May 17, 1927. 1,629,032

G. E. GOODRIDGE

LIQUID FUEL BURNING APPARATUS

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Fig. 1.

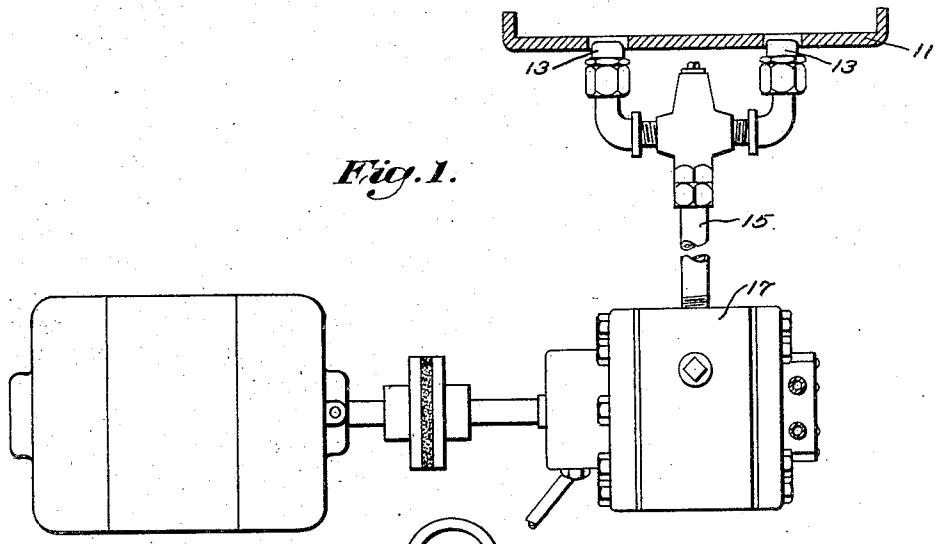
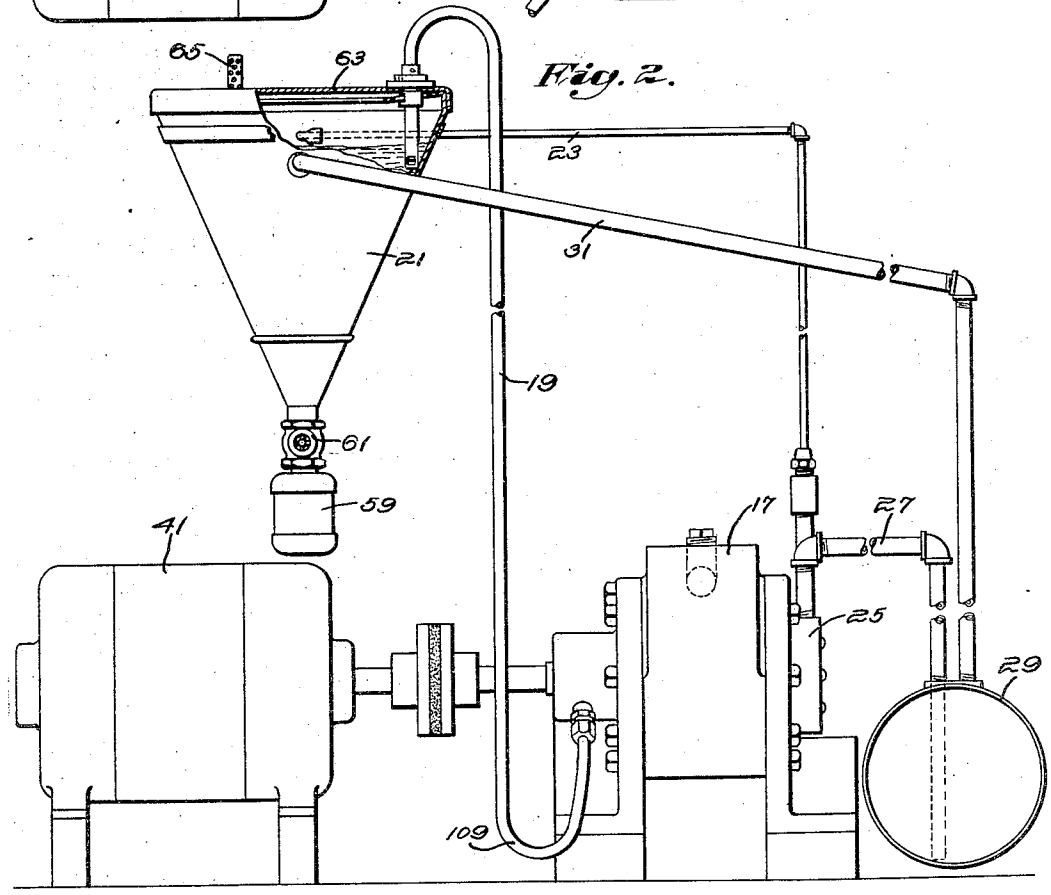


Fig. 2.



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Fig. 3.

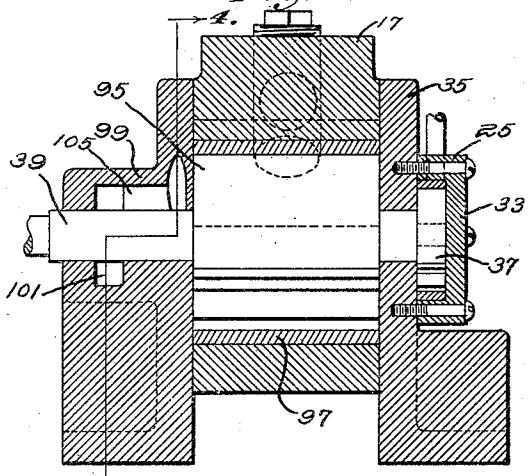


Fig. 4.

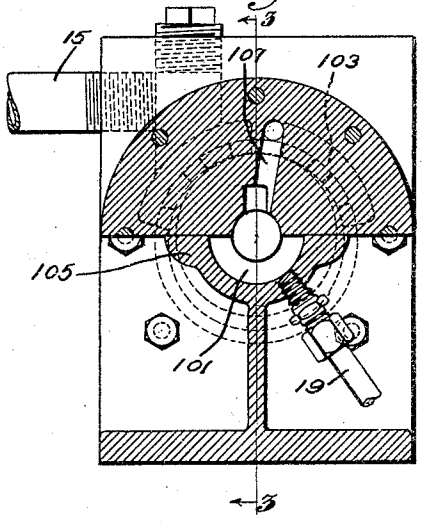


Fig. 5.

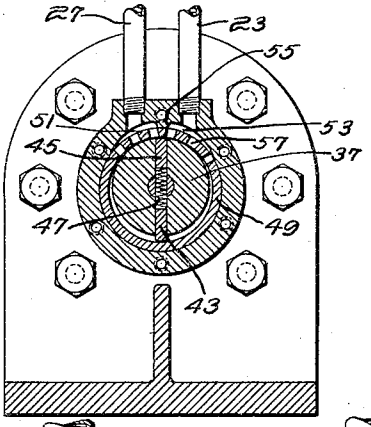


Fig. 6.

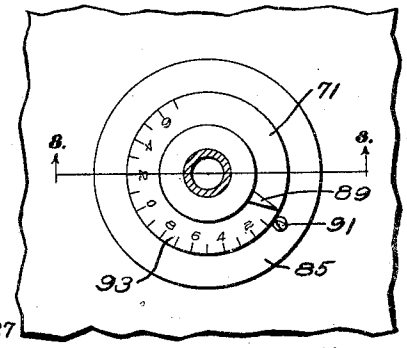


Fig. 7.

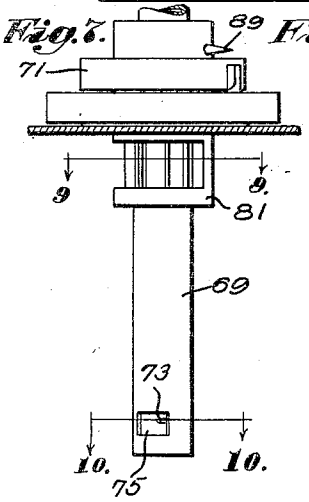


Fig. 8.

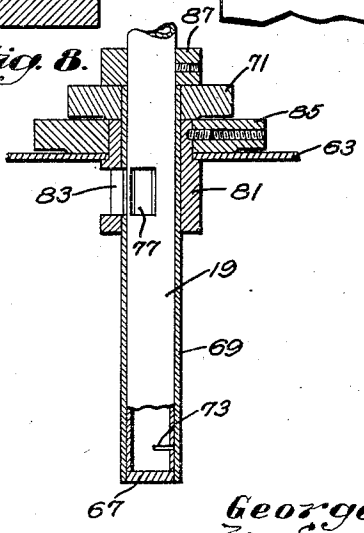


Fig. 9.

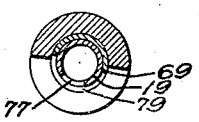
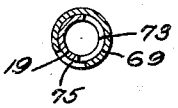


Fig. 10.



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UNITED STATES PATENT OFFICE.

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LIQUID-FUEL-BURNING APPARATUS.

Application filed July 2, 1926. Serial No. 120,061.

This invention relates to liquid fuel burning apparatus and consists in improvements to simplify and add to the efficiency of such apparatus.

The invention will be best understood by reference to the following description when taken in connection with the accompanying illustration of one specific embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings,—

Fig. 1 is a plan view of the burner nozzle, pumps and driving motor;

Fig. 2 is an elevation showing the pumps and their relation to the fuel reservoir and to the air and fuel mixing device;

Fig. 3 is a longitudinal, sectional elevation, on a larger scale, taken through the two rotary pumps;

Fig. 4 is a transverse, sectional elevation taken on the line 4—4 of Fig. 3, showing the connection of the inlet pipe to the delivery pump;

Fig. 5 is a transverse, sectional elevation taken through the rotary fuel pump;

Fig. 6 is a plan showing the adjustable air and fuel mixing device;

Fig. 7 is a side elevation thereof;

Fig. 8 is a sectional elevation of the same;

Fig. 9 is a section in plan on the line 9—9 in Fig. 7; and

Fig. 10 is a section in plan on the line 10—10 in Fig. 7.

Referring to the drawings and to the embodiment of the invention therein shown for illustrative purposes, the liquid fuel burner comprises a burner nozzle operatively related to the combustion chamber 11 of any suitable or usual heating device. The burner nozzle may be of any desired type, but herein comprises a pair of nozzles 13 connected to a common supply pipe 15 for discharging into the combustion chamber an atomized mixture of oil or other liquid fuel and air. The mixture of air and fuel is delivered under pressure through the supply pipe 15 from a delivery pump, the casing of which is shown at 17, and is preferably of the rotary, positive displacement type. The delivery pump 17 is arranged to draw its supply of air and fuel through the conduit 19 from an elevated supply chamber 21 and through a suitable air and fuel mixing device. A constant level of liquid fuel is maintained in the supply chamber 21 through the supply pipe 23 connected to a fuel pump arranged at the side of the delivery pump 17, the casing of the fuel pump being shown at 25. The pump 25 is also preferably of a positive displacement rotary type. The fuel pump 25 has its suction connected through the pipe 27 with the main fuel reservoir 29, and the latter is connected to the elevated supply chamber 21 by means of the return or overflow pipe 31, so that a constant fuel level is maintained in the supply reservoir.

Referring first to the devices for supplying the elevated supply chamber with a constant level of fuel (Figs. 3, 4 and 5), the casing 25 of the fuel pump herein is shown as formed in a single piece with an end closure plate 33 bolted to the side walls of the end plate 35 for the delivery pump 17. The fuel pump may be of any desired type, but herein, within the casing 25, there is mounted the rotor 37 (Figs. 3 and 5) secured to the rotor shaft 39, the latter being driven by the electric motor 41 (Figs. 1 and 2). The rotor 37 is provided with diametrically opposite blades 43 and 45 pressed yieldingly outward by the spring 47 and adapted to wipe over the inner walls of the sleeve 49, the latter fixed within the casing 25 and eccentrically arranged with relation to the rotor shaft. Between the casing and the sleeve are provided small inlet and outlet chambers 51 and 53, respectively, separated by a central division wall 55 which is located at substantially the point of tangency between the rotor and the inner walls of the sleeve. The inlet chamber 51 is connected to the suction pipe 27 leading to the reservoir 29 and the outlet chamber 53 is connected through the supply pipe 23 leading to the elevated supply chamber 21. The pump chamber within the sleeve is connected with the inlet and discharge chambers by a series of perforations 57, so that, as the rotor is driven in a counterclockwise direction (as viewed in Fig. 5), the liquid fuel is drawn in through the suction pipe 27 and inlet chamber 51 and discharged through the outlet chamber 53 and supply pipe 23. The supply chamber 21 should be located at an elevation above that of the fuel reservoir 29 and above that of the pump 17. The fuel reservoir 29 might be arranged at a level above that of the pump 25, a suitable device

being employed between the pump and the reservoir, but preferably, as shown, the fuel reservoir is below the level of the pump so that no siphon break is required.

Referring now to the supply chamber, the latter is preferably in the form of a cone-shaped tank, of the general form shown in a co-pending application filed March 27, 1926 by Arthur H. Ballard, Serial No. 98,014, with the apex of the cone depending and its bottom connected with a settling compartment 59 having the intermediate cut-off valve 61, so that sludge, water and other impurities of relatively high specific gravity will settle to the bottom of the chamber and may be allowed to pass into the compartment 59 from time to time by opening the valve 61. The compartment 59 may be removable to cleanse the same from time to time without interfering with the operation of the apparatus. In order to impart a rotary motion to the body of fuel in the supply chamber and utilize the centrifugal force to cause the heavier constituents to pass to the sides of the chamber and down to the bottom thereof, the discharge mouth of the supply pipe 23 is arranged to direct its discharge in a general tangential direction with reference to the inner circular walls of the chamber.

The capacity of the fuel pump 25 is preferably such as to maintain a supply of fuel in the supply chamber slightly in excess of the maximum requirements of the burner, and provision is made for keeping a substantially constant level of fuel within the supply chamber by means of the return or overflow pipe 31 which leads from the chamber back to the fuel reservoir 29.

The top of the supply chamber is closed by the cover 63, there being provided, however, the vent 65 through which air is permitted to enter the space in the upper part of the supply chamber.

To permit the fuel delivery pump 17 to withdraw from the supply chamber a mixture of air and liquid fuel, a suitable, and preferably adjustable, mixing device is provided. For this purpose the air and fuel supply pipe or conduit 19 extends upwardly above the delivery pump and is then bent downwardly so that its end passes through the cover 63 of the supply chamber and dips below the level of the liquid fuel therein. The pipe 19 has its end closed by the plate 67 and is provided with a fuel adjusting valve, comprising an encasing sleeve 69, which, above the cover, is secured to the dial 71 (Figs. 6, 7 and 8) by means of which the sleeve 69 may be turned to different positions of adjustment on the fixed pipe 19. The pipe 19 is provided with a fuel admission orifice in the form of an arc-shaped slot 73 cooperatively related to the slot 75 in the adjustable sleeve, so that by turning the latter an aperture of varying size may be made available for the suction of liquid fuel through the air and fuel pipe 19.

To regulate the amount of air admitted to the pipe 19 and thereby adjust the proportion of the air and fuel mixture, the pipe 19, just below the cover 63, is provided with an air orifice 77 and the surrounding sleeve 69 is provided with an overlapping orifice 79, both in the form of slots formed in the walls of the pipe and sleeve respectively. Cooperatively related to the aforesaid air orifice is an outer air valve, also in the form of a rotary sleeve 81, having an overlapping slot-shaped orifice 83 and secured to a second dial 85 outside the cover 63. By turning the dial 85, the air adjusting valve or sleeve 81 may be set to different positions to vary the amount of air admitted through the pipe 19. The dials and sleeves are held in their proper relationship by means of a sleeve 87 fixed on the pipe 19 above the cover.

Any suitable means may be provided for aiding in the adjustment of the two dials to definite known positions. Herein, the fixed sleeve 87 is provided with the laterally extending reference point 89, the dial 85 for the air valve with the upright reference member 91, and the fuel adjusting valve 71 with the series of graduations 93, so that both dials may be adjustably set to known positions with relation to the fixed reference point 89.

It is important that a substantially constant level of liquid fuel be maintained in the supply chamber 21 in order to provide a constant and unvarying action by the delivery pump 17. By means of the elevated settling chamber supplied by the fuel pump and the overflow pipe back to the fuel reservoir, such constant level may be maintained in the supply chamber without the need of valves or other devices apt to be incapacitated by the presence of sludge or other impurities in the oil. the air and fuel mixing device being permitted to function to withdraw a definite proportion of comingled air and fuel through the air and fuel supply pipe 19.

Referring now to the delivery pump 17, the latter is provided with a rotor 95 secured on the rotor shaft 39, with the perforated lining sleeve 97, and with inlet and discharge chambers, similar in general arrangement (although slightly larger to secure increased capacity) to the corresponding parts already described in connection with the fuel pump 25. The discharge chamber for the delivery pump is connected directly to the delivery pipe 15 leading to the burner nozzle.

The suction chamber, however, is connected to the air and fuel supply pipe 19 in such manner as to avoid the necessity for valves in the suction, and also the necessity

for packing about the rotor shaft. For this purpose the inboard bearing for the rotor shaft, which is provided by the inboard end closure plate 99, is prolonged and has a circumferential inlet chamber 101 (Figs. 3 and 4) connected near its bottom to the suction pipe 19 and entirely surrounding the rotor shaft 39. This inlet chamber 101 is connected to the suction chamber, which latter is indicated at 103 (Fig. 4), by means of the lateral passage 105 (Figs. 3 and 4) and the radial passage 107. Accordingly, as the pump 17 is rotated, the liquid fuel is drawn under suction into the inlet chamber 101 about the bearing portion of the rotor shaft and into the suction chamber 103 and delivered under pressure through the delivery pipe 15 and the nozzles 13.

During such time as the pump is in operation, therefore, there is no tendency for the oil or other liquid fuel employed to escape from the end plate about the rotor bearings in the inboard side thereof, while the outboard bearing is closed by the closure plate 33 for the fuel pump 25. Consequently, the pump may be operated without the use of packing.

To avoid the tendency of oil or other liquid fuel to escape from about the rotor shaft bearings at such times as the operation of the pump is interrupted, a trap is provided in the supply pipe 19 so that such liquid fuel as remains in the inlet chamber 101 and its passages and in the elevated portion of the pipe 19, is drained back into the trap. Since the pipe 19 during the operation of the pump is filled with a mixture of air and liquid of relatively small liquid volume, such trap may be conveniently provided by providing a relatively small bend 109 (see Fig. 2) in the pipe near its connection to the suction of the delivery pump, such bend being placed below the level of the inlet chamber 101, and serving to form a trap of sufficient capacity to receive the drainage from both the upright portion of the pipe 19 and the inlet passages of the pump.

In the operation of the device, the motor, which may be equipped with the usual thermostatic control device for operating the burner intermittently as may be required, drives the two rotors on the same rotor shaft, and the fuel pump forces the liquid fuel from the reservoir into the supply chamber where a constant level is maintained by the overflow pipe 31. The delivery pump is thereby enabled to draw its adjustable proportion of air and fuel mixture from the supply chamber and to deliver an unvarying amount thereof under pressure to the burner nozzle.

The delivery of fuel by the fuel pump to the supply chamber being in excess of the maximum requirements of the delivery pump, the overflow pipe maintains a constant level in the supply chamber at all times. When the operation of the motor is stopped the surplus portion of the fuel in the pipe 19 and the inlet passages drains into the trap 109. No valves of any kind are required in any part of the system, thereby avoiding troubles which come from interference with the operation of the valves through presence of sludge or other impurities, and no packing is required for either bearing of the rotor shaft, thereby eliminating all leakage and avoiding the difficulties which come from the necessity of such packing.

Both the suction conduit 19 and the supply pipe 23 present gravity opposing paths to the liquid fuel contained in the supply chamber 21, the former because of the reverse bend or goose-neck through which it enters the top of the supply chamber, and the latter because it is located above the level of the liquid fuel which is maintained by the overflow pipe 31. In other words, when the pumps cease the supply chamber can drain back into the pumps 17 and 25, and the only liquid remaining in the respective pipes being the small residuum left at the moment of stoppage.

While I have herein shown and described for the purpose of illustration one specific embodiment of the invention, it is to be understood that extensive deviations may be made therefrom, all without departing from the spirit thereof.

Claims:

1. A liquid fuel burning apparatus comprising a burner nozzle and a main fuel reservoir, a supply chamber arranged at an elevation above the main reservoir, a fuel supply pump through which the entire supply of liquid fuel for said chamber is lifted and delivered thereto, an overflow conduit leading back from the supply chamber to the main reservoir to provide a gravity flow for the surplus liquid fuel back to the reservoir and to insure the maintenance of a substantially constant level in the supply chamber without the necessary use of valved orifices, a second and main pump for delivering commingled gas and liquid fuel in finely divided form through the burner nozzle, said main pump having a suction conduit provided with an inlet orifice immersed below the constant level of the liquid fuel in the supply chamber for delivering a predetermined quantity of liquid fuel from the reservoir when said main pump is operated and provided with a second orifice between the liquid fuel level and the pump connected to a source of gaseous supply to cause the same to commingle with the liquid fuel, said fuel and gas supply orifices being adjustable to vary the mixture and said suction conduit being connected to present a gravity-oppos-

ing path to the liquid fuel from the supply chamber, whereby the passage of liquid fuel from said chamber to the pump is prevented except during the operation of the latter, the supply pump being connected to operate only with and during the operation of the main pump and its delivery conduit being so connected to the supply chamber and so located and arranged as not to be under the influence of the static head therein, thereby to provide a gravity-opposing return path, whereby through said combination there may be provided an open valveless supply system free from leakage.

2. A liquid fuel burning apparatus comprising a burner nozzle and a main fuel reservoir, a supply chamber arranged at an elevation above the main reservoir, a fuel supply pump through which the entire supply of liquid fuel for said chamber is lifted and delivered thereto, an overflow conduit leading back from the supply chamber to the main reservoir to provide a gravity flow for the surplus liquid fuel back to the reservoir and to insure the maintenance of a substantially constant level in the supply chamber without the necessary use of valved orifices, a second and main pump for delivering commingled gas and liquid fuel in finely divided form through the burner nozzle, said main pump having a suction conduit provided with an inlet orifice immersed below the constant level of the liquid fuel in the supply chamber for delivering a predetermined quantity of liquid fuel from the reservoir when said main pump is operated and provided with a second orifice between the liquid fuel level and the pump connected to a source of gaseous supply to cause the same to commingle with the liquid fuel, said suction conduit being connected to present a gravity-opposing path to the liquid fuel from the supply chamber, whereby the passage of liquid fuel from said chamber to the pump is prevented except during the operation of the latter, the supply pump being connected to operate only with and during the operation of the main pump and its delivery conduit being connected to the supply chamber and so located and arranged as not to be under the influence of the static head therein thereby to provide a gravity-opposing return path, whereby through said combination there may be provided an open valveless supply system free from leakage.

3. A liquid fuel burning apparatus comprising a burner nozzle and a main fuel reservoir, a supply chamber arranged at an elevation above the main reservoir, a fuel supply pump, also at an elevation above the fuel reservoir but below that of the supply chamber, through which the entire supply of liquid fuel for said chamber is lifted and delivered thereto, an overflow conduit leading back from the supply chamber to the main reservoir to provide a gravity flow for the surplus liquid fuel back to the reservoir and to insure the maintenance of a substantially constant level in the supply chamber without the necessary use of valved orifices, a second and main pump, also above the level of the fuel reservoir but below that of the supply chamber, for delivering commingled gas and liquid fuel in finely divided form through the burner nozzle, said main pump having a suction conduit for drawing a predetermined quantity of liquid fuel from the reservoir when said main pump is operated, connected also to a source of gaseous supply to cause the same to commingle with the liquid fuel, said suction conduit being connected to present a gravity-opposing path to the liquid fuel from the supply chamber, whereby the passage of liquid from said chamber to the pump is prevented except during the operation of the latter, the supply pump being connected to operate only with and during the operation of the main pump and its delivery conduit being connected to the supply chamber and so located and arranged as not to be under the influence of the static head therein thereby to provide a gravity-opposing return path, whereby through said combination there may be provided an open valveless supply system free from leakage.

4. A liquid fuel burning apparatus comprising a burner nozzle and a main fuel reservoir, a supply chamber arranged at an elevation above the main reservoir, a fuel supply pump through which the entire supply of liquid fuel for said chamber is lifted and delivered thereto, an overflow conduit leading back from the supply chamber to the main reservoir to provide a gravity flow for the surplus liquid fuel back to the reservoir and to insure the maintenance of a substantially constant level in the supply chamber without the necessary use of valved orifices, a second and main pump for delivering commingled gas and liquid fuel in finely divided form through the burner nozzle, said main pump having a suction conduit for drawing a predetermined quantity of liquid fuel from the reservoir when said main pump is operated, connected also to a source of gaseous supply to cause the same to commingle with the liquid fuel, said suction conduit being connected to the supply chamber and so located and arranged as not to be under the influence of the static head therein thereby to present a gravity-opposing path to the liquid fuel from the supply chamber, whereby the passage of liquid from said chamber to the pump is prevented except during the operation of the latter, the supply pump being connected to operate only with and during the operation of the main pump and its delivery conduit being connected to the supply chamber and so located and arranged

as not to be under the influence of the static head therein thereby to provide a gravity-opposing return path, whereby through said combination there may be provided an open valveless supply system free from leakage.

5. A liquid fuel burning apparatus comprising a burner nozzle and a main fuel reservoir, a supply chamber arranged at an elevation above the main reservoir, a fuel supply pump through which the entire supply of liquid fuel for said chamber is lifted and delivered thereto, an overflow conduit leading back from the supply chamber to the main reservoir to provide a gravity flow for the surplus liquid fuel back to the reservoir and to insure the maintenance of a substantially constant level in the supply chamber without the necessary use of valved orifices, a second and main pump below the level of the supply chamber for delivering commingled gas and liquid fuel in finely divided form through the burner nozzle, said main pump having a suction conduit for drawing a predetermined quantity of liquid fuel from the reservoir when said main pump is operated, connected also to a source of gaseous supply to cause the same to commingle with the liquid fuel, said suction conduit being connected to present a gravity-opposing path to the liquid fuel from the supply chamber, whereby the passage of liquid fuel from said chamber to the pump is prevented except during the operation of the latter, said suction conduit having also a trap between the supply chamber and the pump to drain the residual liquid from the conduit when the pump is out of operation, the supply pump being connected to operate only with and during the operation of the main pump and its delivery conduit being connected to the supply chamber and so located and arranged as not to be under the influence of the static head therein thereby to provide a gravity-opposing return path, whereby through said combination there may be provided an open valveless supply system free from leakage.

6. A liquid fuel burning apparatus comprising a burner nozzle and a main fuel reservoir, a supply chamber arranged at an elevation above the main reservoir, a rotary fuel supply pump through which the entire supply of liquid fuel for said chamber is delivered thereto, an overflow conduit leading back from the supply chamber to the main reservoir to provide a gravity flow for the surplus liquid fuel back to the reservoir and to insure the maintenance of a substantially constant level in the supply chamber without the necessary use of valved orifices, a second and main rotary pump for delivering commingled gas and liquid fuel in finely divided form through the burner nozzle, said main pump having a suction conduit for drawing a predetermined quantity of liquid fuel from the reservoir when said main pump is operated, connected also to a source of gaseous supply to cause the same to commingle with the liquid fuel, said suction conduit being connected to present a gravity-opposing path to the liquid fuel from the supply chamber, whereby the passage of liquid fuel from said chamber to the pump is prevented except during the operation of the latter, the respective rotors for said two pumps being mounted on the same shaft, a driving motor for the rotor shaft, and a suction conduit for one pump entering the pump chamber about the inboard bearing portion of the rotor shaft and the opposite end of the rotor shaft being enclosed by the walls of the pump casing, whereby through said combination there may be provided an open valveless supply system free from leakage.

In testimony whereof, I have signed my name to this specification.

GEORGE E. GOODRIDGE.