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2,679,560

IGNITION AND CONTROL SYSTEM FOR FUEL BURNERS

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2 Sheets-Sheet 1

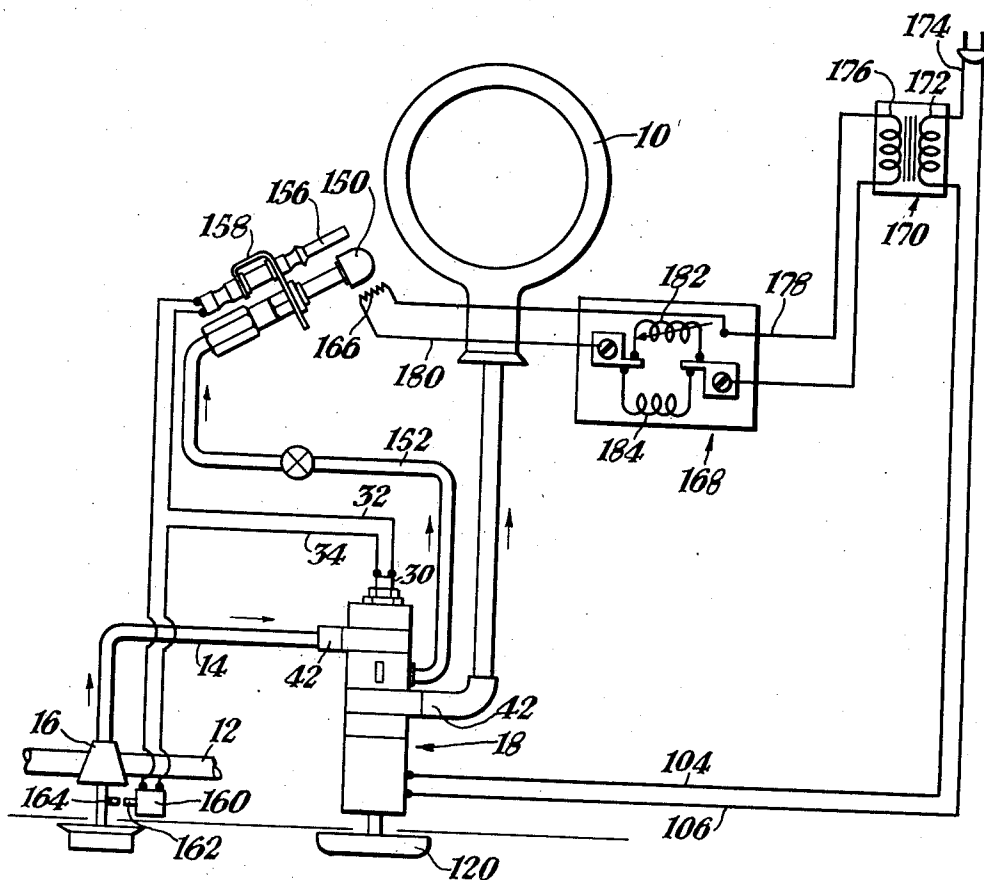


Fig. 1.

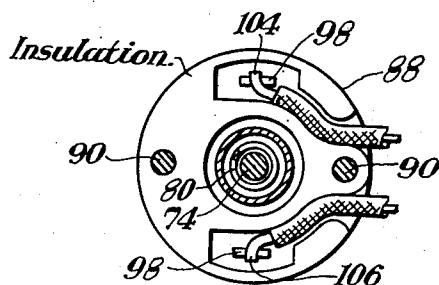


Fig. 6.

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2 Sheets-Sheet 2

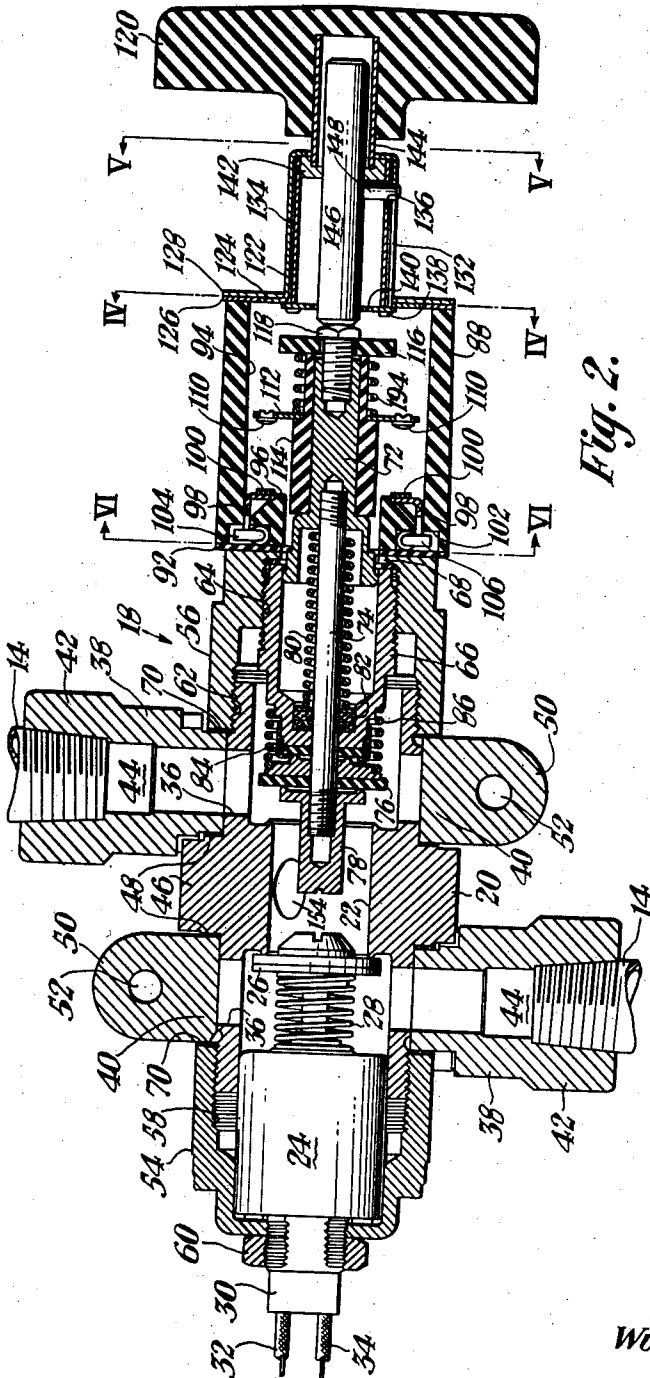


Fig. 2.

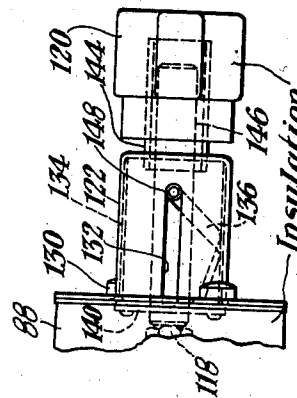


Fig. 3.

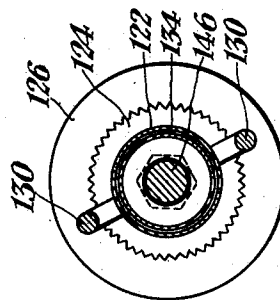


Fig. 4.

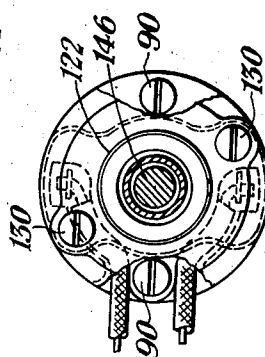


Fig. 5.

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2,679,560

IGNITION AND CONTROL SYSTEM FOR FUEL BURNERS

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3 Claims. (Cl. 200-61.86)

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This invention relates to control and ignition systems for fuel burners and, more particularly, to combined thermoelectric pilot control and electric ignition apparatus for domestic gas ranges.

Electric ignition by hot wire coils for gas burners usually involves electrical connections through step-down transformers to commercial sources of current supply. The voltage from such sources may vary considerably with standard transformers and seriously limit the life of the igniter coil. Moreover, as the igniter is required only for limited periods during range operation, it is unnecessarily wasteful to maintain any part of the electrical system in energized condition beyond such limited periods.

An object of this invention is to obtain reliable igniter performance over a wide range of voltage fluctuations while also extending the useful life of the igniter.

Another object of the invention is to completely deenergize the igniter circuit as soon as the gas burner produces a flame.

Another object of the invention is to secure complete shut-off of fuel to both main and pilot burners in a range compartment upon operation of the automatic pilot device.

Another object of the invention is to control the automatic pilot device by the customary manipulation of the main shut-off valve.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a schematic view of a control and ignition system embodying the invention,

Fig. 2 is a longitudinal sectional view through the control device of this invention,

Fig. 3 is a fragmentary plan view of the handle or knob portion of the control device,

Fig. 4 is a cross-section taken on the line IV—IV of Fig. 2,

Fig. 5 is a cross-section taken on the line V—V of Fig. 2 and

Fig. 6 is a cross-section taken on the line VI—VI of Fig. 2.

Referring more particularly to Fig. 1 of the drawings, a main fuel burner 10 is supplied with fuel from a manifold 12 by way of a main fuel pipe 14 and under control of the usual rotary gas cock 16 carried by the manifold 12.

Interposed in the main fuel supply pipe 14 between the gas cock 16 and the main burner 10 is a control device designated generally by the reference numeral 18. The construction of the

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control device 18 is shown more clearly in Figs. 2 to 6 inclusive and includes a tubular body member 20 provided with an internal annular valve seat 22 interrupting the contour of the flow passage through the tubular body member 20 at a point substantially midway between the ends. One end of the tubular member 20 supports an electromagnetic device 24 embodying the usual winding and armature (not shown). The electromagnetic device 24 is operable to retain a fuel control means or valve member 26 carried thereby in spaced arrangement with one side of the valve seat 22 when the electromagnet is energized and to permit the valve member 26 to engage the valve seat 22 under bias of a spring 28 when the electromagnet is deenergized. The opposite end of the electromagnet device projects from the tubular member 10 and carries the usual terminal connector 30 through which the leads 32, 34 for the magnet winding are carried.

The tubular member 20 is provided with a plurality of ports 36 extending through the wall thereof on either side of the valve seat 22. Any number of ports may be utilized and spaced circumferentially around the tubular member 20 to provide different degrees of adjustment for a pair of connecting members 38. Each of the members 38 has an annular portion 40 and a hollow end portion 42 for cooperation with the tubular member 20 to afford adjustable connecting means. The connecting members both have a passage 44 extending through the hollow end portion 42 and terminating at one end in a threaded internal connection to receive a threaded end of the main fuel pipe 14. In this embodiment, the connecting means 42 on the left-hand side of the valve seat 22, as viewed in Fig. 2 of the drawings, provides an inlet connection for the fuel pipe 14 while the connecting means 42 on the right-hand side of the valve seat 22 provides an outlet connection therefor.

The annular portion 42 of each connecting member 38 is rotatable on the tubular member 20 in order to align the passages 44 with any one of the ports 36 as previously indicated. When such alignment has occurred, each annular portion 40 is clamped in engagement with opposite faces respectively of an external annular abutment 46 which extends from the tubular member 20 opposite the valve seat 22 by means to be more fully described. The opposite faces of the abutment 46 form oppositely disposed seats for each annular portion 40 and a pair of packing rings 48 may be interposed between these abutting end faces for sealing against leakage.

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Each of the connecting members may be provided with means for mounting the control device in a selected location at the point of use. Thus, a lug 50 projects transversely from the annular portion 40 of each connecting member opposite the hollow end portion 42. The lug 50 is approximately equal to the width of the annular portion 40 across the end faces thereof and is relatively shallow in thickness. A perforation 52 is provided in the lug 50 for the reception of a bolt, screw or other securing means when the device is installed.

The connecting members are secured in the selected position by means movable relatively to the tubular member 20 from opposite ends thereof. This means takes the form of end cap members 54 and 56 which may be generally similar in form except as necessarily modified by the particular structure of the control device. In this embodiment, the end cap 54, which is located at that end of the tubular member 20 having the electromagnetic device 24, is provided with internal threads 58 which engage complementary threads on the tubular member 20 for securing the connecting member in position. The end cap 54 is suitably flanged to extend partly around the electromagnetic device 24 and through which the terminal connector 30 projects. The terminal connector 30 is threaded for engagement by a nut 60 which abuts the flanged end of the end cap 54 and serves to secure the electromagnetic device 24 against endwise movement.

The end cap 56 at the opposite end of the control device 18 also has an internal threaded end 62 engaging a complementary threaded end of the tubular member 20. In addition, this end cap 56 is provided with a threaded bore 64 which engages a threaded portion of a reset housing 66 and serves to secure it in position in the cap 56 by provision of a flanged end 68, which engages the end of the reset housing 66. A second pair of packing rings 70 may be provided between the abutting faces of the end caps 54 or 56 and the annular portion 40 of each of the connecting members to seal against leakage at these points.

The reset housing 66 is suitably apertured at one end for slidable engagement with a reset stem 72 which projects exteriorly therefrom and carries an extension rod 74 on its inner end projecting toward the valve member 26. A second valve member 76 is carried on the projecting end of the extension rod 74 and is adapted to engage the opposite side of the valve seat 22 from that engaged by the valve member 26. Such engagement occurs when reciprocation of the reset stem 72 takes place and it is desired that the flow of fuel past the valve seat 22 be interrupted during the resetting operation when the main valve member 26 is moved off its seat. Such movement is effected by the valve member 26 being engageable by a cap nut 78 carried on the end of the extension rod 74 but which is normally spaced from the valve member 26.

The flow interrupter valve member 76 is biased away from the valve seat 22 by a coil spring 80 which is operative between the reset stem 72 and a packing ring 82 for the extension rod 74. A second packing ring 84, secured on the end of the housing 66, is adapted to be engaged by the flow interrupter 76 in its biased position and serves as an additional shield against leakage along the rod 74. A second coil spring 85 is operative between the flow interrupter valve 76 and the housing 66 for biasing the valve 76 toward

the cap nut 78. It will be apparent, however, that the coil spring 80 is stronger than the coil spring 85 in order that the described biased position of the flow interrupter valve 76 may be established in the absence of extraneous force on the reset stem 72 tending to overcome such bias. The essential structure of the control device 18, so far described, forms the subject matter of a copending application of Eskin et al., Serial No. 675,038, filed June 7, 1946, and which has become Patent No. 2,603,509, issued July 15, 1952, and assigned to the assignee of the present invention.

In this invention, switching means are associated with the control device 18 for a purpose which will be apparent hereinafter. To this end, a switch housing 88 of insulating material is secured by screws 90 to the end wall of the end cap 56, there being a cover plate 92 interposed therebetween. The switch housing 88 is substantially rectangular in cross-section and has an axial opening 94 therein terminating in an internal annular flange 96. A pair of terminals 98 of angular form project through the annular flange 96 which is suitably recessed for such purpose and each carries one of a pair of contacts 100 positioned in the opening 94. The opposite side of the annular flange 96 is provided with a pair of arcuate channels 102 to receive a pair of conductors 104, 106 attached to the terminals 98. As will be apparent, the cover plate 92 serves to retain the conductors 104, 106 in position in the channels 102, and the terminals 98 in the recessed flange 96, when the switch housing 88 is secured in position on the end cap 56.

The contact pair 100 is adapted for cooperation with a pair of relatively movable contacts 110 which are supported on a contact plate 112 carried by an insulating sleeve 114 for the reset stem 72. Contact pressure is adjusted by the provision of a coil spring 114 which is operative between the contact plate 112 and insulating collar 116 secured to the end of the reset stem 72 by a set screw 118 projecting axially therefrom. It will be apparent that rectilinear movement of the reset stem 72 by pressure applied to the head of the screw 118 will serve not only to conduct the resetting operation described but also to cause concomitant closure of the switch contact pairs 100, 110.

The rectilinear movement of the reset stem 72 is effected by the usual rotary manipulation of the handle or knob 120 of the control device 18. Consequently, means are provided for translating rotation of the handle 120 into rectilinear movement of the reset stem 72. Such means take the form of an outer sleeve element 122 having a serrated flange 124 formed on the inner end thereof for engagement with a locking plate 126 having a complementary serrated aperture therein. A cover plate 128 extends over the flange 124 and the locking plate 126 and carries a pair of screws 130 by which the parts are secured to the end face of the switch housing 88. The outer sleeve element 122 is provided with a longitudinal slot 132 extending from adjacent the outer end thereof to the flange 124 thereon.

An inner sleeve element 134 is rotatably mounted in the outer sleeve element 122 and is provided with a substantially helical slot 136 terminating at its outer end opposite the outer end of the longitudinal slot 132. The inner end of the outer sleeve element 122 is provided with a pair of oppositely disposed lugs 138, conveniently struck up from the material of the flange 124, and serving to retain an annular cover plate

140 in position between the flange 124 and the adjacent end of the inner sleeve element 134. The opposite end of the inner sleeve element 134 is secured by soldering or other means to a bushing 142 which is also similarly secured to a tubular drive element 144 upon which the handle or knob 120 is carried in driving engagement. The rotary motion of the knob or handle 120 is transmitted to the inner sleeve element 134 by the tubular drive element 144 to rotate the inner sleeve element 134 relative to an operating stem 146 which extends from within the tubular member 144 into operative engagement with the head of the screw 118 and carries a detent 148 intermediate its ends which projects through the slots 136 and 132 in the inner and outer sleeve elements 134, 122, respectively. It will be apparent that due to the helical nature of the slot 136, the rotary motion of the handle 120 and the inner sleeve 134 will be translated into rectilinear movement of the reset stem 72 as rotation of the operating stem 146 is prevented by engagement of the detent 148 with the sides of the longitudinal slot 132 and only a sliding movement thereof can occur.

Referring again more particularly to Fig. 1 of the drawings, the preferred embodiment of the invention includes a pilot burner 150 for effecting ignition of the main burner 10 and being located in lighting proximity thereto. The pilot burner 150 is supplied with fuel by a conduit 152 which is connected to the control device 18 by way of an inlet port 154 which communicates with the valve seat 22 intermediate the valve members 26 and 76. Thus, the pilot burner 150 receives a supply of fuel from the main fuel pipe 14 whenever the valve member 26 is disengaged from the valve seat 22, it being apparent hereinafter that the interrupter valve member 76 is engaged with the valve seat 22 immediately prior to the time that the cap nut 78 opens the valve member 26 during the resetting operation.

The electromagnetic device 24 is adapted to be energized by current generated by thermoelectric means responsive to the heat of a flame at the pilot burner 150. To this end, a tubular type thermocouple 156 is shown as supported on a bracket 158 in unitary arrangement with the pilot burner 150 and located in heating proximity thereto. The lead 32 from the electromagnet 24 is connected directly to the thermocouple 156 while the lead 34 therefrom is connected through a main switch 160 to the other terminal of the thermocouple 156. The main switch 160 is preferably of the normally closed type having its operating member 162 positioned to be engaged by a projection 164 on the operating element of the main fuel cock 16. The arrangement, as schematically shown in Fig. 1 of the drawings, is such that rotation of the main fuel cock 16 to closed position will serve to open the main switch 160 through the connections described and interrupt the circuit of the electromagnet 24.

Electric ignition means are employed in this invention for producing a flame at the pilot burner 150. To this end, an electric igniter 166 in the form of a coil of resistance wire is positioned in lighting proximity to the pilot burner 150. The electrical system for the igniter 166 includes a ballast unit 168, a step-down transformer 170 and the switch contact pairs 100, 110 associated with the control device 18. The primary coil 172 of the transformer 170 has one end connected by wire 174 to one side of the power line while the other end of the primary 75

coil 172 is connected by wire 104 to the terminal 98. The opposite side of the power supply is connected by wire 106 to the other terminal 98 thus completing the connection of the contact pair 100 in the primary circuit of the transformer 170. The secondary coil 176 of the transformer 170 has one end connected by wire 178 to one end of the igniter 166, the opposite end of which is connected by wire 180 to the opposite end of the transformer secondary 176. However, interposed in the latter wire 180 is the ballast unit 168, which is thus connected in series with the igniter 166 and the secondary coil 176.

The ballast unit 168 consists in this embodiment of two coils 182, 184 connected in parallel circuit. The coil 182 is of the variable resistance type having a relatively high temperature coefficient of resistance and being subject to increased temperature upon passage of current therethrough. The resistor 184 may be of the constant resistant type having no appreciable change in resistivity upon passage of current therethrough. As will be more apparent hereinafter, the provision of the ballast unit 168 permits use of an ordinary standard transformer 170 in conjunction with a source of current supply subject to voltage variations without deleterious effect upon the igniter 166.

The operation of the device is as follows: When the parts are positioned as shown in the drawings, no fuel can flow from the manifold 12 to the main burner 10 or the pilot burner 150 and the igniter 166 is deenergized. Operation of the main fuel cock 16 to open position will permit fuel to flow in the main fuel pipe 14 as far as the control device 18 as the valve member 26 is engaged with the valve seat 22. During the rotation of the main fuel cock 16 to open position, the main switch 160 is closed so that the circuit from the thermocouple 156 to the electromagnet 24 is no longer interrupted. The handle or knob 120 of the control device 18 is then rotated in a clockwise direction causing a rectilinear movement to the left, as viewed in Fig. 2 of the drawings, of the operating stem 146 due to the translating action described. The existing operative engagement of the operating stem 146 with the head of the screw 118 causes the reset stem 72 to partake of the rectilinear movement and overcome the bias of the spring 80. The connecting stem 74 is consequently moved to the left, as viewed in Fig. 2 of the drawing, and the interrupter valve member 76 becomes engaged with the valve seat 22. The cap nut 78 thereupon becomes engaged with the valve member 26 and moves the latter away from the valve seat 22 against the bias of the spring 28 to reset the electromagnet 24 for a holding operation.

The fuel from the main fuel pipe 14 flows past the valve seat 22 through the pilot conduit 152 to the pilot burner 150 but no fuel flows to the main burner 10 due to engagement of the flow interrupter valve 76 with the valve seat 22. During the rectilinear movement of the reset stem 72, the contact pairs 100, 110 have become engaged and the circuit for the igniter 166 is completed. The ballast unit 168 is so proportioned that at a comparatively low voltage of 95 volts in the primary coil 172, the igniter 166 is energized sufficiently to ignite the fuel flowing from the pilot burner 150. Should a voltage of comparatively high value of 125 volts in the primary coil 172 be present, then more current will flow through the ballast unit 168. It is apparent that if the resistance of the ballast unit 168

7 remained constant, then the current at such comparatively high voltage would be sufficient to overload the igniter 166 and possibly cause its destruction. However, due to the use of the variable resistor 182 in the ballast unit 168, the resistance thereof increases with temperature and the current is consequently reduced to a safe value. When it is considered that a difference between high and low voltage input current of 2.4 amperes may be satisfactory whereas a difference of 3.2 amperes would be too great for practical usage, it is apparent that the provision of the ballast unit 168 is of importance in this application.

The fuel from the pilot burner 150 being ignited, the thermocouple 156 becomes heated and generates sufficient current to energize the electromagnet 24. This operation takes but a few seconds and then the manual force applied to the handle 120 of the control unit 18 can be relieved. The bias of the coil spring 80 on the reset stem 72 causes retraction of this stem and such force is applied to the operating stem 146 which thereupon moves to the right as viewed in Fig. 2 of the drawing. This motion is translated by the sleeves 122, 134 and the detent 148 engaging with the slots therein into a rotary motion of the handle 120 in a counterclockwise direction to its initial position.

The retraction of the reset stem 72 causes opening of the contact pairs 190, 110 and return of the flow interrupter valve 76 to its initial position out of engagement with the valve seat 22. As the valve member 26 is now held in open position due to energization of the electromagnet 24, the fuel from the main fuel pipe 14 flows to the main burner 10 and is ignited by the flame from the pilot burner 150. The igniter 166 is concurrently deenergized and remains in such condition during normal running conditions at the main burner 10. Thus the system is placed in steady state operating condition without further attention on the part of the operator.

Should the operator by mistake rotate the main fuel cock 16 from "On" to "Off" position and thereafter immediately to "On" position, then the control device 18 will automatically function to shut off the flow of fuel to the main burner 10. Such operation will occur due to the immediate deenergization of the electromagnet 24 when the main switch 160 is operated to open position momentarily during rotation of the main fuel cock 16 to "Off" position. It will be apparent that without this automatic shut-off of the main burner 10, such repeated operation of the main fuel cock 16 while the thermocouple 156 remains heated might tend to cause an accumulation of main burner fuel which is undesirable. In the present embodiment of the invention, it is necessary to reignite the pilot burner 150 before any fuel can flow to the main burner 10.

In the event that the flame at the pilot burner 150 becomes extinguished, then the thermocouple 156 will cool and cause deenergization of the electromagnet 24. The valve member 26 thereupon becomes reengaged with the valve seat 22 under bias of the spring 28 and shuts off flow of fuel to both the main and pilot burners 10 and 150, respectively. A starting operation, as described, must then be conducted in order to place the system in running condition but further description of this operation is deemed unnecessary.

While the preferred embodiment of the invention described and shown herein includes a

pilot burner 150, it will be obvious that this burner could be dispensed with, if desired, and the thermocouple 156 and igniter 166 arranged for cooperation with the main burner 10 accordingly. In such event, the flow interrupter valve 76 would also be dispensed with as the function thereof would be unnecessary. This and other modifications in the general system and changes in the details of construction and arrangement of parts can be made within the scope of the appended claims without departing from the purview of the invention.

We claim:

1. An adapter for converting a flame failure shut-off valve, having a reciprocable reset stem extending from a valve casing, into a combination ignition and fuel control device comprising, a hollow switch housing of insulating material adapted to be secured to the valve casing and to enclose the outer end of the reset stem, a rotatable handle carried by said housing, an operating stem within said housing extending from adjacent said handle and adapted to engage the outer end of the reset stem, first electrical contact means carried on an inner wall of said housing and adapted for connection in the energizing circuit of an electric igniter, second electrical contact means engageable with said first contact means, means for supporting said second contact means and connecting the same to the reset stem for movement therewith, and cam means operatively connecting said handle and said operating stem for translating rotation of said handle into rectilinear movement of said operating stem for imparting resetting movement to the reset stem and moving said second contact means into engagement with said first contact means.

2. Apparatus as claimed in claim 1 wherein said second contact supporting means comprises a tubular member of insulating material adapted to receive the outer end of the reset stem.

3. Apparatus as claimed in claim 2 wherein said second contact means comprises an apertured plate slidably mounted on said tubular member, and an override spring encircling said tubular member and engageable with said plate for biasing the same toward said first contact means.

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