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2,388,939

PUMP FOR FUEL SYSTEM

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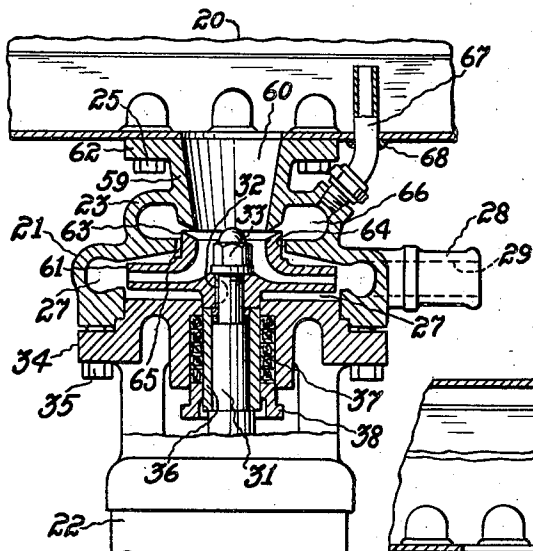


FIG. 5.

FIG. 3.

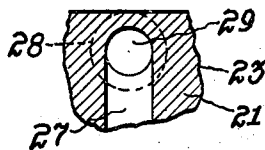


FIG. 4.

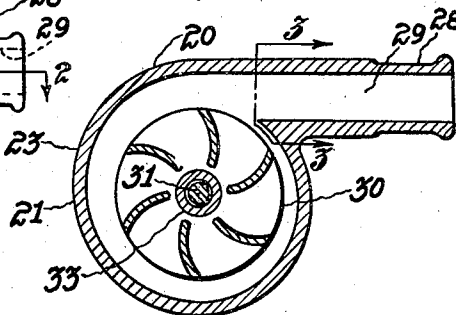
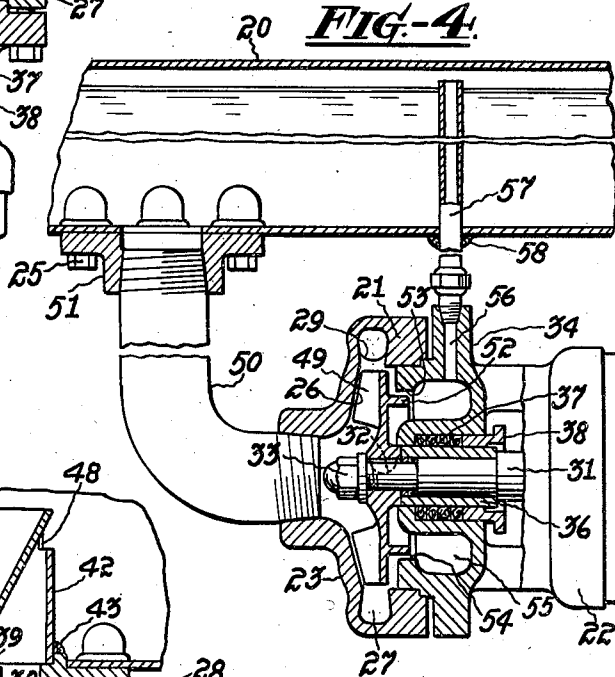


FIG. 2.

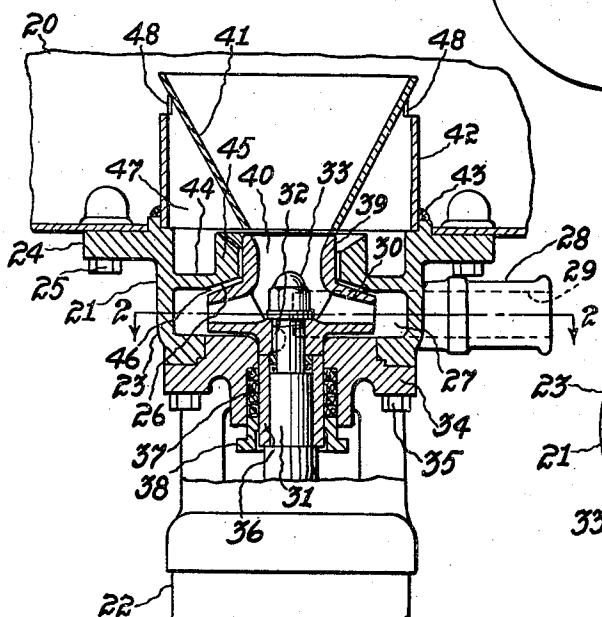


FIG. 1.

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UNITED STATES PATENT OFFICE

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PUMP FOR FUEL SYSTEMS

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2 Claims. (Cl. 103—113)

This invention relates to pumps, and more particularly to a pump for use in the fuel system of an aircraft.

As is well known, the tendency of the gaseous constituent of gasoline to separate from the liquid varies with variations in the pressure to which the gasoline is subjected. Thus, in the fuel system of an aircraft the formation of gas and vapor bubbles in the fuel supply increases with the increased altitude at which the aircraft is being operated, and if fuel containing bubbles of gas and vapor is delivered for distribution to an engine the fuel pump often becomes vapor-bound and is unable to deliver fuel in the form and quantities required for the efficient operation of the engine.

In accordance with the practice of the invention, it is contemplated to introduce a booster pump in the fuel line leading from the supply tank to the fuel pump of an airplane engine and to pump both the liquid and the gases from the supply tank into the discharge chamber of the booster pump where the gases and vapors may break out of the liquid, thence conduct such gases and vapors through suitable channels, other than those in the pump impeller, back into the fuel in the tank at a point remote from the impeller of the booster pump.

Owing to this arrangement not only the bubbles of gas and vapor that form within the fuel tank but also those that form within the impeller of the pump are separated out of the fuel before it is delivered to the fuel pump and only fully liquefied fuel will be delivered for use by the engine.

One object of the invention is to deliver the fuel to the fuel pump in a fully liquefied state.

A more specific object is to prevent the delivery of fuel to the fuel pump of an engine in a vaporous or gaseous state.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawing accompanying this specification and in which similar reference numerals refer to similar parts,

Figure 1 is an elevation, partly in section, of a pump constructed in accordance with the practice of the invention and a fuel tank to which the pump is attached,

Figure 2 is a transverse view taken through Figure 1 on the line 2—2,

Figure 3 is a transverse view taken through Figure 2 on the line 3—3, and

Figures 4 and 5 are views similar to Figure 1

showing other modified forms which the invention may assume in practice.

Referring to the drawing and at first more particularly to the form of the invention illustrated in Figures 1, 2 and 3, 20 designates a fuel tank, and 21 is a pump for pumping liquid fuel, as for example gasoline, from the tank 20 and is driven by a suitable motor 22, only a portion of which is indicated in the drawing.

The pump 21 is of the centrifugal type and its casing 23 has an external flange 24 that seats against the bottom of the tank 20 and is secured thereto by bolts 25. The casing 23 is recessed to provide an impeller chamber 26 and a discharge chamber 27 around the impeller chamber, and on the periphery of the casing 23 is a discharge nozzle 28 which is externally contoured at its free end for connection with a conduit leading to the fuel pump of an engine (not shown). The passage 29 within the nozzle 28 is preferably of uniform flow area throughout its length or should be so constructed that the inlet throat, located in the vicinity of the line 3—3 in Figure 2, is of at least the same flow area as the discharge throat or outer end of said nozzle.

The advantage of thus proportioning the channel through the discharge nozzle is that the velocity of the liquid throughout the length of the passage 29 will be substantially uniform and any gas and vapor bubbles that may be carried into the passage 29 may again break back into the discharge chamber instead of creating a condition of vapor lock at the fuel pump of the engine.

Within the impeller chamber 26 is an impeller 30 that is secured to the end of the motor shaft 31 by a key 32 and a nut 33. The shaft 31 extends through a head 34, secured to the casing by bolts 35, and carries a sleeve 36 to serve as a renewable wearing surface for the shaft. The head 34 contains packing material 37 and a gland 38 for compressing the packing to prevent leakage from the impeller chamber through the head 34.

The impeller 30 is shown as being of the closed type and has a hollow hub 39 the interior 40 of which is in direct communication with the outlet end of a spout 41 within the tank 20. The spout 41 is of funnel shape and is held in position by a support 42 that may be secured to the pump casing, as by welding 43. The support 42 is preferably of annular shape and its upper end may be secured to the spout 41 in any well known manner and preferably at a point near the upper end of larger diameter of said spout.

The pump casing 23 has an internal wall 44 to form a bounding surface for the impeller chamber 26 and the discharge chamber 27, and on the wall is an annular flange 45 that encircles the hub 39 of the impeller. Between the inner surfaces of the wall 44 and the boss 45 and the adjacent surfaces of the impeller is a space 46 through which bubbles of gas and vapor may escape from the discharge chamber 27. The space 46 is of annular shape so that such gases and vapors may readily find an outlet from all points in the upper portion of the discharge chamber.

The upper end of the space 46 opens into a chamber 47 defined by the spout 41 and the support 42, and suitable outlet openings 48 in the upper portion of the support 42 permit the escape of gas from the chamber 47 into the fuel in the tank 20.

In the operation of the device, the fuel is guided to the eye of the impeller by the spout 41, and upon discharge of the fuel into the discharge chamber 27 the bubbles of gas and vapor that break out of the liquid will escape through the space 46 into the chamber 47, thence through the openings 48 into the tank 20. Thus, only fully liquified fuel will be delivered to the fuel pump and the chances of the latter becoming vapor-bound will be obviated.

In the form of the invention shown in Figure 4, the impeller 49 is of the open type. The pump 21 is shown located at a point remote from the tank 20, and fuel is conveyed to the eye of the impeller 49 by a conduit 50 threadedly connected at one end to the pump casing 23 and at its other end to a flanged connection 51 that is secured to the tank by the bolts 25.

On the back of the impeller is a ring 52 that extends into an opening 53 in the head 34 to cooperate with the surface of said opening for defining an annular space 54 through which gas and vapor may escape from the discharge chamber 27. The head 34 in this form of the invention is provided with an annular chamber 55 to receive such gases and vapors, and a passage 56 in the head opens to a conduit 57 that extends into the tank 20 for conveying the gases into the tank. The conduit 57 is threadedly connected to the head 34 and may be secured to the tank by welding 58.

In the modified form of the invention shown in Figure 5, the pump casing 23 is shown provided with an integral spout 59 the interior 60 of which is of coniform shape and positioned to deliver fuel directly into the eye of the impeller 61. On the upper end of the spout 59 is an external flange 62 that is clamped against the tank 20 by the bolts 25.

The impeller 61 is of the closed type and the hub 63 defining the eye of the impeller extends through a bore 64 within the casing 23 and cooperates therewith to define a space 65 of annular shape through which bubbles of gas and vapor may escape from the discharge chamber 27. The outlet end of the space 65 opens into an annular chamber 66 in the casing 23 adjacent the opposed ends of the hub 63 and the spout 59 to receive the gas and vapor and a conduit 67 threadedly connected to the casing 23 conveys the gases into the tank 20. The conduit may, as illustrated, extend part way into the tank and be secured thereto by welding 68.

In the drawing the spaces or channels through which gas and vapor pass from the discharge chamber along the impeller are exaggerated somewhat and it is to be understood that these spaces are so proportioned as to permit the ready escape of gas while at the same time precluding the passage of undue quantities of liquid therethrough from the discharge chamber.

I claim:

1. In combination with a liquid-supply receptacle, a pump casing having an impeller chamber and a discharge chamber, said casing having a bore opening into the impeller chamber, an impeller in the impeller chamber to receive liquid from the receptacle and pump such liquid into the discharge chamber, a discharge nozzle for conveying liquid from the discharge chamber, a hub on the impeller extending into the bore in spaced relation therewith to define an annular channel between the walls of the bore and the periphery of the hub for conveying such gas and vapor from the discharge chamber as will evolve from the liquid, and conduit means for conveying such gas and vapor from the channel to a point in the receptacle remote from the point of entry of the liquid into the impeller.

2. In combination with a liquid-supply receptacle, a pump casing having an impeller chamber and a discharge chamber having a discharge opening, said casing having a bore opening at one end into the impeller chamber and communicating at its other end with the receptacle, an impeller in the impeller chamber to pump liquid from the receptacle to the discharge chamber, an annular hub on the impeller defining the inlet opening for the impeller and extending through the bore in spaced relation therewith to define an annular channel between the wall of the bore and the periphery of the hub for the escape to the receptacle of such gas and vapor as will evolve from the liquid in the discharge chamber.

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