June 28, 1932. A. H. BALLARD 1,865,390

LIQUID FUEL BURNER

Filed July 23, 1930 3 Sheets-Sheet 1

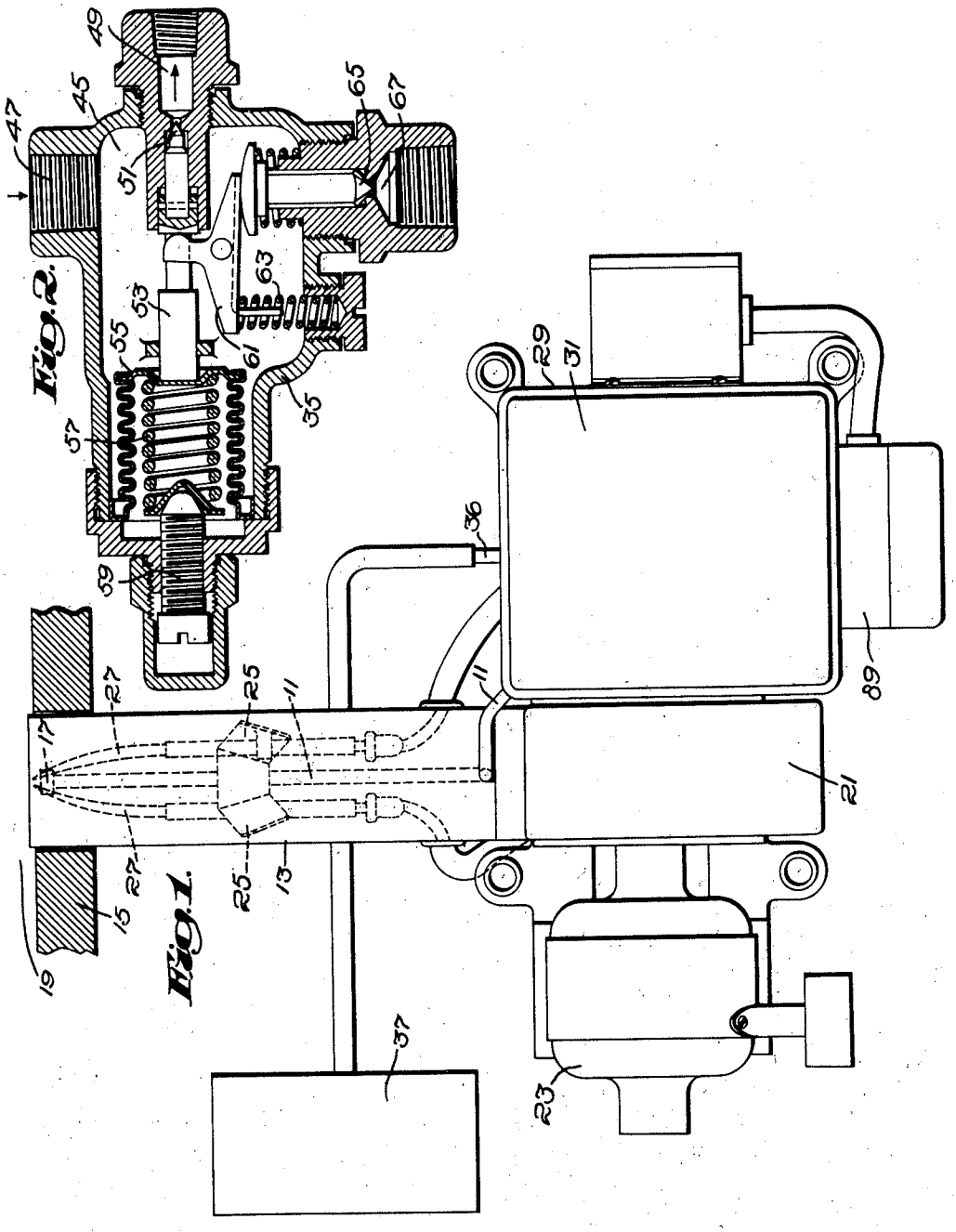


Fig. 2.

Fig. 1.

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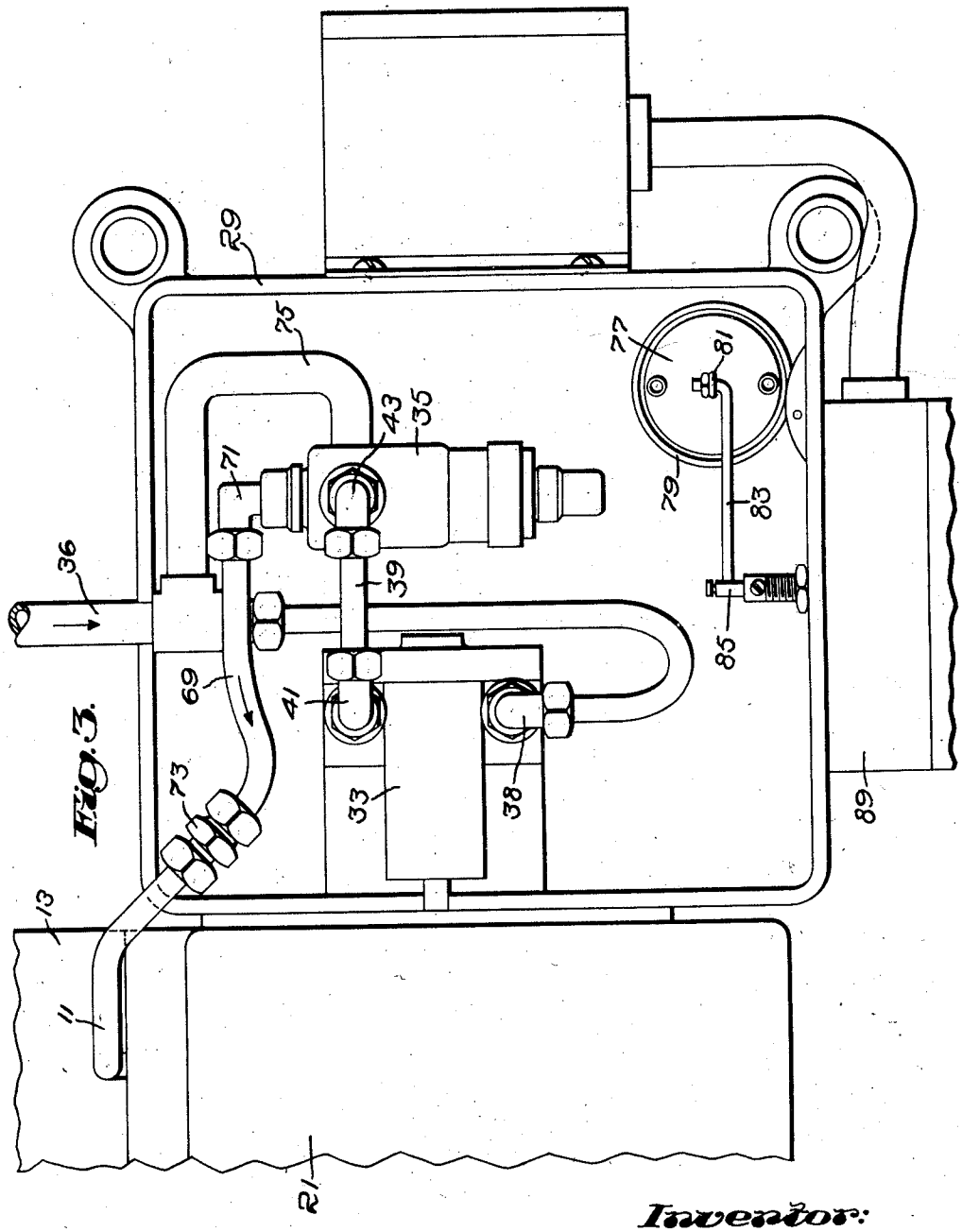


Fig. 3.

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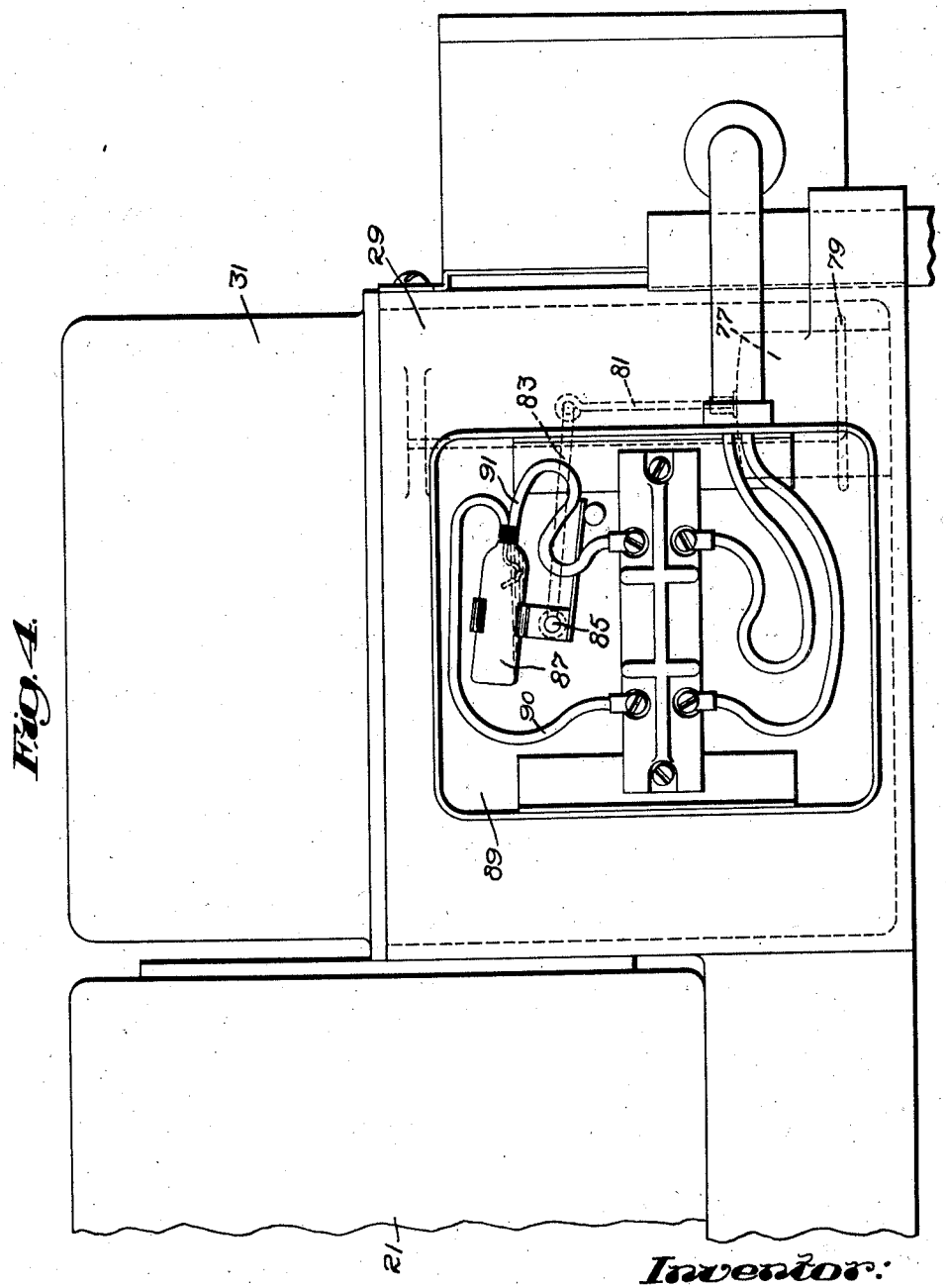


Fig. 4.

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UNITED STATES PATENT OFFICE

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LIQUID FUEL BURNER

Application filed July 23, 1930. Serial No. 469,984.

This invention relates to liquid fuel burners and more particularly to burners of the so-called gun type where the liquid fuel is discharged under high pressure into the combustion chamber through a relatively small nozzle orifice.

In burners of the high pressure gun type the liquid fuel is commonly drawn from a supply tank through the suction of a pump which discharges the oil through some pressure-regulating device, such as a pressure-relief valve, the latter serving to by-pass a certain amount of fuel back to the pump suction when the pressure exceeds the desired amount, so that the fuel delivered to the nozzle is delivered through a fuel delivery pipe at a substantially constant pressure. This arrangement involves the employment of numerous joints and connections between the high pressure side of the pump and the fuel delivery pipe which must be so constructed as to prevent leakage under the high pressure employed, the latter ordinarily ranging from approximately 100 to 150 pounds to the square inch. If leakage develops under the high pressure used, either through improper packing or faulty connection, the amount of liquid fuel leaking out may not only be considerable and a source of annoyance or even danger, but the fault in the pump or pipe connection may be aggravated with continued operation of the burner so that the rate of leakage will rapidly increase. It may therefore become both a source of trouble and an element of danger which is not present where low pressure delivery is utilized.

The present invention aims to meet this condition by providing a drainage chamber adapted to catch and retain the leakage which may result from the development of a fault in the connections on the high pressure side of the pump and by providing in conjunction with this a leakage responsive device such as a float so that, if the leakage accumulates to an amount indicating something wrong in the connections, the driving motor for the pump is cut out of operation. This not only prevents any slight leakage from spreading over the floor, but serves as a warning and safety device giving an indication when such leakage has reached a point where it is serious and where attention should be given to the pump connections before the burner is further operated.

In the illustrative form of the invention this office is carried out by enclosing the pump, together with the pressure regulating valve and other high pressure connections, in a small tank-like casing which is equipped with a float and provided with a float-actuated cut-out switch adapted to cut out the burner motor when and if the leakage accumulates to a substantial depth in the bottom of the casing.

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 showing the pump-enclosing casing in its relation to the delivery nozzle, blower and driving motor;

Fig. 2 is a sectional elevation on an enlarged scale showing a typical form of pressure regulating valve;

Fig. 3 is a plan view on an enlarged scale showing the enclosing casing for the pump, together with the pump, pressure-regulating valve and connections and also a switch-controlling float; and

Fig. 4 is an elevation of the casing showing the switch mounted on the side thereof.

Referring to the drawings and to the embodiment of the invention which is there shown for illustrative purposes, the latter is embodied in a well known type of burner comprising the fuel delivery pipe 11 which extends through a surrounding tubular air delivery shell 13, the latter entering the side of the furnace 15. The end of the pipe has a nozzle 17 with a relatively small aperture through which fuel in liquid form is discharged into the combustion chamber 19 under high pressure and in a more or less atomized condition.

The shell is connected to the delivery end of a rotary blower fan 21 driven by the elec-

tric motor 23, the blower serving to discharge air through the tubular shell into the combustion chamber about the nozzle. The current of air delivered through the shell is preferably given a rotary or whirling movement by the stationary inclined blades 25 mounted within the shell. The combustible mixture of air and atomized fuel is ignited by the electric ignition provided through the electrodes 27 connected to a suitable source of electricity.

At the side of the blower casing there is provided an enclosed casing or tank 29 of box-like shape having the cover 31 (Figs. 1 and 4) which is of curved contour in side elevation to conform to the contour of the blower casing. Within this casing there is mounted the pump 33 (Fig. 3) adapted to be driven by an end of the motor shaft which extends through the blower, there being also contained within the casing the pressure regulating or relief valve 35 together with the various pipe connections between the pump and fuel supply pipe 36, between the pump and the valve and between the valve and the fuel delivery pipe 11.

The fuel supply pipe 36 for the liquid fuel, which for purposes of description may be assumed to be oil, is connected to the main supply tank, diagrammatically represented at 37, and enters through the side of the casing 29, being connected to the pump suction through the connection 38. The pump may be of any suitable type, but is herein of the eccentric, rotary, positive-displacement type capable of delivering the oil under a pressure of from 75 to 150 pounds to the square inch. It discharges the oil to the pressure regulating valve 35 through the pipe 39 having the connections 41 and 43 respectively to the pump and the valve.

The regulating valve may be of any suitable type, the construction herein employed being shown in Fig. 2. The oil entering the valve chamber 45 through the inlet 47 is discharged to the burner nozzle 17 through the nozzle supply passage 49 controlled by the valve 51. The latter is moved to a closed position when the pressure drops below a predetermined minimum and opened when it rises above a predetermined maximum, its movement being effected by the plunger 53 controlled by the diaphragm 55, the tension of which may be adjusted by the spring 57 and adjusting screw 59. If the pressure tends to exceed the predetermined amount the contraction of the diaphragm moves one end of the pivoted rocker arm 61 against the spring 63, the opposite end of the arm withdrawing from the head of the spring-opened, by-pass valve 65 which thereupon serves to by-pass a certain amount of the oil back through the by-pass passage 67 to the pump suction, thereby serving to govern the pressure of the oil delivered to the nozzle and maintain it within the desired limits.

The nozzle supply passage 49 is connected (Fig. 3) to the nozzle delivery pipe 11 by the short connecting pipe 69 having the connection 71 to the valve and the connection 73 to the fuel delivery pipe, both connections being within the tank or casing 29, and the fuel delivery pipe entering the casing through the side walls thereof. The by-pass passage 67 has connection to the by-pass pipe 75 which in turn is connected to the oil supply pipe 36 leading back to the pump suction. Preferably a straining device (not shown) is inserted in the fuel supply pipe between the connection thereto of the by-pass 75 and the pump suction 38, which strainer will serve to clean the oil and to cool the oil by-passed through the regulating valve.

The pump pressure regulating valve and the principal pipe couplings and fittings which carry the high pressure oil are accordingly enclosed within the casing 29. Under normal conditions the latter contains no accumulation of oil. In the event that any leakage of the oil occurs, however, the oil drains down into the casing to be retained in the bottom thereof where it is prevented from spreading over the floor area or occasioning any damage or inconvenience and prevented from becoming a fire hazard.

Any slight leakage of the oil will effect no change in the operation of the burner, but, if a fault develops which permits a continued or increasing leakage of oil and which calls for attention or repair in the pump connections, the accumulation in the bottom of the casing will finally lift the float 77 (Figs. 3 and 4), contained within the casing and guided for vertical movement by the stationary guiding ring 79, so that the float will finally reach an elevation where it acts to cut out the motor and stop the further action of the burner.

To this end the float has connected thereto (Figs. 3 and 4) an upright rod 81, the upper end of which is pivotally connected to the arm 83, the opposite end of the arm being secured to the rock shaft 85 which is journaled in and extends through the side wall of the casing and is adapted on the rise of the float to impart a tilting movement to the cut-out switch 87 which is mounted on the end of the rock shaft in an enclosed compartment 89 at the side of the casing. This switch may be of any suitable type, but herein it is of the mercury tube form comprising an enclosed glass tube mounted on the rock shaft and containing a small quantity of mercury. The tube normally tips to such a position that the two sealed-in, separated terminals of the lead wires 90 and 91 which form part of the motor circuit are immersed in the mercury and electrically connected, maintaining the motor circuit closed at that point. The tube is

adapted to be reversely tilted by the rock shaft, however, when the float rises to a sufficient height, causing the mercury to flow to the opposite and then depressed end of the tube, leaving the terminals out of contact with the mercury and disconnected, thereby opening the motor circuit and stopping further operation of the burner until the tank has been drained of the accumulated oil.

The result is that if any leakage results from any fault developed in the packing or high pressure connections, it is not only collected and held in the tank and prevented from spreading on the adjoining floor area, but if it becomes abnormal the float acts to open the motor circuit, serving as a warning to indicate that attention should be given to the pump or pipe connections and as an automatic cut-out to stop the burner until such attention has been accorded it.

While I have herein shown and described for the purpose of illustration one specific embodiment of the invention, it is to be understood that the same may be applied to burners of different type of construction from that shown and that extensive deviations and changes may be made in the character of the elements employed in the combination and in the mechanical construction and relative arrangement of parts, all without departing from the spirit of the invention.

Claims:

1. In a liquid fuel burner, the combination with a nozzle, of a main fuel supply tank, a motor driven pump for withdrawing fuel from the tank and delivering it to the nozzle under relatively high pressure, connections providing a circulating system from the tank through the pump to the nozzle including a pressure regulating valve between the pump and the nozzle having a pressure controlled by-pass for returning liquid fuel to the suction side of the pump, a closed casing enclosing said pump and valve and providing a normally empty leakage retaining chamber adapted to hold and receive leakage from the high pressure connections of the pump and prevent the escape of fuel odors at all times and avoid fire hazard, a float in said chamber responsive to the accumulation therein of fuel leakage, and a switch for cutting out said motor on the rise of said float whereby normal leakage is confined in said casing and abnormal leakage stops the operation of the burner.

2. A liquid fuel burner of the high pressure gun type having a liquid fuel supply tank and a nozzle, a high pressure pump with connections providing a circulating system from the tank through the pump to the nozzle including pressure regulating means adapted to deliver fuel in liquid form at a relatively high pressure to the nozzle, a closed casing independent of said circulating system enclosing said pump and the high pressure connections thereto including said pressure regulating means and presenting a leakage chamber adapted to retain leakage of fuel therefrom and to prevent the escape of fuel odors and avoid fire hazard at all times, a float in said chamber responsive to the accumulation of liquid therein, and means responsive to the movement of said float by an abnormal accumulation in said chamber to stop the operation of the burner.

3. A liquid fuel burner of the high pressure gun type having a fuel supply tank, a nozzle and a high pressure pump with connections providing a circulating system from the tank through the pump to the nozzle adapted to deliver fuel in liquid form at a relatively high pressure to the nozzle, means associated with the pump and all the high pressure connections to the nozzle therefrom where leakage may occur comprising a closed casing providing a drainage chamber adapted to receive fuel leakage from the pump and all such high pressure connections to prevent the escape of fuel odors at all times and avoid fire hazard, and means responsive to the accumulation of leakage therein to cut said burner out of operation.

4. A liquid fuel burner of the type having a nozzle and a high pressure pump connected to deliver fuel in liquid form at a high pressure to the nozzle, a casing enclosing all high pressure connections between the pump and the nozzle where leakage may occur comprising a drainage chamber adapted to receive fuel leakage from said high pressure connections, said casing being closed to prevent the escape of fuel odors at all times and avoid fire hazard, and means associated with said chamber responsive to the accumulation of leakage for cutting the burner out of operation.

5. In a liquid fuel burner of the high pressure gun type embodying a liquid fuel nozzle and means for introducing air adjacent thereto, a motor, a fan driven by said motor for supplying air to said means, a fuel supply tank, a pump driven by said motor for withdrawing fuel from said tank and supplying it in liquid form under relatively high pressure to said nozzle, connections providing a circulating system from the tank through the pump to the nozzle and including a pressure regulating valve between the pump and the nozzle having a pressure controlled by-pass for returning liquid fuel to the suction side of the pump, a closed casing enclosing the pump and valve and providing a chamber to trap and retain leakage from the same, a float in said chamber responsive to the accumulation of leakage therein, and a switch cutting out said motor and actuated by the rise of said float, whereby normal leakage is confined in said casing, avoiding odors

and fire hazard at all times, and abnormal leakage stops the operation of said fan and pump.

6. A liquid fuel burner of the high pressure gun type having a fuel supply tank and a nozzle, a high pressure pump with connections providing a closed circulating system from the tank through the pump to the nozzle including pressure regulating means adapted to deliver fuel in liquid form at a relatively high pressure to the nozzle, a closed casing completely enclosing said pump and pressure regulating means and presenting a closed leakage chamber adapted to retain leakage of fuel, and means responsive to the accumulation of liquid in said chamber for cutting said burner out of operation whereby normal leakage is confined in a closed casing avoiding odors and fire hazard at all times and abnormal leakage stops the operation of the burner.

7. In combination with a liquid fuel burner embodying a source of liquid fuel, a burner nozzle, a high pressure pump connected to receive liquid fuel from said source, and connections for conducting liquid fuel under high pressure from said pump to said nozzle; a drainage chamber comprising a closed casing embracing all high pressure connections between the pump and the nozzle where leakage may occur to trap and retain such leakage and prevent escape of fuel odors at all times and avoid fire hazard, and means associated with said chamber to stop the operation of said pump in response to accumulation of leakage by said chamber.

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

ARTHUR H. BALLARD.