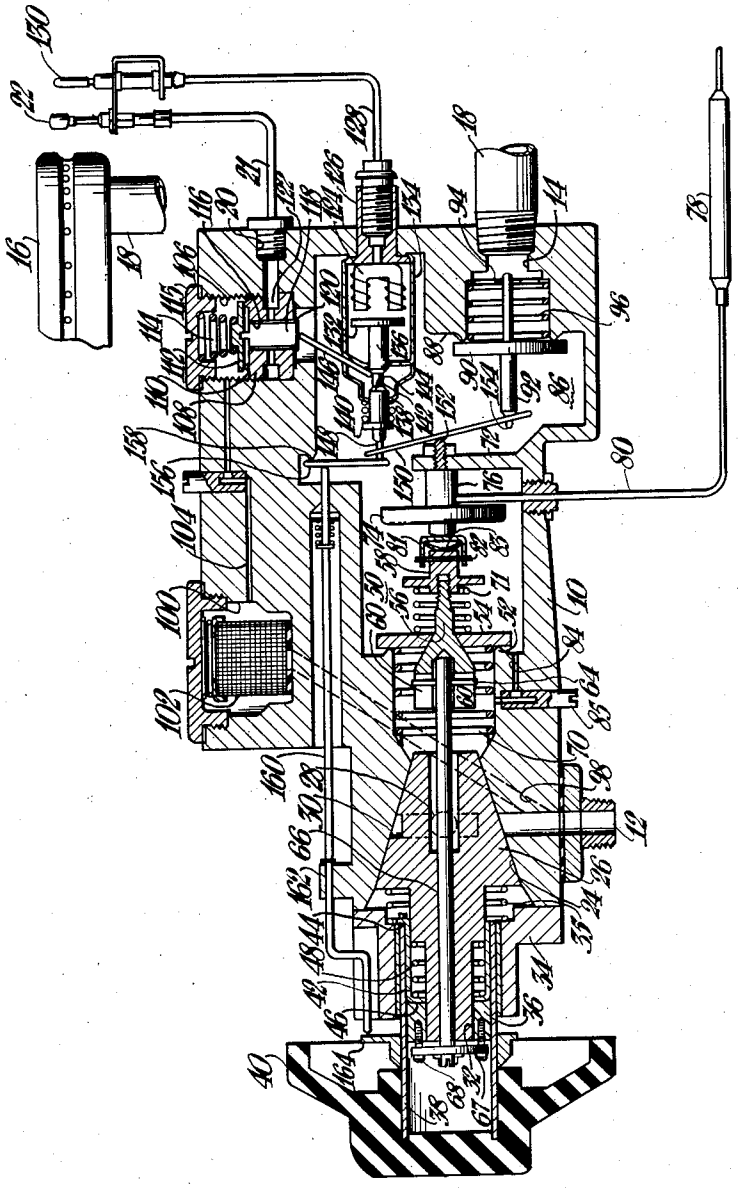
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THERMOSTATIC CONTROL DEVICE FOR FLUID FUEL BURNING APPARATUS

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THERMOSTATIC CONTROL DEVICE FOR FLUID FUEL BURNING APPARATUS

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This invention relates to controls for fluid fuel burning apparatus and more particularly to a combination thermostat and safety pilot control for gas appliances.

It is an object of this invention to effect so-called 100 percent shut-off of fuel supply in the event of pilot flame extinguishment.

Another object of this invention is to arrange a safety shut-off device to insure safe lighting of the appliance.

Another object of this invention is to control a pilot valve and a safety valve by means of a single thermoelectric device.

Another object of this invention is to permit a resetting operation of the thermoelectric device only in the "Off" position of a shut-off cock.

Another object of this invention is to control a pilot valve, a safety control valve, and a temperature responsive valve by a single manually operable dial.

In one preferred embodiment of the invention, a casing having inlet and outlet openings for fuel is provided with a thermostatic valve and a shut-off cock to control the flow of fuel therethrough, the operating member of the shut-off cock being associated with the thermostatic valve and rotatable to adjust the temperature at which the same will respond. Valve means are provided in one of the outlets for controlling the flow of fuel to a pilot burner, and a safety control valve is provided in another outlet to control the flow of fuel to a main burner. A thermoelectric device is associated with the pilot valve and safety valve and includes an armature operative to maintain said safety and pilot valves in closed positions in absence of the flame at the pilot burner. The operating member of the shut-off cock is adapted for reciprocal movement independently of the shut-off cock and is cooperable with a plunger during reciprocal movement thereof to reset the armature and simultaneously open both the safety valve and the pilot valve. Means are provided whereby the armature may only be reset in the "Off" position of the shut-off cock.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawing which is a schematic showing of a control device embodying this invention.

Referring to the drawing, the control device structure is shown as comprising a casing 10 provided with an inlet 12 and an outlet 14 for supplying fuel to a main burner 16 of a fluid fuel burning appliance by means of a conduit or pipe 18. The casing 10 is provided with another outlet 20 which is adapted to supply fuel by means of a conduit 21 to a pilot burner 22 positioned adjacent the main burner 16 for igniting the same.

The inlet 12 communicates with a tapered valve seat 24 formed in the casing 10 and within which a hollow shut-off cock 26 is seated and adapted to rotate. Communication between the inlet 12 and hollow interior of the shut-off cock 26 is afforded by a port 28 formed in the cock 26. An arcuate recess 30 is formed in the tapered surface of the shut-off cock 26 and extends from the port 28 sufficiently to establish registry of the inlet

12 with the port 28 throughout a predetermined arc of rotation of the cock 26, thus establishing an "On" or open position of the cock 26 in various settings thereof. When the cock 26 is rotated sufficiently to move the recess 30 out of alignment with the inlet 12, the cock 26 is in "Off" position as shown in the drawing.

The shut-off cock 26 is provided with an axially extending operating stem 32 which projects exteriorly of the casing 10 through a centrally disposed bore in a cover plate 34 attached to the end of the casing 10. A spring 35 is mounted in compression between a shoulder of the cock 26 and the cover plate 34 and is operative to bias the cock 26 into engagement with the tapered seat 24. The stem 32 carries on its end a slotted collar 36 which carries and is cooperable with a suitably tongued sleeve 38 of a manually operable dial 40. By means of the slotted collar 36 and tongued sleeve 38 the cock 26 may be rotated between positions by manipulation of the dial 40, or the dial 40 and sleeve 38 may be moved axially relatively to the cock 26 as is well known in the art.

A sleeve 42 is slidably mounted on the stem 32 and provided with a flange 44 at one end thereof engageable by the end of the sleeve 38 and another flange 46 on the other end thereof. A spring 48 is mounted in compression between the flange 46 and a shoulder of the stem 32 and is operative to bias the flange 44 into engagement with the end of the sleeve 38 as shown. If the dial 40 should be moved axially toward the casing 10, the end of the sleeve 38 will engage the flange 44 to cause movement of the sleeve 42 and compress the spring 48. Upon release of the dial 40 the spring 48 is operative to return the dial 40 to its outward position as shown in the drawing.

The hollow interior of the cock 26 communicates with a valve chamber 50 within which an annular valve seat 52 is formed on the casing 10 defining a valve port through which fluid may flow from the interior of the cock 26 to the outlet 14. A disc-shaped valve member 54 is positioned in the chamber 50 to be reciprocal into and out of engagement with the seat 52 and is loosely mounted on a reciprocal and rotatable valve stem 56. The valve stem 56 is provided with a generall tapered medial portion on which the valve member 54 is normally seated, and has one end threaded for reception in an internally threaded tubular adjusting element 58. The other end of the valve stem 56 is provided with a pair of oppositely disposed slots 60 which are adapted to receive a drive pin 64 fixed to one end of an operating shaft 66. The other end of the operating shaft 66 extends through an axial bore of the cock 26 and is attached to the end of the stem 32 by means of a clamping plate 67 and screws 68. A spring 70 is mounted in compression between the shoulder of the casing 10 and the valve member 54 and operative to bias the valve member 54 away from the seat 52. A second stronger spring 71 is mounted in compression between the valve member 54 and the adjusting element 58 to permit override movement of the stem 56 relative to the valve member 54 when the valve member 54 engages the seat 52.

For actuating the valve member 54 between positions, the casing 10 is provided with an upstanding bracket 72 on which a thermostatic mechanism is mounted. The thermostatic mechanism includes an expansible and contractible power element 74 carrying a stud 76, which is fixed to the bracket 72. The element 74 is connected to a temperature sensing bulb 78 by means of a capillary tube 80 which extends exteriorly of its casing 10 and may be positioned to sense the temperature of the medium heated by the main burner 16. The power element 74, tube 80, and bulb 78 comprise a closed system filled with a fluid which upon changes in the temperature sensed

by the bulb 80 will serve to expand and contract the power element 74 in a manner well known to those skilled in the art.

For transmitting movement from the power element 74 to the valve member 54, a cup-shaped member 81 has the end thereof fixed to the power element 74 and encloses the end of the adjusting element 58. A pin 82 is inserted through aligned bores in the walls of the adjusting element 58 and cup-shaped member 81 thereby preventing rotation of the adjusting element 58 and connecting the same with the member 81. A curved bimetal disc 83 is positioned within the member 81 in engagement with the end of the adjusting element 58 for transmitting movement thereto and to compensate for ambient temperature conditions affecting the power element 74.

Rotation of the dial 40 serves to rotate the cock 26 and operating shaft 66 as a unit. Rotation of the shaft 66 screws the valve stem 56 into or out of the adjusting element 58 thereby moving the valve member 54 relative to the seat 52 to vary the temperature at which the same will engage the seat 52 under the influence of the thermostatic mechanism in a manner well known in the art.

The casing 10 may be provided with a passage 84 which establishes communication between the upstream side of valve member 54 and the chamber 50 thereby permitting a small flow of fuel around the seat 52 when the valve member 54 is closed to establish a minimum flame at the main burner at all times. An adjustment screw 85 is threaded within the casing 10 and is operative upon adjustment thereof to vary the flow of fuel through the passage 84.

From the valve chamber 50 fuel may flow around the partition 72 and into a second valve chamber 86 defined by the bracket 72 and casing 10. Safety valve means for the main burner are positioned in this chamber and comprise an annular valve seat 88 formed on the interior of the casing 10 and defining a port through which fuel may flow to the outlet 14 and main burner 16. A disc-shaped valve member 90 is positioned to be reciprocal into and out of engagement with the seat 88 and is carried by a medial portion of an axial movable valve stem 92 which has one end slidably positioned in a guide 94 and the other end thereof extending toward the bracket 72 for connection to an actuating means later to be described. A spring 96 is mounted in compression between the valve member 90 and the guide 94 for biasing the valve member 90 toward an open position.

For supplying fuel to the pilot burner, the casing 10 is provided with a passage 98 which bypasses the cock 26 and extends from the inlet 12 to a chamber 100 in the casing 10 in which a filter cartridge 102 of any suitable type may be positioned. A passage 104 connects the filter chamber 100 with a threaded bore 106 in the wall of the casing 10 in which a valve seat member 108 having an annular seating surface 110 is threaded. A disc-shaped valve member 112 is positioned in the bore 106 and is reciprocal into and out of engagement with the seating surface 110 and is biased toward engagement therewith by means of a spring 114 mounted in compression between the valve member 112 and a bushing 115 threaded in the open end of the bore 106.

The valve seat member 108 is provided with an axial bore 116 in which a plunger 118 of non-circular cross section is slidably positioned. One end of the plunger 118 engages the valve member 112 and the other end thereof engages a flexible diaphragm 120 which is clamped into engagement with a shoulder of the bore 106 by means of the valve seat member 108 thereby sealing the bore 106 from the valve chamber 86. The axial bore 116 communicates with the pilot burner outlet 20 by means of a passage 122 in the valve seat member 108. Upon axial movement of the plunger 118 toward the bushing 115, the valve member 112 will be moved out of engagement with the seat 110 to permit flow of fuel through the bore 116, passage 122 to the pilot burner.

A thermoelectric device responsive to a flame at the pilot burner is provided for actuating the pilot valve member 112 and safety valve member 90 between their operative positions. To this end, a magnet frame 124 is fixed to a terminal bushing 126 mounted in the end wall of the casing 10 and connected by a conductor 128 to a thermocouple 130 which is positioned adjacent the pilot burner. A disc-shaped armature 132 is movable between attracted and released positions relative to the magnet frame 124 and is disposed within a housing 134 which substantially encloses the magnet frame 124 and armature 132.

The armature 132 is provided with an axially extending integral stem 136 which is slidably positioned in a bore in the end of the housing 134 and extends exterior of the housing 134. A coil spring 138 is mounted in compression between the end of the housing 134 and the flange 140 formed on the end of the stem 136 and is operative to bias the armature 132 to its released position as shown on the drawing.

The stem 136 is provided with a reduced diameter portion 142 defining a generally tapered annular shoulder 144 at the edge thereof. A plunger 146 is slidably mounted in the wall of the housing 134 and has one end engaging the stem 136 and the other end thereof engaging the diaphragm 120 in alignment with the end of the plunger 118. In the released position of the armature 132 shown, the plunger 146 engages the reduced diameter portion 142 and is positioned thereby to permit the valve member 112 and plunger 118 to assume their biased positions under influence of the spring 114. However, should the armature 132 be moved to its attracted position in engagement with the frame 124, axial movement of the stem 136 will cause the plunger 146 to ride up the tapered shoulder 144 thereby moving the plunger 146 axially toward the diaphragm 120. Such movement of the plunger 146 is sufficient to flex the diaphragm 120 and actuate the plunger 118 toward the bushing 115 against the bias of spring 114 thereby moving the valve member 112 out of engagement with the seat 110 to permit flow of fuel to the pilot burner.

The end of the stem 136 is provided with a pintle 148 on which one end of an operating lever 150 is loosely positioned by means of a bore therein. The lever 150 has a medial portion thereof fulcrumed on a screw 152 threaded within the partition 72 and has the other end thereof loosely fitted on a pintle 154 defined by the end of the safety valve stem 92.

The spring 138 is preferably stronger than combined forces of the springs 96, 114 and operative upon deenergization of the magnet 124 to simultaneously move the reduced diameter portion 142 into engagement with the plunger 146 and rotate the lever 150 counterclockwise on the fulcrum 152. Thus, the valve members 90 and 112 are both simultaneously moved to closed positions upon extinguishment of the flame at the pilot burner.

Resetting means are provided for resetting the armature 132 to its attracted position and the valve members 90, 112 to their open positions. To this end, a second lever 156 overlies the end of the lever 150 and has one end thereof loosely connected to the pintle 148 and the other end thereof fulcrumed on a shoulder 158 of the casing 10. The lever 156 is rotatable on the shoulder 158 by means of a stem 160 which has one end thereof engaging the lever 156 adjacent the shoulder 158. The stem 160 extends exterior of the casing 10 toward the dial 40 and is slidably positioned in a bore in a wall of the casing 10 and in a bore in a lug 162 formed on the exterior surface of the casing 10. The exterior end of the stem 160 un-

derlies the dial **40** and is adapted to be engaged by an abutment **164** provided by the sleeve **38**.

The abutment **164** is positioned whereby the same will engage the end of the stem **160** in the "Off" position of the cock **26** when the dial **40** is moved axially toward the casing **10**. Such axial movement of the dial **40** moves the stem **160** axially to effect counterclockwise rotation of the lever **156** on the shoulder **158**. Rotation of the lever **156** effects axial movement of the armature stem **136** and opening of the valve members **90**, **112** as previously described.

Operation

To place the device in operation, the dial **40** is first pushed inwardly in the "Off" position thereof to cause abutment **164** to engage and move the stem **160** axially toward the lever **156**. Such movement of the stem **160** causes counterclockwise rotation of the lever **156** on the shoulder **158** which in turn moves the stem **136** and armature **132** axially until the armature engages the magnet frame **124**. This operation also causes axial movement of the plunger **146** by the tapered shoulder **144** and opening of the pilot valve member **112**. Also, lever **150** is rotated clockwise on the fulcrum **152** to open the safety valve member **90**.

Fuel is now supplied to the pilot burner, however, since the gas cock **26** is still in the "Off" position fuel cannot flow to the main burner. The pilot burner may now be ignited by any suitable means, such as manually, or by means of a flash tube. When the hot junction **130** is heated sufficiently to energize the magnet **124**, the dial **40** may be released whereupon it will assume its outwardly biased position as shown under the bias of the spring **48**. The pilot valve **112** and safety valve **90** are now held in their open positions by the magnet **124** and remain in such positions as long as the pilot burner remains energized.

The dial **40** may now be rotated to any desired temperature setting to supply fuel to the main burner under control of the valve member **54**. The valve member **54** is positioned between open and closed positions by the power element **74** in response to variations in the temperature conditions sensed by the bulb **46** in a manner well known in the art.

If at any time the flame of the pilot burner should become extinguished, the armature **132** will move under the bias of the spring **138** to the released position shown in the drawing, thereby closing the pilot valve member **112** and the safety valve member **90** as previously described. Thus, the device provides so-called 100 percent shut-off in the event of pilot flame failure. To reset the device after such a failure, the operator must turn the dial **40** to the "Off" position wherein abutment **164** overlies the end of the stem **160**, thus preventing any flow of gas except to the pilot burner during the resetting operation. It will be apparent that since the abutment **164** overlies the stem **160** only in the "Off" position of the shut-off cock, the armature cannot be reset in the "On" positions of the cock, thus insuring safe lighting.

In those instances where it is desirable to have no flow interruption, the abutment **164** may be attached to the dial **40** whereby the same will engage the stem **160** at the highest dial setting. In this position, the flow of gas is not interrupted and fuel flow to the main burner is available at the time the stem **160** is depressed. With this arrangement, the gas may be flashed instantly to start up the system.

While only one embodiment of the invention has been herein shown and described, it will be apparent to those skilled in the art that the construction and arrangement of parts may be in other ways variously embodied or changed without departing from the scope of the invention as defined in the appended claims.

It is claimed and desired to secure by Letters Patent:

1. In a control device for main and pilot burners, the combination comprising main valve means movable between positions and adapted for controlling a flow of fuel to the main burner, pilot valve means movable between positions and adapted for controlling a flow of fuel to the pilot burner, safety valve means movable between positions and adapted for controlling a flow of fuel to the main burner, thermally responsive operating means associated with said main valve means for actuating the same between said positions in response to a change in a temperature condition, an adjustable element rotatable between positions for setting the temperature at which said operating means will respond, and lever means operatively connecting said safety valve means and said pilot valve means for simultaneously moving said safety valve means and said pilot valve means, said lever means comprising a first lever pivoted at one end, a reciprocable member connected to the other end of said first lever, a second lever pivoted intermediate the ends thereof and having one end cooperable with said reciprocable member and having the other end cooperable with said safety valve means for actuation thereof, and a plunger cooperating with said reciprocable member for moving said pilot valve, said adjustable element being reciprocal and in operative engagement with said first lever for moving said safety valve means and said pilot valve means to one of said positions.

2. A control device as claimed in claim 1 wherein means responsive to a flame at the pilot burner are operatively connected with said lever means for holding said safety and pilot valve means in said one position.

3. In a control device for fluid fuel burning apparatus having main and pilot burners, the combination comprising safety valve means movable between open and closed positions for controlling the flow of fuel to the main burner, means for biasing said safety valve means to said open position, pilot valve means movable between positions for controlling the flow of fuel to the pilot burner, electro-magnetic means responsive to a flame at the pilot burner and including armature means movable between attracted and released positions, a plunger extending between said pilot valve and said armature means, means associated with said armature means for causing said plunger to move said pilot valve means between said positions in response to movement of said armature means, and a lever pivoted intermediate the ends thereof having one end operatively connected to said armature means and having the other end connected to said safety valve means for permitting said safety valve means to move to said open position upon movement of said armature means to said attracted position.

4. The device of claim 3 including biasing means operatively connected to move said pilot valve means and said safety valve means to shut off the flow of fuel to the main and pilot burners in response to failure of the flame at the pilot burner.

5. The device of claim 3 including means operatively connected to move said armature to said attracted position to allow fuel to flow to the main and pilot burners.

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