132 and 134 respectively. A valve member 136 is carried by a valve stem 138 connected to the movable plate 48 and is cooperable with a valve seat 140 formed on the partition 134 to interrupt the flow of fuel from the inlet chamber 126 to the outlet chamber 130. A valve member 142 carried on a valve stem 144 is cooperable with a valve seat 146 formed on the partition 132 to interrupt flow of fuel between the inlet chamber 126 and the outlet chamber 128. A spring 148 acts between the end wall 150 of the upper section 124 and a plate 152 carried by the valve stem 144 to bias the valve member 142 away from the seat 146, and a spring 154 is disposed between the valve member 136 and the valve member 142 to bias such members away from each other, the strength of the spring 148 relative to

the strength of the spring **154** being such that the position of the valve member **142** when the expansible element **106** is in its nonexpanded condition will be as shown in Fig. 2 with the valve element **136** seated on the seat **140** and the valve element **142** positioned away from the seat **146**.

The inlet chamber **126** of the upper section **124** communicates with the pipe **110** so that supply of fuel to the upper section **124** is under the control of the main cock **28**. The outlet chamber **128** of the upper section **124** communicates with the pipe **120** and thus with the flash pilot burner **22** while the outlet chamber **130** of the upper casing **124** communicates with the pipe **112** and thus with the oven burner **10**. The inlet of the lower section of the casing is connected to the pipe **114** and thus is in communication with the conduit **14** and a source of fuel without being subject to the control of the main cock **28**. The outlet of the lower section **36** is connected to the standby pilot burner **20** through the pipe **116**.

Operation of the apparatus of Fig. 2 is similar to that of Fig. 1 and it will be apparent that fuel will be permitted to flow through the ported partition **54** to the standby pilot burner **20** to maintain a flame thereat as long as the valve member **136** is in a position to permit a flow of fuel to the main burner **10**.

It will be apparent from the foregoing that the illustrated embodiments of the invention obviate the possibility of fuel being admitted to the oven burner when there is no pilot flame in igniting relation thereto and it will also be apparent to those skilled in the art that the illustrated embodiments of the invention provide new and improved safety control and ignition apparatus. On the other hand, it will be obvious to those skilled in the art that the illustrated embodiments may be variously changed and modified, or features thereof, singly or collectively, embodied in other combinations than those illustrated without departing from the scope of the invention or sacrificing all of the advantages thereof, and that accordingly the disclosures herein are illustrative only and the invention is not limited thereto.

I claim:

1. In a main fuel burner control and ignition system having a standby pilot burner and a flash pilot burner, a control device comprising a casing having fuel outlets for a main burner, standby pilot burner and flash pilot burner respectively and a plurality of fuel inlets, a plurality of apertured valve seats in said casing interposed one between each of said inlets and outlets respectively, a valve assembly in said casing including a plurality of aligned valve elements connected together for movement relative to said valve seats substantially as a unit for controlling fuel flow to said outlets respectively, and thermally responsive means for moving said assembly between controlling positions, said valve elements being positioned relative to each other and to said seats to prevent fuel flow to said main and standby burner outlets while permitting fuel flow to said flash burner outlet in one position of said assembly and to permit fuel flow to said main and standby burner outlets while preventing fuel flow to said flash burner outlet in another position of said assembly.

2. In a main fuel burner control and ignition system having a standby pilot burner and a flash pilot burner, a control device comprising a casing having fuel outlets for a main burner, standby pilot burner and flash pilot burner respectively and a plurality of fuel inlets, a plurality of apertured valve seats in said casing axially aligned with each other and interposed one between each of said inlets and outlets respectively, a first valve element in said casing movable between controlling positions relative to one of said valve seats for controlling fuel flow to said main burner outlet, a second valve element in said casing movable between controlling positions relative to a second of said valve seats for controlling fuel flow to said standby pilot burner outlet, a third valve element in said casing movable between controlling positions relative to a third of said valve seats for controlling fuel flow to said flash pilot burner outlet, connection means for connecting said valve elements together for movement substantially as a unit, means for biasing said first and second valve elements to fuel flow preventing position and said third valve element to fuel flow permitting position, and means movable in response to changes in a temperature condition for moving said valve elements against said bias upon an increase in said temperature.

3. Apparatus as claimed in claim 2 wherein said connection means includes a yieldable connection between said second and third elements.

4. In a main fuel burner control and ignition system having a standby pilot burner and a flash pilot burner, a control device comprising an elongated casing having a pair of spaced yieldable partitions dividing the interior thereof into three aligned valve chambers, each of said chambers being provided with an inlet adapted for connection with a source of fuel and a fuel outlet adapted for connection with a main burner, standby pilot burner, and flash pilot burner respectively, an apertured valve seat in each of said chambers between each of said inlets and outlets respectively said valve seats being aligned with each other, valve means including a valve element in each of said chambers movable between controlling positions relative to said valve seats for controlling fuel flow to each of said outlets, means cooperable with said yieldable partitions for connecting said valve members together for movement substantially as a unit relative to said valve seats, means for biasing said unit to a first position wherein said valve elements are disposed to prevent fuel flow to said main and standby burner outlets while permitting fuel flow to said flash burner outlet, and means responsive to a temperature condition and operatively connected to one of said valve elements for moving said unit to a second position wherein said valve elements are disposed to permit fuel flow to said main and standby burner outlets while preventing fuel flow to said flash burner outlet.

5. In a main fuel burner control and ignition system having a standby pilot burner and a flash pilot burner, a control device comprising an elongated casing having a yieldable partition dividing the interior thereof into two aligned valve chambers adapted for connection with a source of fuel, one of said chambers being provided with an outlet adapted for connection with a main burner, the other of said chambers being provided with a pair of outlets adapted for connection with standby and flash pilot burners respectively, valve means including a plurality of apertured valve seats aligned with each other and interposed between said source and said outlets respectively and a valve element in each of said chambers movable between controlling positions relative to a selected one of said valve seats for controlling fuel flow to each of said outlets, means cooperable with said yieldable partition for connecting said valve members together for movement substantially as a unit relative to said casing, means for biasing said unit to a first position wherein said valve elements are disposed to prevent fuel flow to said main and standby burner outlets while permitting fuel flow to said flash burner outlet, and means responsive to a temperature condition and operatively connected to one of said valve elements for moving said unit to a second position wherein said valve elements are disposed to permit fuel flow to said main and standby burner outlets while preventing fuel flow to said flash burner outlet.

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