Jan. 15, 1929. **1,699,194**

H. JUNKERS

LIQUID FUEL PUMP

Original Filed Feb. 24, 1927

Fig. 1

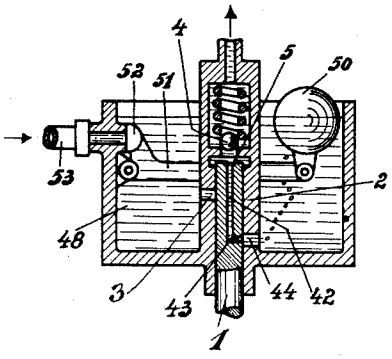


Fig. 2

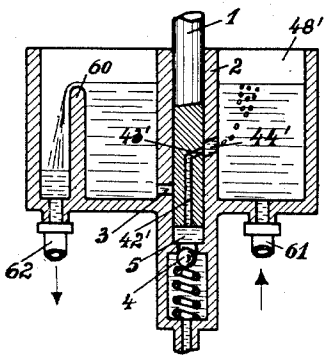
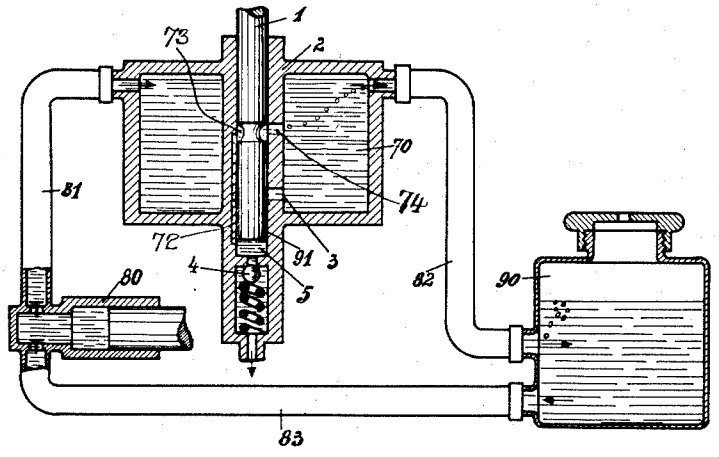


Fig. 3



Inventor:
Hugo Junkers
by Kissinbacher
Atty.

Patented Jan. 15, 1929. 1,699,194

UNITED STATES PATENT OFFICE.

HUGO JUNKERS, OF DESSAU, GERMANY.

LIQUID-FUEL PUMP.

Original application filed February 24, 1927, Serial No. 170,693, and in Germany February 26, 1926. Divided and this application filed November 25, 1927. Serial No. 235,701.

My invention relates to fuel pumps which are especially adapted for use in connection with internal combustion engines, and more particularly to pumps in which the delivery is interrupted by connecting the space in front of the piston with a point of reduced pressure.

It is an object of my invention to provide a pump with means for enabling air or other gases which may be present in or may have entered the pump together with the fuel to escape. I am aware that it has already been suggested to exhaust air or other gases contained in the pump chamber together with a surplus of liquid into an exhaust pipe or directly into the atmosphere by means of special members controlled by the pump piston movement.

The present invention relates to an improved arrangement, which provides for a particularly complete removal of air from the pump and for a quick separation of the air from the surplus of fuel escaping together with the air, so as to render this part of the fuel directly available for being sucked into the pump.

According to this invention I obtain this by placing the exhaust member for the surplus of fuel in communication with a fuel storage chamber arranged in close vicinity to the pump and having the fuel stored therein in practically currentless condition. The communication is effected by means of a pipe or conduit of short length and little resistance. The air thus introduced into the supply of fuel can escape freely either into the atmosphere or, if the storage chamber is closed, it can easily be exhausted by suitable means, preferably the suction conduit of the pump is also connected with the storage chamber, so that the surplus of fuel removed by the pump can at once be sucked in again by the pump. The exhaust member for the surplus fuel and for the air can have any suitable form and may be a valve or a conduit controlled by the pump piston. This member is preferably connected with the highest part of the piston chamber, so that the air sucked into this chamber can escape directly whenever the exhaust member is opened.

The communication between the pump chamber and the fuel supply for the purpose of separating the air can also be effected by means of the suction member and suction passage itself, but as a rule I prefer employing for this purpose a separate conduit in order to prevent air, which has already been separated out, from entering the pump again together with the fuel sucked in. In any case the passage for removing the air should be as short and wide as possible.

I further found it advantageous for the escape of the air conveyed into the storage chamber, if the liquid level in this chamber is kept constant relative to the pump, so that always the same conditions prevail for the air separation. The keeping constant of the liquid level can for instance be effected by means of a float acting on an inlet valve or by means of an overflow.

A further means of removing the air separated out from the pump consists in washing it away by a liquid current, for instance by supplying an excess of fuel to the fuel pump by means of an auxiliary pump, this fuel in excess being utilized for carrying along the air separated from the fuel pump up to a point where it can easily escape into the atmosphere. This arrangement offers the advantage that no open liquid surface is required near the fuel pump, which is frequently desirable in view of danger of fire.

In the drawings affixed to this specification and forming part thereof pumps embodying my invention are illustrated diagrammatically by way of example.

In the drawings

Fig. 1 illustrates a pump having means for removing air from the fuel,

Fig. 2 illustrates a similar pump in which the piston is inverted with respect to Fig. 1,

Fig. 3 illustrates a pump in which the cylinder is provided with a longitudinal groove, the piston being inverted as in Fig. 2.

In all the figures, 1 is the piston, 2 is the cylinder, 3 is the suction port, 4 is the delivery valve, and 5 is the space or working chamber of the cylinder in front of the piston.

The cylinder 2 is surrounded by a fuel supply tank which is open in Figs. 1 and 2 and closed in Fig. 3. The suction passage 3 and the system of passages for removing the air open into this tank, so that the air removed from the pump is readily separated and cannot be drawn back into the system.

Referring first to Fig. 1, 42 and 43 are the central and radial bores of the piston and 44 is a discharge passage in the cylinder wall cooperating with the bore 43. A float 50 with

a lever 51 and a valve 52 controls the supply of fuel through the pipe 53 and maintains a constant liquid level in the tank 48. If near the innermost point of piston displacement the passages 43 and 44 coincide, the air accumulated in the space 5 may escape through these channels onto the stationary liquid contents of the tank 48, whence it escapes easily into the atmosphere. Removal of air is facilitated, it is true, when the piston is inverted, that is when the space 5 is at the lower end of the piston as in Figs. 2 and 3 and not at the upper end, as in Fig. 1, but the air may be removed with an "upright" piston as well and notwithstanding the fact that the opening of the interrupting passage 42 is not at the highest point of the space 5. This is due to the fact that the mixture of fuel and air which enters into the space 5 at high speed under the vacuum generated by the piston, forms with the air still in the space 5 a sort of froth, part of which is discharged through the interrupting passage.

In Fig. 2 the piston 1 is shown inverted, so that its lower face defines the highest point of the space 5 and the bores 42′ and 43′ extend upwards from this face and cooperate with the discharge passage 44′. The delivery valve 4 is arranged at the lowest point of the space 5, so that entrance of air into the delivery system is effectively obstructed. The tank 48′ is provided with an overflow 60, a supply 61 and a discharge pipe 62.

Fig. 3 illustrates a pump having a closed fuel tank 70 and an inverted piston 1. 3 is the suction passage and 72 is a channel in the piston extending to the space 5 at the lower end of the cylinder and coming into communication with the suction passage 3 when the piston makes its downward stroke, thus allowing the air accumulated in the space 5 to escape through the passages 72, 73 and 74 into the fuel tank 70. 80 is a circulating pump, the suction pipe 83 of which is connected with a supply tank 90 and the delivery pipe 81 of which opens into the closed tank 70. Fuel is supplied in excess and the overflow is returned to the supply tank 90 through a pipe 82 and the air from the passage 3 is carried along with the overflow and separated in the tank 90 or conducted to any other point where it is permitted to separate from the fuel. A single circulating pump 80 may be provided in connection with a plurality of fuel pumps and the fuel pumps may be connected in parallel or in series with respect to the fuel supply.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described for obvious modifications will occur to a person skilled in the art.

I claim:—

1. Fuel pump comprising a cylinder, a piston reciprocable in said cylinder, one of said parts being formed with a conduit adapted to be opened and closed in harmony with the movement of the pump piston for interrupting the delivery, a reservoir in close vicinity of said cylinder and containing a substantially stationary body of liquid fuel in communication with said conduit, and escape means for venting to atmosphere air entrapped with the liquid by the piston.

2. Fuel pump comprising a cylinder, a piston reciprocable in said cylinder, one of said parts being formed with a conduit adapted to be opened and closed directly by said piston for interrupting the delivery, and a reservoir in close vicinity of said cylinder and containing a substantially stationary body of liquid fuel in communication with said conduit, said reservoir being provided with escape means for the venting to atmosphere air entrapped by the pump.

3. Fuel pump comprising a cylinder, a piston reciprocable in said cylinder, one of said parts being formed with a conduit adapted to be opened and closed in harmony with the movement of the pump piston for interrupting the delivery, a fuel inlet in said cylinder and a reservoir in close vicinity of said cylinder, containing a substantially stationary body of liquid fuel in communication with said conduit and with said inlet, said fuel constituting a liquid seal for said inlet, and being maintained at a substantially constant level thereover, and means in said reservoir for venting the air entrapped in the pump to atmosphere.

4. Fuel pump comprising a cylinder and a piston reciprocable in said cylinder, one of said parts being formed with a air venting conduit communicating with the highest point of the working chamber of the pump and adapted to be opened and closed directly by said piston for interrupting the delivery and exhausting trapped air, said piston becoming active in its downward stroke, and a pressure valve in said cylinder below said piston.

5. Fuel pump comprising a cylinder, a piston reciprocable in said cylinder, one of said parts being formed with a conduit adapted to be opened and closed in harmony with the movement of the pump piston for interrupting the delivery, a liquid container surrounding said pump and communicating with said conduit, spaced escape and supply passages between the cylinder and container normally below the liquid therein, and means for keeping said container permanently filled with liquid.

6. Fuel pump comprising a cylinder having suction and outlet means, a piston reciprocable in said cylinder, one of said parts being formed with a conduit adapted to be opened and closed in harmony with the movement of the pump piston for interrupting the delivery, a liquid container in immediate

vicinity of said pump and communicating with said conduit, said container being closed on all sides, means for maintaining a circulation of liquid across said container, an outlet conduit extending from said container and adapted to transmit the liquid passing through said container together with the air removed from the pump to the place of its separation from the liquid.

7. Fuel pump comprising a cylinder, a piston reciprocable in said cylinder, a fuel inlet in said cylinder, means for placing said inlet into communication with the working space of the pump during the delivery stroke, a reservoir in close vicinity of the pump and in communication with said inlet and containing a substantially stationary body of liquid fuel, and a separate escape passage between the pump and the reservoir for venting air entrapped in the pump to atmosphere through the latter.

In testimony whereof I affix my signature.

HUGO JUNKERS.