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3,180,357

GAS SUPPLY UNIT

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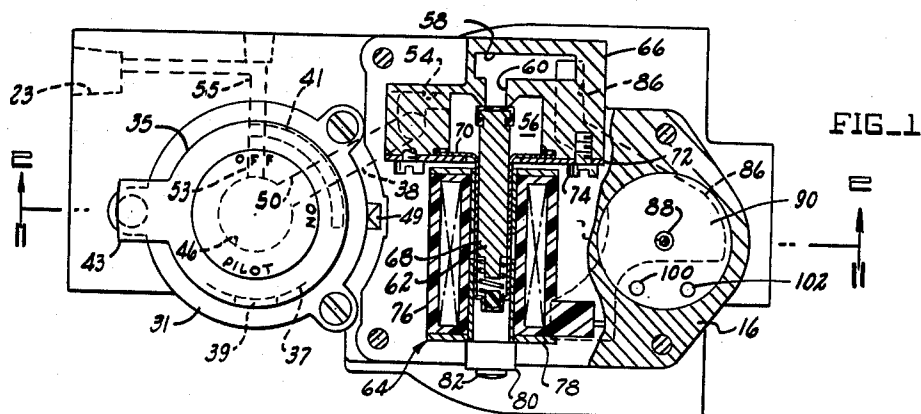


FIG. 1

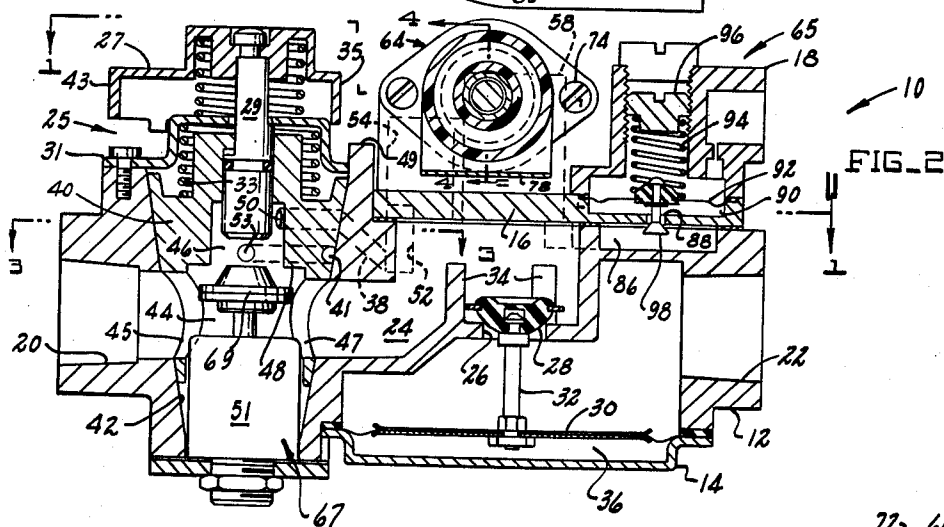


FIG. 2

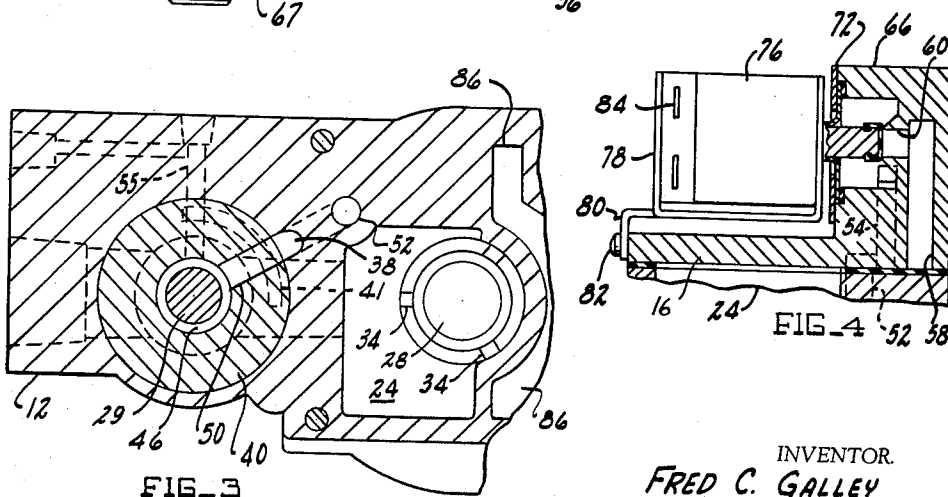


FIG. 3

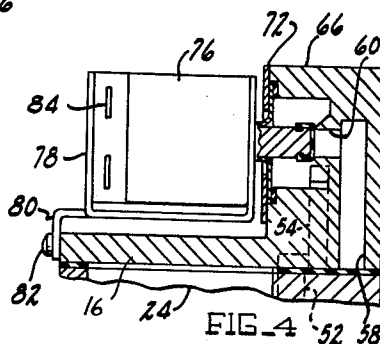


FIG. 4

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GAS SUPPLY UNIT

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This invention relates to a fuel gas supply unit, which for example is controlled by a pilot burner, room thermostat and pressure regulator. In certain respects the invention is an improvement on the invention disclosed and claimed in U.S. Patent 2,980,133.

One of the more important objects of the present invention is to provide a fuel gas supply unit having a cluster of control components arranged in an especially compact pattern, whereby to enable the unit to be disposed in small clearance spaces.

A further object of the invention is to provide a gas supply unit having a thermocouple-operated safety valve arranged so that the thermocouple wiring does not protrude laterally from the side surface of the unit.

A still further object of the invention is to provide a regulated fuel gas supply unit having a manual selector valve arranged to accomplish positive closing of the gas supply unit without reliance on gas supply pressure.

Another object is to provide a gas supply unit which operates without producing an appreciable pressure drop in the gas stream.

An additional object is to provide a gas supply unit having a manual selector valve which is ported to provide straight-through flow from the inlet to the main burner passageway.

A still further object of the invention is to provide a fuel gas supply unit having a manual selector valve and pilot-operated safety valve arranged one within the other whereby to reduce the overall length of the two valves.

Another object is to provide a fuel gas supply unit having a solenoid-operated valve therein arranged so that the electric portion of the valve is isolated from the controlled gas stream, whereby to preclude possibility of electric spark ignition of the gas.

A further object is to provide a fuel gas supply unit having a solenoid valve arranged in a prone position whereby to reduce the vertical dimension of the supply unit.

Other objects of this invention will appear from the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIGURE 1 is a sectional view of one embodiment of the invention taken substantially on line 1-1 in FIG. 2;

FIG. 2 is a sectional view taken substantially on line 2-2 in FIG. 1;

FIG. 3 is a sectional view taken substantially on line 3-3 in FIG. 2; and

FIG. 4 is a sectional view taken substantially on line 4-4 in FIG. 2.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring more particularly to the drawings, there is shown a fuel gas supply unit 10 having as its principal parts a manual selector valve 25, a pilot-operated safety

valve 67, a solenoid control valve 64, and a pressure stabilizing device 65. The gas supply unit is designed to supply a main stream of gas to a main gas burner through main outlet 22 and a smaller stream of gas to a pilot burner through an auxiliary outlet 23.

The manual selector valve 25 has three rotational positions, including a first off position wherein neither the main outlet 22 nor the auxiliary outlet 23 are supplied with gas, a second pilot position wherein only the auxiliary outlet 23 is supplied with gas, and a third on position wherein both the main outlet 22 and the auxiliary 23 are supplied with gas. In its third position the selector valve also feeds gas to a control passageway which includes the solenoid valve 64, the pressure stabilizing mechanism 65, and the control chamber 36 at the underside of diaphragm operator 30. The flow of gas through the control passageway causes operator 30 to oscillate valve element 28 so as to produce a closely regulated gas pressure at the main outlet 22.

Solenoid valve 64 may be energized by a room thermostat or other control device (not shown) so that the main burner can be operated automatically in accordance with heating demand. Safety valve 67 is provided for automatically halting all gas flow through the supply unit in the event the pilot burner is for any reason extinguished. To reset the safety valve to the open position there is provided a manually depressible stem 29.

Referring in somewhat greater detail to the drawings, the fuel gas supply unit 10 is shown as having a major body member 12, a lower cap-like closure 14, and two upper closure members 16 and 18. Member 12 is configured to provide a gas inlet 20, a main gas outlet 22, and a main burner passageway 24. As best shown in FIG. 2, the main burner passageway is provided with a port 26 which is controlled by a main valve element 28, said element being connected with the diaphragm operator 30 by means of the stem 32. Three equi-distant arms 34 may be provided in member 12 for guiding the valve element during its up-and-down movement.

It will be seen that the upper face of diaphragm operator 30 is exposed to the main pressure downstream of port 26 so that increasing downstream pressure tends to close the main valve element. The underface of diaphragm operator 30 is exposed to the control chamber 36 which during operation of the unit has a stabilized control pressure supplied thereto for opposing the main downstream pressure; thus the diaphragm operator tends to open the main valve element in response to decreasing downstream pressure and close the valve element in response to increasing downstream pressure. The intended result is a very closely regulated pressure at the outlet 22 without significant pressure losses.

The aforementioned control pressure for chamber 36 is supplied through a control passageway which initiates as a drilled duct 38 in member 12. Gas flow into duct 38 is controlled by the selector valve 25 which in the illustrated arrangement comprises a hollow plug valve element 40 disposed in a frusto-conical cavity 42. The hollow interior of the plug valve defines a lower central chamber 44, an upper auxiliary discharge chamber 46, and a valve seat 48 therebetween. As best seen in FIG. 3, chamber 46 is provided with a port 50 which, when the valve element is in its illustrated position, communicates with the drilled duct 38. Thus there is provided a path for the flow of control gas from central chamber 44 through auxiliary discharge chamber 46, port 50 and drilled duct 38.

Hollow valve element 40 is provided with a non-circular opening at its extreme upper end which mates with the non-circular portion of a stem 29 carried by manual knob element 27. By this arrangement the knob element 27 and plug element 40 are movable as a unit in a rota-

tional sense, while the knob element is movable axially relative to the plug element.

Retention of the plug element in cavity 42 is accomplished by a fixed cap member 31 and compression spring 33. The upwardly projecting portion of the cap member is generally circular and fits within the circular portion 35 of the knob element 27. The general contour of the circular portion of the fixed cap member is designated by numeral 37 in FIG. 1; however a portion of the cap is preferably struck out at 39 so as underlie the lower edge of the knob element and thus prevent depression of the knob element except when the radial extension 43 of the element registers with the struck out portion 39. This registry is obtained only when the "pilot" marking on the knob element is aligned with the fixed reference arrow 49. When the knob is in the pilot position it can therefore be manually depressed to cause stem 29 to strike portion 69 of the safety valve 67. Portion 69 is disposed within chamber 44 in alignment with seat 48 so that when the electric portion 51 of the safety valve is de-energized portion 69 is automatically moved against seat 48 to interrupt flow from chamber 44 into chamber 46. The safety valve may be varied as to general construction, but one suitable construction is shown in FIG. 3 of U.S. Patent 2,645,238. As under conventional practice, the valve receives its electric current from thermocouples located adjacent the pilot burner.

The general arrangement of selector valve 25 and safety valve 67 permits the safety valve to normally admit gas to chamber 46 when the pilot is heating the thermocouples. Upon extinguishment of the pilot burner the safety valve portion 69 closes against seat 48 until reopened by manual depression of knob 27. With valve portion 69 in the open position chamber 46 supplies gas to a port 53 which discharges to a peripheral groove 41 formed in the outer surface of the plug valve element. The groove is of such length and location that it registers with an auxiliary passageway 55 when the selector valve is in either the on or pilot positions. Thus gas can be supplied to pilot outlet 23 when the selector valve is in either of these two positions. Gas can be supplied to control passage duct 38 only when the selector valve is in the on position.

The control passage includes in addition to duct 38 a vertically drilled passage 52 in member 12, and a communicating L-shaped passage section 54 formed in the lower face of closure member 16. As best seen in FIGS. 1 and 4, passage section 54 discharges to a cylindrical chamber 56 which is connected with another chamber 58 by means of a short port-forming passage 60. The short passage provides a horizontal axis port which is opened and closed by the plunger type armature 62 of the solenoid valve 64. Preferably the armature is arranged for horizontal movement as shown in the drawings so that the solenoid is disposed in a prone position whereby to minimize the vertical height of the complete gas supply unit.

The various chambers 54, 56 and 58 are disposed in an upstanding portion 66 of closure member 16 so that the various chambers are disposed alongside the solenoid portion of the valve rather than beneath the solenoid portion. With this arrangement there is very little intervening space between the solenoid operator portion and the main body member 12. The total vertical dimension of the unit is therefore reduced, as compared for example with the arrangement of the aforementioned Patent 2,980,133 wherein the solenoid unit 25 is disposed in an upright position above the port which it controls.

Preferably armature 62 of the solenoid valve is disposed within a closed guide tube 68 which has a radial flange 70 arranged in sealed gas-tight engagement with the upstanding portion 66 of the closure member 12. As shown in the drawing the sealing action is attained by an annular clamping plate 72 which is held on the upstanding portion 66 by suitable screws 74. The use of a closed

armature guide tube as shown in the drawings is advantageous in that it completely isolates the electric coil portion 76 from the gas in the various passages 54 through 58, thus precluding possibility of electric spark ignition of the gas.

The electric coil portion of the solenoid may be of conventional construction. Preferably, however, the coil windings are encased in a molded covering which is disposed within a U-shaped magnetic frame 73 as generally disclosed in U.S. Patent 3,036,246. The coil is supported partially by the guide tube 68 and partially by a flange 80 which is struck from frame 73 and held by a securement screw 82. The spade-type terminals 84 for the solenoid are preferably extended laterally from the solenoid to thus minimize the total vertical dimension of the gas supply unit and solenoid valve assembly. The terminals are in practice connected with any convenient control device, as for example a room thermostat when the gas supply unit is utilized in domestic heating.

From the description thus far it will be seen that the flow of control gas to chamber 36 may be interrupted either by rotation of plug valve element 40 or de-energization of electric coil 76. Assuming, however, that the plug valve is in its illustrated position and the coil 76 is energized, the control gas will flow into chamber 58, and thence into a cavity 86 formed in the upper face of main body member 12. The cavity is shown in dotted lines in FIG. 1, and is suitably configured so as to be isolated from the main gas passage 24 and other passages to be described hereinafter.

As shown in FIG. 2, cavity 86 communicates with a port 88 and a second cavity 90 formed in member 16. A diaphragm 92, compression spring 94 and adjustable spring seat 96 are suitably arranged above valve element 98 so that any tendency of the gas pressure in cavity 90 to decrease causes diaphragm 92 to open the valve element. A pressure sensing passage 100 is drilled from cavity 90 into outlet 22 so that main outlet pressure is applied to diaphragm 92 in opposition to spring 94. The arrangement of parts thus produces a substantially stabilized control pressure in cavity 90. In order to conduct the stabilized control gas from cavity 90 to control chamber 36 there is provided a passage system which includes a vertical passage 102 and a short laterally directed passage (not shown) at its lower end. The arrangement is generally similar to that shown at 35D and 41 in aforementioned Patent 2,980,133.

In operation of the gas supply unit, the selector valve 25 may be rotated to any one of three positions, namely "off," "on," or "pilot." Assuming the selector valve is in its "off" position (rotated clockwise ninety degrees from FIG. 1), port 50 is sealed from passage 38 and there is no gas flow to the underside of operator 30. Valve element 28 is thus closed. As additional insurance the main ports 45 and 47 of the selector valve are at this time in registry with the frusto-conical surface of cavity 42 so that gas is prevented from reaching valve element 28.

Assuming that manual element 28 is then rotated to the pilot position and subsequently depressed, stem 29 is caused to move the flow-interrupting portion 69 of the safety valve away from seat 48 so that gas can flow into chamber 46 and thence into pilot burner outlet 23 for permitting the pilot burner to be lit in the conventional manner. After sufficient heating of the thermocouples the electro-magnetic portion of the safety valve 67 is able to hold the interrupting portion 69 in its FIG. 2 position wherein gas is continued to be supplied to the pilot burner.

After the manual pressure on element 27 is released the element can be rotated to the illustrated "on" position wherein ports 45 and 47 feed gas to the main passageway 24, and the port 50 feeds gas to the control passageway leading to the underside of diaphragm 30, the arrangement being such as to produce a regulated gas flow through outlet 22 (when permitted by solenoid valve 64). It will be noted that with the selector valve in the "on" position the

pilot burner outlet 23 is continually fed with gas via the groove 41. The main valve element 28 is of course automatically closed whenever solenoid valve 64 is closed.

As previously noted, one object of this invention is to provide a fuel gas supply unit having a cluster of control components arranged in an especially compact pattern. In the illustrated arrangement compactness is achieved partly by disposing the safety valve 67 within the central chamber 44 of the plug valve 40. The illustrated vertical disposition of the safety valve is further advantageous in that it permits the thermocouple wiring to protrude downwardly from the gas supply unit rather than laterally from the supply unit side surface as in the arrangement of Patent 2,980,133. This disposition of parts is of some importance because the thermocouple wiring is relatively stiff and any considerable protrusion thereof laterally may in some cases constitute an obstruction to the furnace paneling.

Further arrangements for compactness are provided by the prone disposition of the solenoid valve 64 wherein the chamber-forming means 66 is located laterally of the electrical coil portion rather than therebelow as in Patent 2,980,133. The location of the chamber means port as a horizontal axis port does away with the intervening vertical space which would otherwise be necessary to accommodate the port and associated passages.

A further advantageous feature of the illustrated gas supply unit is the construction of the selector valve element 40 whereby the gas from inlet 20 can have a straight-through flow to the main burner passage 24. Such straight-through flow is of material benefit in minimizing pressure drop occurring across the supply unit. Conventionally the supply gas has a very low pressure on the order of less than one p.s.i., so that any substantial pressure drop across the supply unit cannot be tolerated. In the illustrated arrangement the straight-through flow characteristic is achieved while at the same time achieving a satisfactory telescoping of the safety valve 67 and selector valve 25 whereby the overall vertical dimension of the two valves is less than the individual valve lengths.

While one specific embodiment of the invention has been shown and described, yet it is realized that some variation in construction and arrangement of the gas supply unit components can be practiced. Also, some variation in parts configuration and specific component design can be resorted to without departing from the spirit of the invention as set forth in the accompanying claims.

What is claimed:

1. In a regulated fuel gas supply unit having an inlet, a main burner passageway connected with the inlet and provided with a port therein, a pilot burner passageway connected with the inlet, a main valve element controlling flow through the main burner port, a valve element operator responsive to increasing pressure downstream of the port for closing the main valve element, and a control passageway connected with the inlet for applying a stabilized control pressure to the operator to cause same to open the main valve element in response to decreasing downstream pressure: the improvement comprising a selector valve interposed between the inlet and each of said passageways for movement between a first position wherein none of the passageways are opened to the inlet, a second position wherein only the pilot burner passageway is opened to the inlet, and a third position wherein each passageway is opened to the inlet; said selector valve comprising a hollow rotary plug valve defining a central chamber, an auxiliary discharge chamber, and a seat therebetween; the combination further comprising a safety valve operated by extinguishment of the pilot burner flame to close against the seat whereby to interrupt flow from the central chamber to the auxiliary discharge chamber; the plug valve central chamber being ported to provide straight-through flow from the inlet to the main burner passageway; and the auxiliary discharge chamber being ported to direct gas into the pilot burner passageway and control passageway

when the safety valve is in its non-interrupting position and the selector valve is in its third position.

2. In a fuel gas supply unit having an inlet, a main burner passageway, and a pilot burner passageway: the improvement comprising a rotary selector valve interposed between the inlet and each of said passageways for movement between a first position wherein none of the passageways are opened to the inlet, a second position wherein only the pilot burner passageway is open to the inlet, and a third position wherein each passageway is opened to the inlet; said selector valve comprising a hollow valve element defining a central chamber, an auxiliary discharge chamber and a seat therebetween; a safety valve aligned with the selector valve and operated by extinguishment of the pilot burner flame to close against the seat whereby to interrupt flow from the central chamber to the auxiliary discharge chamber; the valve element central chamber being ported to provide straight-through flow from the inlet to the main burner passageway; and the auxiliary discharge chamber being ported to direct gas into the pilot burner passageway when the safety valve is in its non-interrupting position and the selector valve is in its second or third position.

3. In a fuel gas supply unit having an inlet, a main burner passageway, and a pilot burner passageway: the improvement comprising a selector valve interposed between the inlet and each of said passageways for movement between a first position wherein none of the passageways are opened to the inlet, a second position wherein only the pilot burner passageway is opened to the inlet and a third position wherein each passageway is opened to the inlet; said selector valve comprising a hollow rotary plug valve configured to define a central chamber, an auxiliary discharge chamber, and a seat therebetween; a safety valve operated by extinguishment of the pilot burner flame to close against the seat whereby to interrupt flow from the central chamber to the auxiliary discharge chamber; said safety valve comprising an electromagnetic operator portion occupying one part of the central chamber, and a flow-interrupting portion occupying another part of the central chamber, whereby to provide a selector valve-safety valve assembly of lesser overall length than the individual valves; the plug valve central chamber being ported to provide straight-through flow from the inlet to the main burner passageway; and the auxiliary discharge chamber being ported to direct gas into the pilot burner passageway when the safety valve is in its non-interrupting position and the selector valve is in its second or third positions.

4. In a regulated fuel gas supply unit having an inlet and an outlet horizontally aligned therewith, a pilot burner passageway connected with the inlet, a main burner passageway extending between the inlet and outlet and provided with a main port therein, a main valve element disposed above the port for controlling flow therethrough, a diaphragm operator arranged below the main port and responsive to increasing pressure downstream of said port for closing the main valve element, and a control passageway for directing a stabilized control pressure to the underside of the diaphragm operator for thereby causing same to open the main valve element in response to decreasing downstream pressure: the improvement comprising a vertically disposed selector valve interposed between the inlet and each of said passageways for movement between a first position wherein none of the passageways are opened to the inlet, a second position wherein only the pilot burner passageway is opened to the inlet, and a third position wherein each passageway is opened to the inlet; said selector valve comprising a hollow rotary plug valve defining a lower central chamber, an upper auxiliary discharge chamber, and a seat therebetween; an electromagnetic safety valve disposed below the plug valve and operated by extinguishment of the pilot burner flame to close against the seat whereby to interrupt flow from the central chamber to the auxiliary discharge chamber; the plug valve central chamber being ported to provide straight-through flow from the inlet to the main burner passageway;

and the auxiliary discharge chamber being ported to direct gas into the pilot burner passageway and control passageway when the safety valve is in its open position and the selector valve is in its third position; a solenoid valve disposed atop the gas supply unit and including a chamber-forming means which defines a second port arranged as part of the aforementioned control passageway, a horizontally disposed armature guide tube secured to the chamber-forming means in gas-tight relation, an electric coil surrounding the guide tube so that its windings are isolated from the gas within the chamber-forming means, and an armature slidably disposed within the horizontal guide tube for movement toward and away from the second port;

said electric coil being closely spaced above the gas supply unit and having electric terminals extending laterally to thus minimize the overall height of the gas supply unit-solenoid valve assembly.

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LAVERNE D. GEIGER, *Primary Examiner*.