Jan. 8, 1929. 1,698,422

L. I. ALDRICH

LIQUID FUEL ATOMIZING DEVICE

Filed April 19, 1923 3 Sheets-Sheet 1

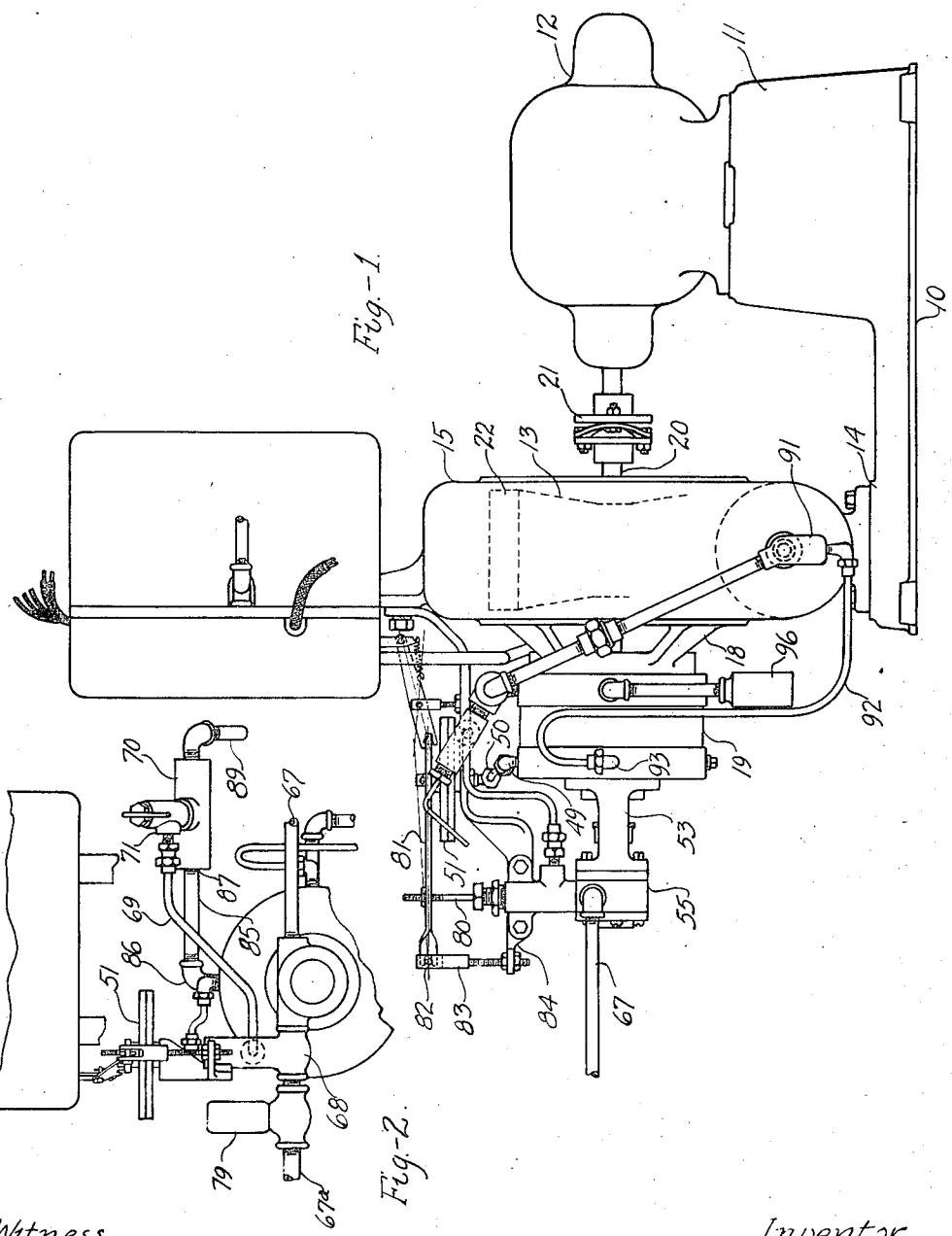


Fig.-1.

Fig.-2.

Witness
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LIQUID FUEL ATOMIZING DEVICE

Filed April 19, 1923 3 Sheets-Sheet 2

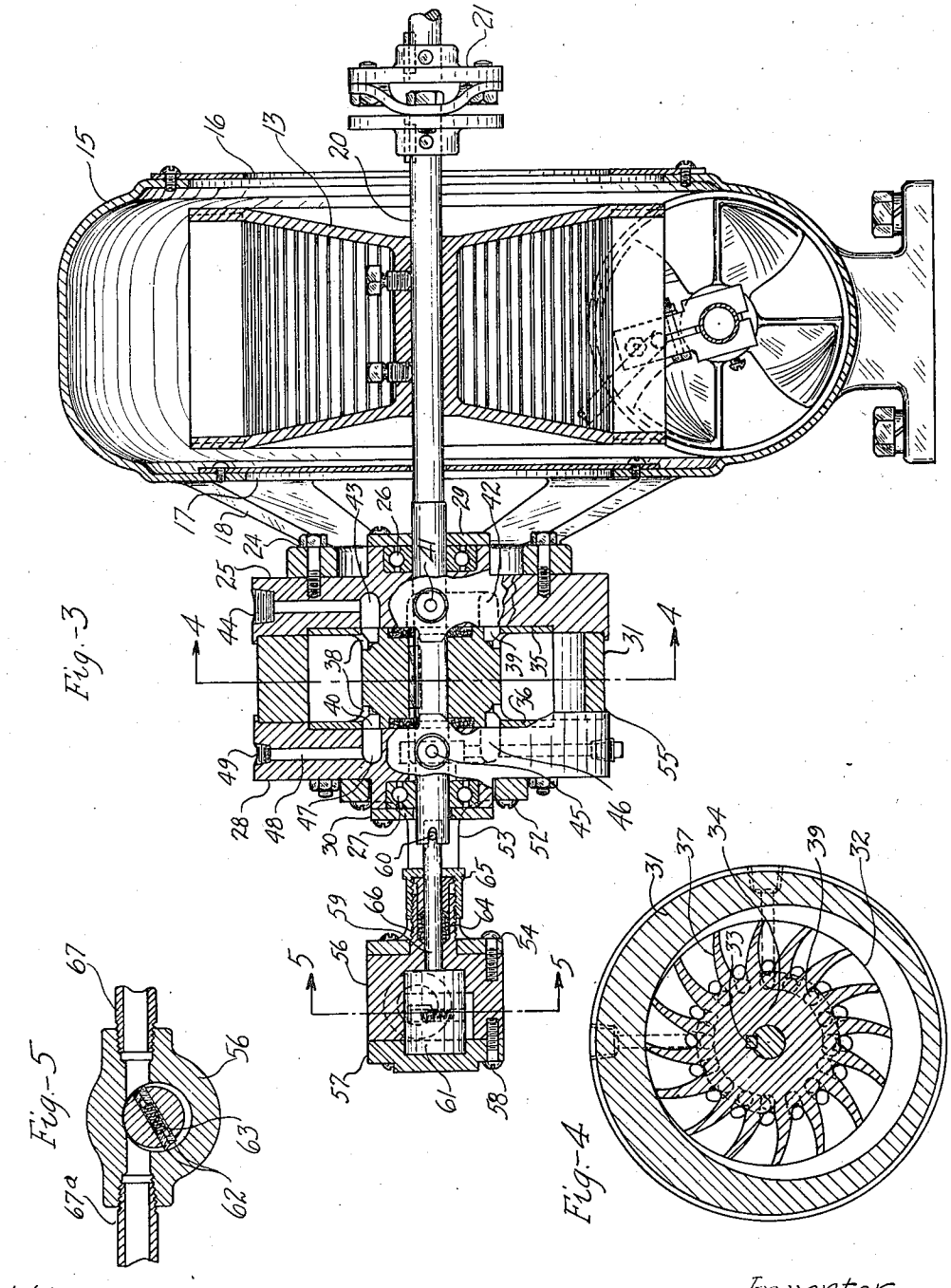


Fig. 3

Fig. 5

Fig. 4

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LIQUID FUEL ATOMIZING DEVICE

Filed April 19, 1923 3 Sheets-Sheet 3

Fig-6

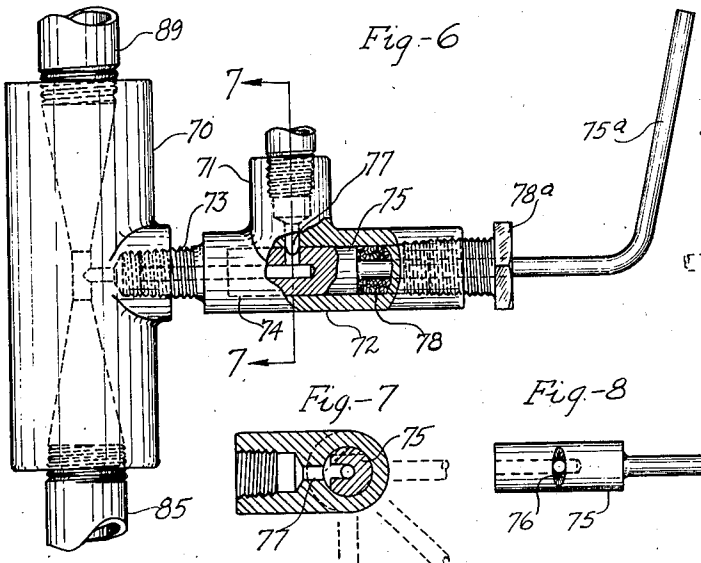


Fig-9

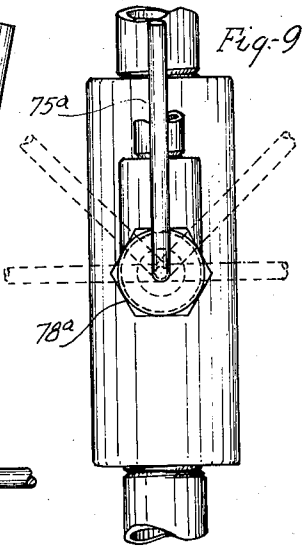


Fig-7

Fig-8

Fig-11

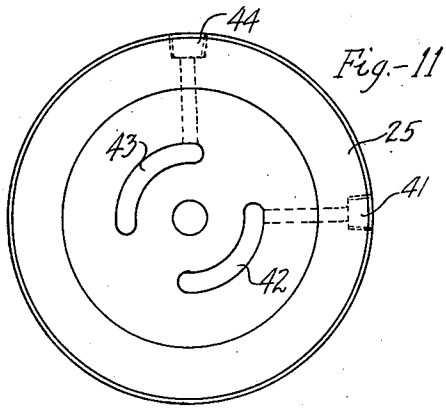


Fig-10

Witness
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UNITED STATES PATENT OFFICE.

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LIQUID-FUEL ATOMIZING DEVICE.

Application filed April 19, 1923. Serial No. 633,272.

My invention relates to liquid fuel atomizers.

The object of my invention is in the provision of a power operated device for atomizing a fuel mixture.

Another object of my invention, is the provision of a particular combination of air and fuel pumps whereby an efficient atomization of a fuel mixture results.

A further object is in the adaptation of a special air pressure pump in connection with a fuel feeding device which results in a thorough mixture of the air and oil.

Yet another object is in the provision of a fuel pump and liquid fuel air pressure pump for the purpose of atomizing a fuel mixture and a special means for replenishing said liquid fuel air pump.

Still another object of my invention includes a novel structure permitting the introduction of air and fuel thereto under determined pressure for the purpose of atomization.

A still further object is the provision of a complete fuel atomizing unit having detachably related thereto the power means comprising an electric motor.

Other objects of my invention will appear in the following specification in connection with the annexed drawings in which

Figure 1 is a side elevation of my device.

Figure 2 is a front elevation showing detailed arrangement of the pump and valve mechanism.

Figure 3 is a longitudinal sectional view of the fuel pump, air pressure pump and fan.

Figure 4 is a cross sectional view on the line 4—4 of Figure 3.

Figure 5 is a cross sectional view on the line 5—5 of Figure 3.

Figure 6 is an enlarged detail of a portion of my atomizing mechanism.

Figure 7 is a sectional view on the line 7—7 of Figure 6.

Figure 8 is a detail of the fuel adjustment valve.

Figure 9 is an enlarged detail view of the fuel adjusting mechanism.

Figure 10 is a side elevation partially broken away showing the relative arrangement of the fan, atomizing tube and ignition device.

Figure 11 is a detail of a portion of the air pressure pump.

It may be said concerning my liquid fuel atomizer that primarily it is adapted to be used in the conventional house furnaces that are used in connection with the various systems of heating.

However, the above is not the only use for my particular atomizer and as a matter of fact it may be used where ever a heating agent is required. My device is adapted to be used in connection with the formal thermostat and also has the electrical connections that are necessary to establish automatic operation in connection therewith. In view of the fact that another application having specific reference to such points accompanies the present one, I am merely alluding generally to such portions.

In the drawings there is shown a base 10 having a raised portion 11 which provides an attachment means for an electric motor 12 of approximately ¼ horse power, although the size of the motor is determined by the size of the outfit desired. The fan or blower 13 of conventional design is attached at 14 to the base 10 and includes the fan housing 15 open at both sides as at 16 and 17, in the present structure, although one opening would provide sufficient draft. Cast integrally with the housing 15 are the extended arms 18 which support the air pump 19 to be later described. A shaft 20 is attached at one end to the electric motor by means of the flexible coupling 21 and provides the driving power for the various elements of my device. This shaft 20 is supported at its opposite end in bearings in the air pressure pump but it has attached thereto at an intermediate point the blade portion 22 of a fan. This blade portion 23 is shown in detail in Figure 10 wherein the blades per se appear at 23 to be curved slightly for more efficient draft. The air pump described generally as 19 is supported adjacent the fan by means of the arms 18 which are bolted as at 24 to the inner face 25 of said pump. The power shaft 20 has its outer end supported within said pump, upon one side by the bearing 26 disposed in the inner plate 25 and on the other side by a similar bearing 27 mounted in the outer face plate 28, of almost similar construction to the plate 25. Closure members 29 and 30 secure the bearings in the respective face plates. A cylindrical outer housing for the air pump is shown at 31 and is supported by the clamping action of the inner and outer plates 25 and 28. This pump hous-

ing 31 as shown in Figure 4 is of greater thickness at one side than the other in order to provide an eccentric mounting with relation to the rotor 32 therein which has as its axis the drive shaft 20. The rotor 32 of my air pump is keyed as at 33 to the drive shaft and is made up of a hub portion 34, side plates 35 and 36, and the curved blades 37 as shown in Figure 4, which provide a series of hollow cups 38. A series of circumferentially disposed holes 39 are drilled through the plate 35 providing entrance therethru to the cups 38. In a similar manner on the opposite side, a series of holes 40 are drilled thru side plate 36 providing entrance to the cups at the other side. An air inlet is drilled at 41 in plate 25 of the air pump and has connection with the series of holes 39 thru the arcuate shaped opening 42 on the inner face of said plate 25. Means for taking the air under pressure from the pump is provided in another arcuate shaped slot 43 on the inner face of plate 25 adapted to register with the circumferentially disposed holes 39 and also thru an outlet 44 in the same plate.

The air pump of my present structure, the operation of which is to be later described, must necessarily be supplied by a continually fed small amount of fuel for lubrication purposes to replenish loss by evaporation and for cooling same. Means for supplying this fuel is provided thru the inlet 45 which has connection with the inner portion of said pump thru the arcuate shaped slot 46 on the inner face of plate 28 which is adjacent the circumferentially disposed holes 40 in the plate 36 and registers therewith. At 47 is shown another arcuate slot registering with apertures 40 and also at 48 there is a drilled portion adapted to have screwed therein as at 49 a tube 50 leading to a formal diaphragm member 51 having connection with a fuel cutoff valve mechanism to be later described. Securely bolted as at 52 to the outer face of plate 28 is a longitudinally disposed support 53 which at its outer end is attached at 54 to a rotary fuel pump generally described as 55. The outer end of the support 53 serves also as the inner face of said rotary fuel pump, which includes the pump housing 56 and the outer face plate 57 securely attached thereto as at 58. The pump housing 56 is drilled at its inner side to provide entrance for the stub shaft 59 which is attached to the main drive shaft 20 by means of the slip or pin coupling 60. The outer end of this stub shaft is enlarged as at 61 to provide the rotor of the conventional rotary pump 55. This rotor 61 has disposed transversely therein the leaves 62 being tensioned by means of coil spring 63. A packing for the stub shaft is shown at 64 and an outer collar 65 is threaded onto the extended portion 66 of the pump housing to securely contain said packing therein.

In Figures 1 and 2 there is shown a fuel inlet 67 for the conventional rotary pump 55 and a fuel outlet at 67ª. The fuel from the rotary pump 55 passes thru a fuel cut-out valve 68, thru the tube 69 to the adjustable valve mechanism shown in figure 6, to be later described, and then to the venturi 70 shown in detail in Figure 6.

The adjustable valve mechanism shown in Figure 6 includes the following:

A fuel inlet 71 which is merely the extension of the lead 69, and the housing portion 72. This housing is screwed into the venturi as at 73 and has an inner chamber 74 adapted to receive the plunger 75 which is revolvable therein and securely fastened by means of the screw cap 78ª. The fuel regulating handle 75ª is merely an extension of the stem of the plunger. A packing for my valve member is shown at 78. The plunger member 75 is drilled longitudinally to permit passage of fuel to the venturi and has a transverse clearance way 76 for register with the fuel inlet opening 77. This transverse clearance way is of particular importance in that it is rotatable beneath the fuel inlet opening and though reducing and enlarging the opening, nevertheless, at all times, has a substantially rounded fuel passage way.

In Figures 1 and 2 where I have shown the general outline of my device, I have not included the conventional fuel container but it may be said that both the fuel inlet 67 and the fuel overflow tube 67ª are connected with the same or same series of fuel tanks. At 79 is shown an adjustable pressure valve of formal construction. The fuel cut-out valve 68 has the stem of its closure member therein extending upwardly as at 80 and secured to a longitudinally disposed arm 81 which has a pivotal mounting 82 in an adjustable supporting member 83 which is attached to a frame 84 having connection with the supports for the electrical controls. At a point near the other end of the longitudinally disposed rod 81 there is a connection between said rod and the pressure diaphragm 51 with the result that movement of said diaphragm due to the reduced or increased pressure within said air pump 19 will raise and lower the rod, transmitting a corresponding movement to the cut-off member in the fuel cut-out valve 68. At the extreme end of the rod 81 and pivotally related thereto is a lever having connection with the electrical controls for the device which are not included within the scope of the present application.

An air outlet tube 85 is threaded at one end in a receiving portion 86 in the inner plate 25 of the pump 19 and at its outer end at 87 in the venturi 70. A fuel mixture tube 89 is threaded in the venturi 70 and provides passage for the mixture therethru to the discharge end 90 of the burner. At an intermediate point in this fuel mixture tube there is

shown a sump 91, and this sump is positioned at a point where the fuel mixture tube makes a substantially right-angular turn before its final passage to the nozzle 90. Leading from this sump 91 is a small by-pass 92 which leads back and is threaded into a receiving portion 93 in the outer face plate 28 of the air pump. In Figure 10, a tubular casing 94 is shown as an extension of the fan or blower and houses the blast therefrom to a point within the fire chamber (not shown).

I have not shown the heat chamber into which my device is adapted to be projected but merely state that the blast end or nozzle 90 thereof is adapted to be disposed within any formal fire pot or combustion chamber. The fuel tube 89 is disposed within the tubular section 94 and discharges the fuel mixture at a point substantially the same as the exit of the blast from the fan thru said tubular section.

Disposed within the end of the section 94 and surrounding the discharge nozzle of the fuel tube are a series of wing members 95 for the purpose of deflecting the air blast from the fan.

Before I describe the operation of my present structure it might well be said that my device is adapted to be used in connection with the formal house thermostat and in co-operative relation with a pilot light for the fuel blast and a series of electrical switches and controls. However, in my description of the operation of the present structure I am limiting it merely to the operation of the burner or atomizing device, per se, I have not shown fuel containers for the present device as they are merely conventional but the fuel is fed by either gravity or suction to the rotary fuel pump 55 from where a portion of the discharge from said pump is forced under pressure predetermined by the adjustment of the adjustable pressure valve 79 thru the cut-out valve 68 and tube 69 to the adjustable valve mechanism where the amount of fuel is determined prior to its admission to the venturi 70. The balance of the discharge from the pump 55 flows thru the adjustable pressure valve to the container (not shown). The rotary action of the air pump 19 draws air thru the muffler 96 into the air inlet 41 and then to the air pump where it is placed under pressure by the action thereof and forced therefrom thru the air outlet 44 to the venturi 70.

I wish at this time to go into a detailed description of the operation of my specific air pump. I have described in detail the structural features thereof but have not brought out the fact that this is a fluid pressure air pump.

In Figure 4 a cross section of my specific air pressure pump is shown and with an enlarged detail of the included elements. The pump housing is partially filled with a determined amount of liquid and although this type of pump is adapted to operate with any kind of liquid contained therein, in view of the fact that the present device is adapted to burn a fuel oil, for the purpose of efficiency a by-pass means has been provided to continually replenish the liquid in the pump with said fuel oil. Action of the rotor within said housing which is partially filled with fuel results, due to centrifugal force, in throwing the fuel outwardly from the swiftly moving blades of the rotor and in a direction and speed substantially the same as the movement of the rotor. As said before there is a series of circumferentially disposed holes in the inner plate 35 of the rotor 32 which alternately pass the arcuate shaped air inlet 42 in plate 25 of the air pump. The rotation of the pump results in the suction of air thru said openings into the base or inner part of the cups 38 of said rotor. The holding of the fuel against the pump housing due to centrifugal force leaves a certain space wherein a vacuum is created to be filled by air admitted thru the ports. Now the eccentric mounting of the rotor within the housing gradually forces the fuel in between the blades and compresses the air contained in the cups, thus acting in a manner similar to an internal gear working with the blades of the rotor. I have previously described the arcuate shaped air outlet port on the inner plate 25 and hence when these cups pass this air outlet the air therein, which has been compressed by the action of the rotor and fuel, is permitted to escape and pass thru the air outlet into the air pressure tube and hence to the venturi. It may be seen that with a continuous movement of the rotor a maintained air pressure due to the successive escape of air from the cups will result. The maintenance of a determined amount of fuel within the pump as a compression agent is of course necessary and due to the fact that the swift rotation thereof must necessarily utilize a certain amount for lubricating purposes, it is necessary to constantly replenish the supply therein.

For this purpose, I have provided a small sump 91 in the fuel mixture line and from this sump a very small fuel tube is by-passed to the air pump. I think it only necessary to say that entrance of the fuel into the pump is accomplished by an exactly similar means as in the case of the air, the only difference being that there is no outlet for the fuel, but this is not necessary in that the by-pass 92 has such a diameter that the supply of fuel within the pump is merely maintained, not increased. There is also shown a second air outlet in connection with the conventional diaphragm and it may be clearly seen that with increased pressure within the air pump a similar amount of pressure will be applied to said diaphragm with corresponding movement thereof. In this case the diaphragm is co-operating with the longitudinally disposed arm 81 which op-

erates the fuel cut-off valve 68. The initial movement of the fuel pump and air pump will not permit the opening of the fuel cut-off valve until the pressure within the air pump has been raised to a pre-determined degree. In other words when the pressure within the air pump has become such that operation of the diaphragm 51 will take place, then a corresponding movement will be transmitted to the arm 81 with a consequent opening of the valve 68 due to the raising of the stem thereof by said arm. The purpose of the above is merely to have a determined air blast before admission of fuel for a more efficient atomization and also to prevent the admission of any fuel when the device is idle.

The operation so far has been carried to the admission of air under pressure and the fuel under pressure to the venturi 70. By means of the regulating valve heretofore described, the amount of the fuel delivered into the venturi may be determined and as a matter of fact the fuel pressure must be slightly greater than the air pressure. This is obtained by setting of the fuel pressure valve 79. This regulating valve also acts as a means for regulating the fuel mixture within the venturi with a consequent regulation of the size of fire blast. There is an initial atomization of the fuel mixture within the venturi due to its peculiar form and also to the fact that the air and fuel are both under high pressure. This resulting fuel mixture is carried thru the fuel tube 89 to the nozzle 90 which has the conventional spiral (not shown) therein, to again slightly retard and break up the fuel mixture before discharge. The discharge opening is also reduced for the above purpose and to permit the discharge of the fuel mixture at a greater velocity therefrom and in the shape of a cone. The fan operated of course by the electric motor provides an auxiliary draft means and the blast therefrom is deflected by the wings 95 adjacent the fuel discharge nozzle, to assist in the so-called "re-atomization" of the fuel mixture. A means for igniting the fuel mixture at the point of discharge is shown at 97 and may be any one of a number of well known types.

What I claim is:

1. In a liquid fuel atomizing device, the combination of an atomizing chamber, an atomizing nozzle, a fuel pump adapted to supply fuel to said chamber, an air pump in which liquid fuel acts as a piston adapted to supply air to said chamber, a single fuel mixture discharge tube, and means for by-passing a portion of said mixture to replenish said air pressure pump.

2. In a device of the class described, the combination of a fuel pump, an air pump in which liquid fuel acts as a piston, a common power shaft for said pumps, an atomizing chamber adapted to receive the discharge from said pumps, means for automatically replenishing said liquid fuel air pump with fuel, and an electric motor detachably related to said common shaft and supplying the power for the device.

3. In a liquid fuel atomizing device, the combination of a fuel pump, an air pump in which liquid fuel acts as a piston, a common shaft for the fuel and air pressure pumps, means for atomizing the discharge from said pumps, including a venturi regulating means for the fuel flow, and mechanism adapted to atomatically replenish said air pressure pump with fuel for the purpose of lubricating same.

4. In a liquid fuel atomizing device, the combination of a fuel pump, an air pump in which liquid fuel acts as a piston, power means therefor, means adapted to receive the discharge from said pumps, and to atomize same an atomizing nozzle, mechanism for controlling the flow of fuel from the fuel pump to said atomizer, and mechanism adapted to by-pass a portion of the atomized fuel mixture into the liquid air pressure pump for the purpose of replenishing same.

5. In a liquid fuel atomizing device, the combination with an electric motor, of a fuel pump, an atomizing chamber into which the fuel pump is adapted to deliver the fuel, an atomizing nozzle, an adjustment valve for controlling the fuel flow to the atomizing chamber, a fuel mixture delivery tube connecting the atomizing chamber and the atomizing nozzle, a rotary air pressure pump adapted to discharge into the atomizing chamber, and means for by-passing a portion of the fuel from the main delivery tube to the air pressure pump for the purpose of lubricating same.

6. In a device of the class described, the combination with an electric motor, of a fuel pump, an air pump in which liquid fuel acts as a piston, means for atomizing the discharge from said pumps including an atomizing nozzle and a fuel delivery tube, and means including a by-pass from the main fuel delivery tube to the air pump for the purpose of lubricating same.

In testimony whereof I affix my signature.

LOYD I. ALDRICH.