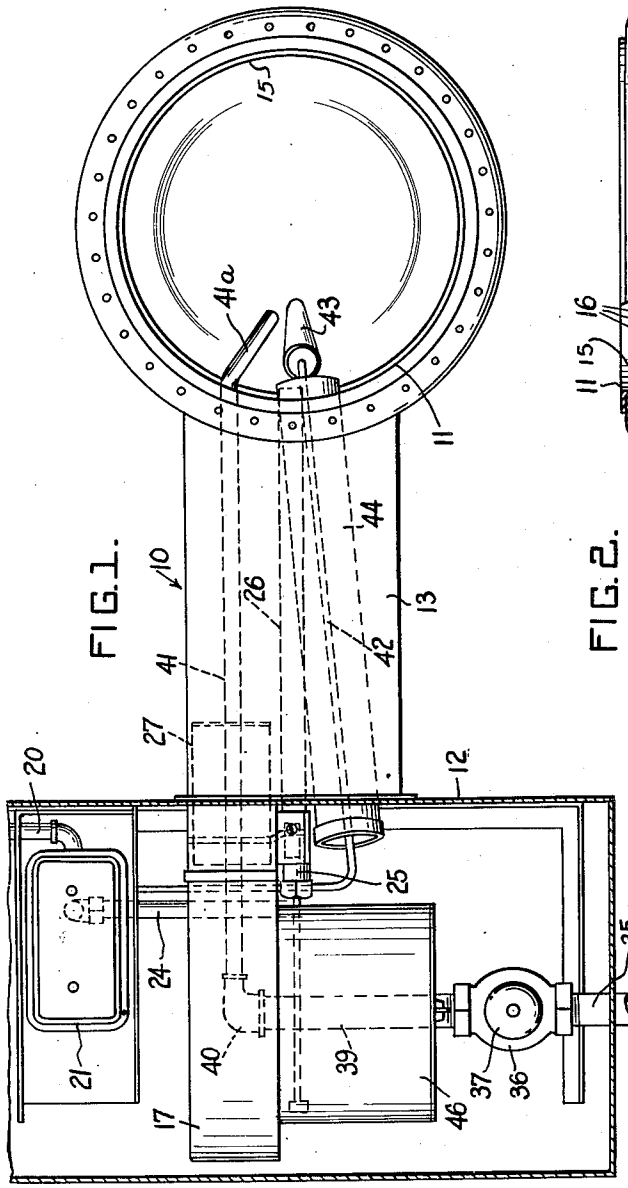
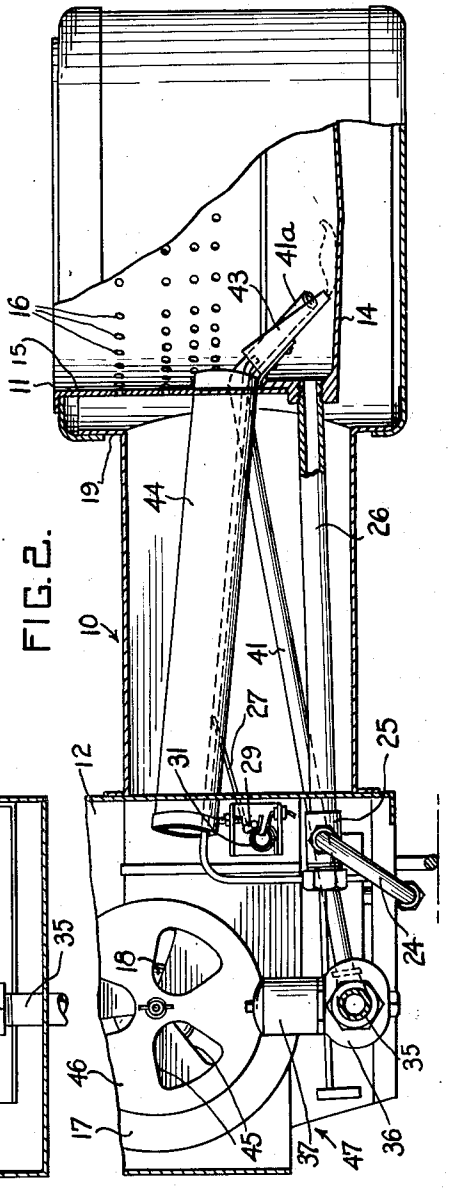
Oct. 20, 1953 E. A. NORMAN, JR 2,655,987

COMBINATION OIL-GAS FIRED CONVERSION BURNER

Filed Nov. 22, 1950 2 Sheets-Sheet 1





INVENTOR

Edward A. Norman Jr.

BY *W. S. McDowell*

ATTORNEY

Oct. 20, 1953 E. A. NORMAN, JR 2,655,987

COMBINATION OIL-GAS FIRED CONVERSION BURNER

Filed Nov. 22, 1950 2 Sheets-Sheet 2

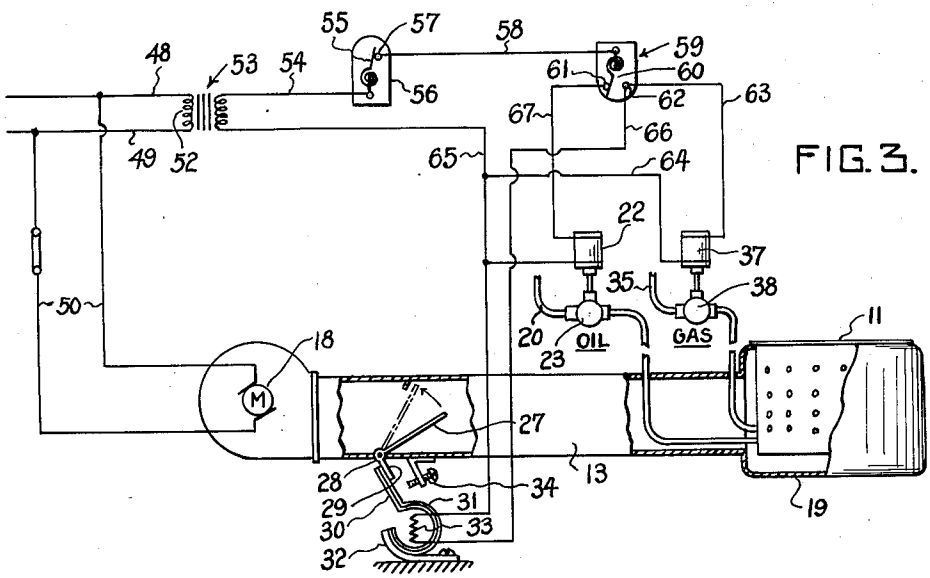


FIG. 3.

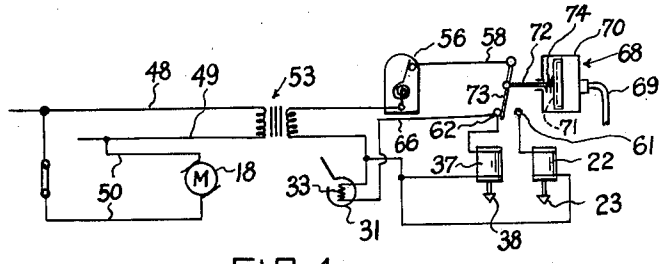


FIG. 4.

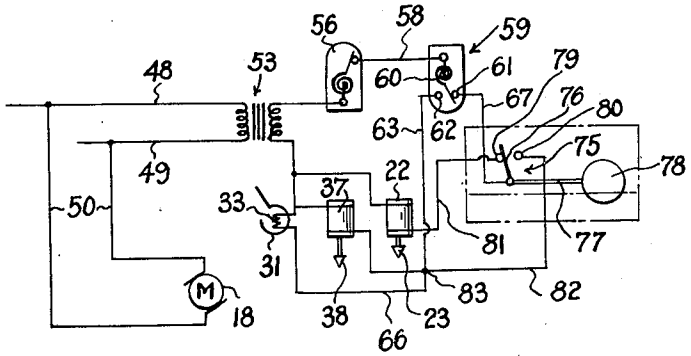


FIG. 5.

INVENTOR.
Edward A. Norman Jr.
BY
W. S. McDowell
ATTORNEY

Patented Oct. 20, 1953 2,655,987

UNITED STATES PATENT OFFICE

2,655,987

COMBINATION OIL-GAS FIRED CONVERSION BURNER

Edward A. Norman, Jr., Columbus, Ohio, assignor to Norman Products Company, Columbus, Ohio, a corporation of Ohio

Application November 22, 1950, Serial No. 197,077

5 Claims. (Cl. 158—11)

1

The present application is a continuation-in-part of my previous U. S. patent application Serial Number 50,103, filed September 20, 1948, entitled "Combination Oil-Gas Fired Conversion Burner," and now abandoned.

This invention relates to conversion burners of the type employed in furnaces for the burning of fluid fuels in lieu of coal or other solid fuels. Such conversion burners heretofore have been of two general types:

(1) Those utilizing normally gaseous hydrocarbons, and
(2) Those utilizing normally liquid hydrocarbons.

Both of these fluid fuels lend themselves readily to automatically controlled burner mechanisms and are widely used in the heating industry. Both types of burners, however, have their limitations. For example, an oil burner usually requires a storage tank for the liquid fuel which requires replenishment from time to time. It is not uncommon for such oil supplies to become exhausted and the operation of the associated burner thereby arrested before the owner or operator has knowledge of the deficiency.

In a gas fired burner, during periods of extremely cold weather, it is also not uncommon for gas pressure in municipal mains to drop to levels making gas burner operation inefficient or ineffective, or, in some instances, causing complete curtailment. Also, it is sometimes difficult under present day conditions to obtain from normal supply sources one or the other of these two fluid fuels.

Again, it is often advantageous from an economic standpoint to use one of said fuels under conditions requiring limited heat production, and the other of the fuels when heat requirements are more severe. For example, in certain districts, gaseous fuels are more expensive than liquid fuels, and, therefore, it is an object of the present invention to provide a combined gas and oil burner in which provision is made for shifting automatically from one to the other of the said fuels to meet most economically and advantageously various demands for heat production.

It is another object of the present invention to provide a fluid fuel burner which utilizes advantageously normally gaseous or liquid hydrocarbons as fuels, so that if for any reason one of such fuels should not be readily obtainable, the other may be employed to maintain efficient burner operation.

It is another object of the invention to provide a common fuel burner system which may use efficiently either gas or oil as a fuel and wherein automatic controls are provided, responsive to various changeable conditions, for shifting the operation of the burner from one of said fuels to the other.

2

A further object is to provide a dual fuel burner of the character indicated in which the controls are such that in the event pressure of gas supplied to such a burner should fail or diminish to an undesired extent, provision is made for shutting off further gas supply and transferring the operation of the burner for the consumption of oil.

A still further object of this invention is to provide a combination oil-gas fired burner of the forced draft type which embodies an electrically controller damper or valve mechanism operable automatically to vary the flow of combustion air to the associated fuel burner in response to a change from one fuel to another, and which, in the event of a failure within its operating circuit, automatically opens to assure the passage of sufficient quantities of combustion air to the burner necessary to sustain complete combustion of either type of fuel.

Other objects are to provide a burner mechanism for the consumption of both oil and gas as fuels and in which the oil is adapted to be contained in a storage tank or vessel and wherein provision is made for automatically delivering gaseous fuel to the burner mechanism when the oil level within the storage tank or receptacle recedes to a predetermined low level, whereby to sustain the operation of the burner mechanism without interruption; to provide a control system for the burner of the type set forth in which the use of the particular fuel is automatically responsive to temperatures prevailing exteriorly of a building in which the burner mechanism is used, whereby in periods of cold weather oil may be employed as the fuel for the burner and in milder weather, gas may be utilized, thus adapting the burner for economy in fuel consumption and with satisfactory heat production.

For a further understanding of the invention, reference is to be had to the following description and the accompanying drawings, in which:

Fig. 1 is a top plan view of a fluid fuel burner mechanism constructed for the use of both gaseous and liquid fuels;

Fig. 2 is a vertical longitudinal sectional view taken therethrough;

Fig. 3 is a diagrammatic view disclosing the automatic controls of the burner mechanism for

governing fuel selection in a manner based on variations in outside air temperatures;

Fig. 4 is a similar view disclosing the control arrangement for the automatic selection of fuels based on variations in gas supply pressures; and

Fig. 5 is also a diagrammatic view disclosing the control arrangement for the dual fuel burner in which gas is supplied when a predetermined low oil level is reached in an associated storage tank.

Referring more particularly to the drawings, the numeral 10 designates the improved multiple fuel consuming conversion burner comprising the present invention. In this instance, the same embodies a burner vessel 11 which is adapted to be positioned in the combustion chamber, not shown, of an associated furnace. Exteriorly of the furnace, the burner mechanism embodies a housing 12, the latter being joined with the vessel 11 by means of a forced air duct 13. The vessel 11 is of the so-called "pot" type, and, conveniently, the same may be formed to comprise a cast bottom member 14 and an upstanding annular side wall 15, the latter being provided with a multiplicity of perforations 16 admitting of the flow of air into the interior of the vessel from the duct 13. The duct 13 is normally supplied with air by means of a fan or blower 17 driven by an electric motor 18 and mounted within the housing 12. The duct 13 at its forward end terminates in a shell 19 in which the vessel 11 is positioned, with the bottom and side walls 14 and 15 of the vessel spaced from that of the shell, whereby to provide for air circulation or passage therebetween.

Oil under gravity flow, usually from a storage tank, is transmitted to the housing 12 by way of the oil inlet pipe 20. This pipe extends to a control valve and oil level establishing unit 21 of well known construction, the unit involving a solenoid 22 for the operation of an associated flow-controlling valve member 23. When the solenoid is energized, the valve member is actuated to admit of the passage of oil through the unit 21 in metered quantities.

From the unit 21, the oil travels under gravity flow by way of a pipe line 24 to a strainer unit 25 which is carried by a straight pipe member 26 disposed so that it extends from the housing 12 through the duct 13, and through the side wall of the vessel 11 at the bottom thereof. The oil collects in the form of a film or shallow pool on the upper surface of the bottom member 14 of said vessel where it is vaporized and admixed with air entering the vessel by way of the perforations 16 in the side wall 15, producing a combustible mixture which, when ignited, provides a controlled flame issuing from the open top of said vessel.

The fan or blower 17 is preferably of the continuously operating type; hence the present invention provides a movable valve or shutter means for regulating the volumes of air flowing through the duct 13 in accordance with the type of fuel being burned in the burner 11.

As shown in Fig. 3, there is provided in the entrance end of the duct 13, which is in direct communication with the outlet of the fan or blower 17, a vertically swinging shutter 27 which may be in the form of a plate or panel. The shutter, when occupying its full line position as shown in Fig. 3, opens the duct to permit substantially unrestricted flow therethrough of air from the fan to the burner pot 11 to sustain complete combustion of oil fuel. However, when the shutter is swung to assume its dotted line position as shown in Fig. 3, the amount of air flowing into the duct is reduced in accordance with the predetermined amount of air necessary to sustain complete combustion of gaseous fuel.

It is preferable that the shutter be operated automatically, and to this end, the shutter carries a rock shaft 28 which is rotatably journaled in openings provided in the walls forming the entrance end of the duct. At one end the rock shaft 28 terminates exteriorly of the duct in a crank extension 29, and the outer end of this extension is disposed in contact with a laterally directed lip 30 provided on a substantially circular bimetallic strip 31, the latter having one end thereof fixed to a bracket 32 supported exteriorly on the inlet end of the duct. In close thermal proximity to the bimetallic strip, there is mounted a coiled resistance-type electric heater 33 which, when energized, liberates heat which is absorbed directly by the strip 31. The arrangement of the bimetallic strip 31 is such that when the strip is heated, it expands causing the lip 30 to move in a clockwise direction, as viewed in Fig. 3. The shutter 27 is of the over-balanced type so that the same will automatically swing toward an open position as the lip 30 moves in a counter-clockwise direction upon cooling of the strip 31, allowing virtually unrestricted air flow through the duct 13. When the coil 33 is deenergized so that the strip 31 cools, with the lip thereof turning in a counter-clockwise direction, the shutter swings by gravity to its open position permitting substantially unrestricted air flow through the conduit or duct 13.

An adjustable set screw 34 may be arranged in a position to limit upward movement of the lip 30 and the extent of closure of the shutter 27. As will be later explained, the heating coil 33 is arranged in a control circuit governed by a thermostatic switch, or other equivalent operating means, so that the supply of combustion air to the burner vessel may be increased or diminished in accordance with the particular type of fuel being burned in the vessel.

Extending into the housing 12 is a gas supply line 35. Within the housing, the line 35 communicates with a gas flow controlling unit 36, which may be any one of a number of commercial types now available, but which, in this instance, employs a solenoid 37 for actuating a movable valve member 38 by which gas flow through the unit 36 is regulated. The gas discharge side of the unit 36 includes a pipe line 39 which leads to an elbow 40, and from this elbow a rigid pipe 41 extends through the duct 13 in an upwardly directed angle with respect to the horizontal, the discharge end of the pipe 41 being extended through the side wall of the vessel 11 and turned downwardly, as at 41a, to direct gas downwardly across the bottom wall of the burner vessel. Gaseous fuel thus delivered to the interior of the vessel 11 is commingled with combustion air delivered into the vessel through the wall perforations 16, producing a combustible mixture which burns with an observable flame combustion at the top of the vessel.

A pilot burner supply line 42 terminates at its forward end in a downwardly directed nozzle 43 which is disposed within the burner vessel 11. Either oil or gas may be introduced into the pipe line in quantities sufficient to maintain continuously pilot combustion at the nozzle 43. Preferably, the pipe line 42 passes through a

tube 44 which is disposed in the duct 13 and is supported at its ends by the walls of the housing 12 and the burner vessel 11 so that air flows through the tube 44 under atmospheric pressures or furnace draft conditions in a manner uninfluenced by the fan or blower 17. The nozzle 43 may be angularly disposed downwardly and inwardly of the vessel so that the pilot flame sweeps across the bottom wall 14 of said vessel. The casing of the fan or blower 17 includes air inlet openings 45, as shown in Fig. 2, and these openings are variable by means of an adjustable rotating valve device 46. The front of the housing 12 at the bottom thereof is provided with an opening 47 admitting of ready flow of atmospheric air into the housing and rendering accessible the fuel-controlling units.

In Fig. 3, a circuit arrangement is provided by which the shift in the use of either gaseous or liquid fuels is effected in accordance with temperature conditions prevailing exteriorly of a building heated by the burner mechanism. Thus in periods of extremely cold weather, better heating results may be obtained through the use of oil as a fuel, whereas during periods of relatively mild weather, it may be preferable to use gas as the fuel, or vice versa, depending on various considerations such as costs and the availability of the two fuels. In the form of the invention illustrated in Fig. 3, conductors 48 and 49, joined with a source of electric current supply, such as the ordinary household circuit, have connected therewith branch conductors 50 which lead to the windings of the fan motor 18. In this instance, the conductors 48 and 49 extend to the primary windings 52 of a transformer 53. From the transformer 53, a conductor 54 extends to the movable bimetallic arm 55 of a room mounted thermostatic switch 56. The arm 55 is so constructed that when the room atmosphere in which the thermostatic switch is disposed cools to a predetermined level, the free end of the switch arm 55 will be flexed in a direction bringing said arm into engagement and circuit-completing relation with a contact 57 of said switch. From the contact 57, a conductor 58 extends to an outside air thermostatic switch 59. This switch includes a movable temperature-responsive switch arm 60, the latter being connected with the conductor 58, and a pair of spaced contact points 61 and 62. The switch arm 60 is normally arranged to engage the circuit contact 62 during normally mild weather when it is desirable to operate on gas fuel, but is movable, in response to the attainment of a predetermined low temperature, into engagement with the contact terminal 61 to shift to oil consumption, as shown in Fig. 3. From the terminal 62, a conductor 63 leads to the winding of the solenoid 37 of the gas valve flow-controlling unit which, in turn, is connected with the secondary winding of the transformer by way of the leads 64 and 65, thereby providing for energization of the solenoid 37 so that its valve member 38 is elevated or unseated to provide for gas flow through the unit 36 and thence to the burner vessel when the arm 60 is in contact with the terminal 62. From the contact terminal 62, a conductor 66 leads to one side of the heater coil 33 which has its opposite side connected with the lead 65 connected to the secondary winding of the transformer 53.

By this arrangement, the burner mechanism normally functions on gas as its main fuel. However, if the temperature of the outside air drops below a given point, the switch arm 60 moves out of engagement with the contact terminal 62 and into engagement with the contact terminal 61. This deenergizes the solenoid 37 of the gas valve and enables current to flow from conductor 58 through switch arm 60, terminal 61, and through a conductor 67 to the winding of the solenoid 22 of the oil flow-controlling valve, moving the valve member 23 to an open position for oil flow after gas flow has been discontinued by the deenergizing of the solenoid 37. In this manner, there is an automatic shift from the use of gas as the burner fuel to that of oil, enabling the burner operation to be sustained without attention on the part of an operator or attendant.

Fig. 4 of the drawings discloses an operating circuit in which provision is made for shifting the operation of the burner from gas consumption to oil consumption automatically in the event that the pressure of the gas supply falls below a predetermined low level. It sometimes happens in periods of cold weather, particularly when gas consumption reaches high figures, that the gas supplies of public utilities companies or municipal mains decrease as a result of peak demands and the normal gas pressures consequently drop to such a degree that gas burners cannot supply heat in sufficient quantity for normal house-heating purposes. In Fig. 4, the outside air thermostat switch of the circuit shown in Fig. 3 is replaced by a gas pressure-responsive switch 68 which is connected, by way of a conduit 69, with the gaseous fuel supply main, not shown. The switch 68 is provided with a substantially closed chamber-forming casing 70 in which is positioned a flexible diaphragm 71. The diaphragm 71 carries an exteriorly extending rod 72 which is connected with a switch arm 73. The switch arm 73 is electrically connected with the conduit 58 in series with the room thermostatic switch 56. At its open end, the switch arm is movable between the circuit terminals 61 and 62 to control the energization of the solenoids 22 and 37 and resistance heater 33. The rod 72 and diaphragm 71 are urged against the pressure of gas in the conduit 69, as by means of a spring 74, to a position establishing an operating circuit to the solenoid 22 of the oil flow-controlling valve 23. So long as gas pressure within the conduit 69 remains at a level to sustain burner operation and efficient heating, the diaphragm 71 is flexed outwardly in opposition to the spring 74, as shown in Fig. 4, to maintain an operating circuit for the solenoid 37 of the gas valve 38, but should the gas pressure drop below a predetermined level, the pressure-responsive switch 68 immediately shifts the switch arm 73 into contact with the terminal 61 associated with the oil supply valve 23. As in the operating circuit shown in Fig. 3, the resistance heater 33 controlling the operation of the damper or shutter 27 is energized concurrently with the energization of the gas solenoid 37.

Fig. 5 of the drawings discloses still another modification of the operating circuit of the present dual fuel burner. The circuit of Fig. 5 is identical to that of Fig. 3 with the exception that a float controlled oil level switch 75 is connected in series with the solenoids 22 and 37 so as to automatically shift from oil consumption to gas consumption in the event that the supply of oil falls below a predetermined level. The float controlled switch 75 comprises a movable switch arm 76 which is electrically connected with the lead

67 extending from the terminal 61 of the outside air thermostat 59. The switch arm 76 is carried upon an arm 77 which supports a buoyant float 78 arranged within the oil tank or sump reservoir of the oil supply circuit. The switch arm 76 is movable between a pair of contacts 79 and 80 to control the energization of the respective solenoids 22 and 37. So long as the level of oil remains sufficient to sustain burner operation, the switch arm 76 is held in engagement with the contact 79 which is connected by way of a lead 81 with the solenoid 22. Thus, as the outside air thermostat 59 shifts to oil operation in response to the attainment of a predetermined low temperature, the float controlled switch 75 is brought into play. So long as the float controlled switch is in engagement with the terminal 79, the burner will operate on the oil fuel cycle. However, should the oil supply drop below a given level, the buoyant float member 78 is arranged to swing the switch arm 76 into engagement with the second terminal 80 which is connected by way of a lead 82 with one side of the solenoid 37, in order that the burner operation may shift once again to the gas cycle until the level of oil is replenished. The lead 66 associated with the resistance heater 33 is connected, as at 83, with the leads 82 and 63 in order that the resistance heater may be energized concurrently with the energization of the gas solenoid 37.

From the foregoing, it will be apparent that the present invention provides a burner for fluid fuels and associated controls by which the burner may employ and operate successfully on either oil or gas. As above indicated, such an arrangement offers under present day conditions very definite advantages in burners utilizing fluidic fuels. It has been discovered that the hydroxylating or pot-type burner heretofore employed exclusively with the use of oil or other similar liquid fuels lends itself quite readily to use also with normally gaseous hydrocarbons. In this manner, virtually two burners are combined in one with but slight, if any, additional costs in manufacture. By so combining in one burner the features of dual fuel consumption, many advantageous features of automatic control in the operation of the burner are made possible in its adaptation to fuel economies, outside weather conditions, and sustained operation.

The apparatus is, of course, subject to certain variation and modification with respect to that disclosed herein without necessarily departing from the spirit and scope of the following claims.

I claim:

1. A combination oil and gas-fired conversion burner comprising a vertically arranged open-mouth burner vessel having perforate side walls; an imperforate casing surrounding the side walls of said burner vessel and arranged to be positioned within the combustion chamber of a normally solid fuel-burning furnace; a substantially horizontally arranged air duct communicating at one end with said casing and arranged to extend outwardly and exteriorly of a furnace in which said casing is positioned; a blower communicating with the opposite end of said duct for supplying forced air to said casing and to said vessel by way of the perforate side walls thereof; damper valve means including a shutter in said duct movable between positions permitting of free or restricted flow of air through said duct, said shutter being movable by gravity to a position permitting free flow of air through said duct; electrically actuated means engageable with said damper valve means and energizable to move the shutter to a position restricting the flow of air through said duct; a liquid fuel supply conduit communicating with said vessel; a separate gaseous fuel supply conduit communicating with said vessel; a pilot burner positioned in said vessel for directing a pilot flame downwardly against the bottom thereof and for igniting liquid or gaseous fuels introduced to said vessel by way of said fuel supply conduits; electro-responsive valve means connected with each of said fuel supply conduits and energizable to permit the free passage of fuels through said conduits and to said vessel; and switch means having electrical connections respectively with each of said electro-responsive valve means and with said electrically actuated means and operable selectively to close an operating circuit for either of the electro-responsive valve means while opening an operating circuit for the other of said electro-responsive valve means, and for closing an operating circuit for said electrically actuated means simultaneously with the closing of an operating circuit for the electro-responsive valve means associated with said gaseous fuel supply conduit only, whereby to move said shutter to a position restricting the flow of air through said duct upon introduction of gaseous fuels within said burner vessel.

2. A combination oil and gas-fired conversion burner comprising a vertically arranged open-mouth burner vessel having perforate side walls; an imperforate casing surrounding the side walls of said burner vessel and arranged to be positioned within the combustion chamber of a normally solid fuel-burning furnace; a substantially horizontally arranged air duct communicating at one end with said casing and arranged to extend outwardly and exteriorly of a furnace in which said casing is positioned; a blower communicating with the opposite end of said duct for supplying forced air to said casing and to said vessel by way of the perforate side walls thereof; damper valve means including a shutter in said duct movable between positions permitting of free or restricted flow of air through said duct, said shutter being movable by gravity to a position permitting free flow of air through said duct; electrically actuated means engageable with said damper valve means and energizable to move the shutter to a position restricting the flow of air through said duct; a liquid fuel supply conduit communicating with said vessel; a separate gaseous fuel supply conduit communicating with said vessel; a pilot burner positioned in said vessel for directing a pilot flame downwardly against the bottom thereof and for igniting liquid or gaseous fuels introduced to said vessel by way of said fuel supply conduits; electro-responsive valve means connected with each of said fuel supply conduits and energizable to permit the free passage of fuels through said conduits and to said vessel; a first switch means responsive to the temperature of a zone to be heated by said burner for establishing an operating circuit for said electro-responsive valve means and said electrically actuated means; and other switch means connected in series with said first switch means and having electrical connections respectively with each of said electro-responsive valve means and said electrically actuated means and operable for selectively closing simultaneous operating circuits for said electrically actuated means and the electro-responsive valve means associated with said gaseous fuel supply conduit while opening an operating circuit for the electro-

responsive valve means associated with said liquid fuel supply conduit, or for closing an operating circuit for the electro-responsive valve means associated with said liquid fuel supply conduit while opening operating circuits for said electrically actuated means and the electro-responsive valve means associated with the gaseous supply conduit, whereby to control the position of said shutter so as to provide increased air flow through said duct upon supply of liquid fuel to said burner vessel.

3. A combination oil and gas-fired conversion burner as defined in claim 2 wherein said last-named switch means comprises a thermostatic switch responsive to temperatures outside the zone to be heated by said burner for automatically closing an energizing circuit for the electro-responsive valve means associated with said liquid fuel supply conduit and for opening an operating circuit for the other of said electro-responsive valve means and said electrically actuated means in response to a predetermined low temperature of said outside atmosphere.

4. A combination oil and gas-fired conversion burner as defined in claim 2 wherein said last-named switch means comprises a pressure-actuated switch responsive to a predetermined low pressure of gaseous fuel within said gaseous fuel supply conduit for opening an operating circuit for the electro-responsive valve means associated with said gaseous fuel supply conduit and for closing an operating circuit for the electro-responsive valve means associated with said liquid fuel supply conduit.

5. A combination oil and gas-fired conversion burner as defined in claim 2 in combination with a liquid fuel reservoir connected to supply fuel to said liquid fuel supply conduit, and wherein said last-named switch means comprises a float-actuated switch responsive to a predetermined low level of fuel within said reservoir for opening an operating circuit for the electro-responsive valve means associated with said liquid fuel supply conduit and for closing an operating circuit for the electro-responsive valve means associated with said gaseous fuel supply conduit.

EDWARD A. NORMAN, JR.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,752,727	Breese	Apr. 1, 1930
1,840,744	Scott	Jan. 12, 1932
1,860,311	Klees	May 24, 1932
1,885,478	Powers	Nov. 1, 1932
2,364,591	Stoughton et al.	Dec. 5, 1944
2,552,302	Young	May 8, 1951