

Dec. 15, 1925.

1,565,461

E. R. HUNTLEY

LIQUID FEED SYSTEM

Filed April 14, 1920

3 Sheets-Sheet 1

Fig. I.

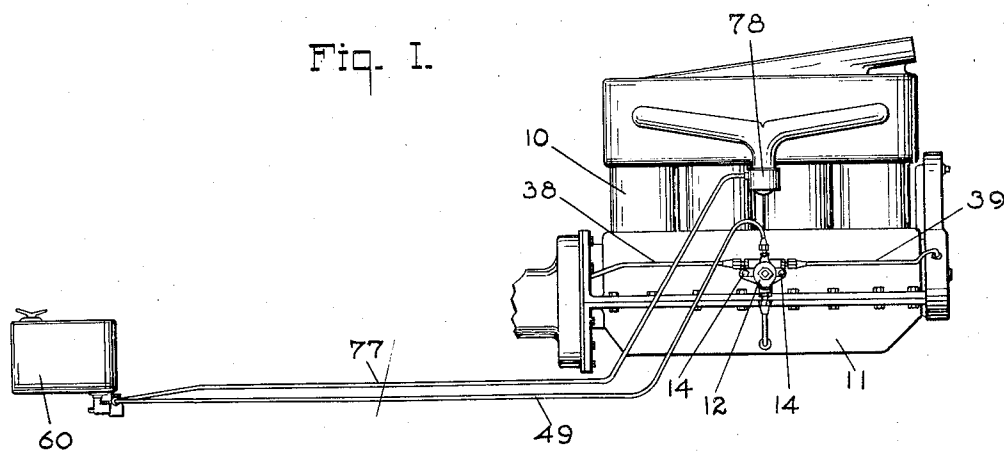
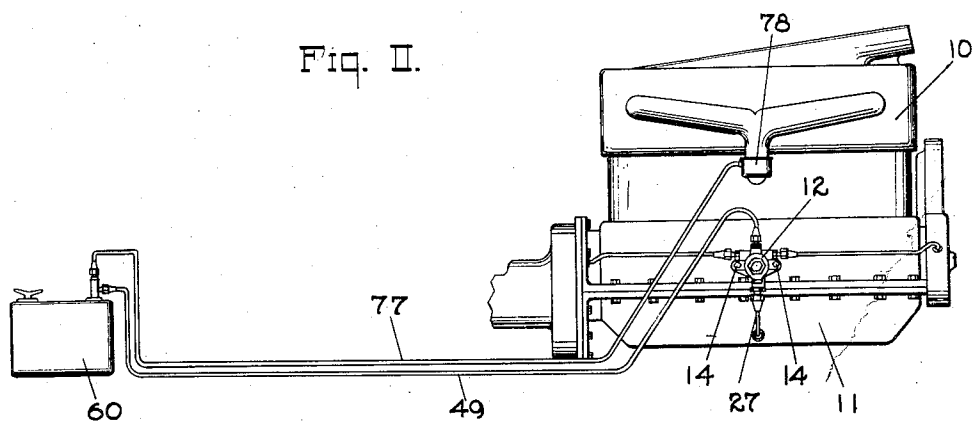


Fig. II.



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3 Sheets-Sheet 3

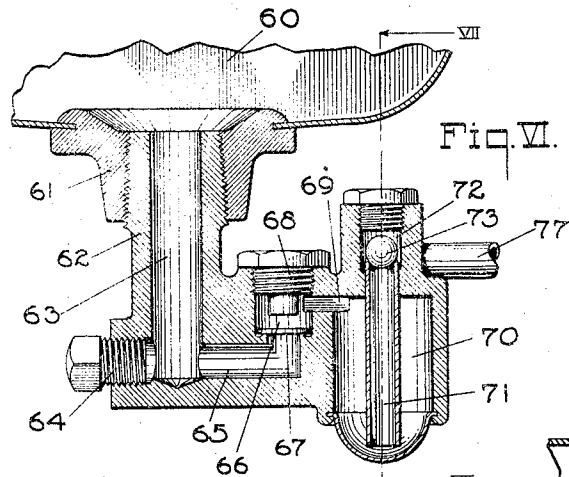


Fig. VI.

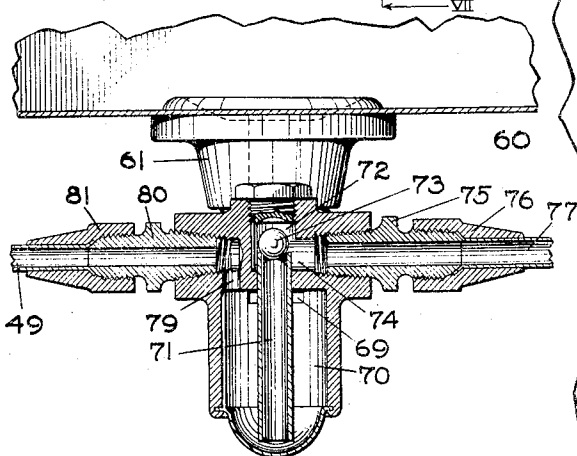


Fig. VII.

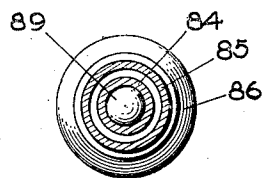


Fig. IX.

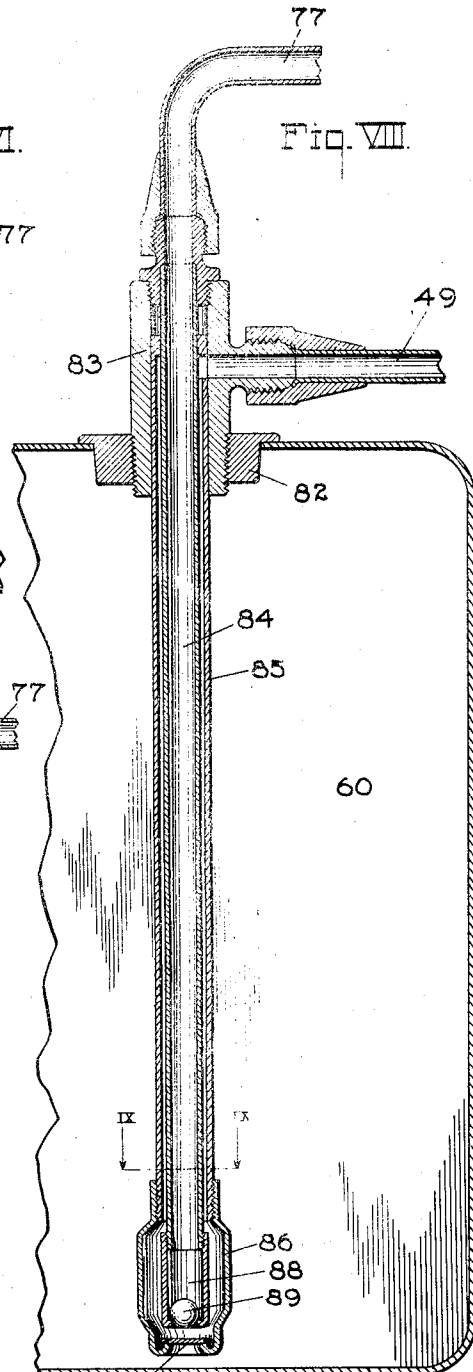


Fig. VIII.

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UNITED STATES PATENT OFFICE.

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LIQUID-FEED SYSTEM.

Application filed April 14, 1920. Serial No. 373,850.

To all whom it may concern:

Be it known that I, ERNEST R. HUNTLEY, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Liquid-Feed Systems, of which I declare the following to be a full, clear, and exact description.

This invention relates to improvements in fluid feed systems, particularly systems for raising fuel from a low level automobile tank to the carbureter. In some respects the invention is similar to that disclosed in my co-pending application Serial Number 367,327, filed March 20, 1920.

The principal object of the invention is the provision of means for pumping fuel from a low level tank directly to a carbureter, with automatic regulation of the amount pumped to correspond with the requirements of the carbureter.

A secondary object is the provision of a reciprocating piston air pump or compressor for accomplishing the above objects.

Another object is the provision of a pump by which compression impulses only are delivered to the liquid in the valved pumping chamber, my purpose being to prevent the taking of fuel, such as gasoline, into the pump cylinder in response to a suction impulse, the presence of gasoline in the pump being objectionable because of the fact that it is a solvent of lubricating oil.

A further object is the combining of a fuel raising air pump with a lubricant pump, both being mounted in the same casing and operated from the engine by a single cam.

A subsidiary object is the provision of a fluid tight partition between the aligned cylinders of the two pumps, through which the single piston rod extends, part of said partition being mounted upon and floating with the piston rod so as to avoid binding or unnecessary friction at this joint.

Other objects, and objects relating to details of construction and economies of manufacture will appear as I proceed with the description of that embodiment of the invention, which, for the purposes of the present application, I have illustrated in the accompanying drawings, in which—

Figure I is a more or less diagrammatic view showing in elevation an internal combustion engine and a fuel tank in the relative position, which they ordinarily occupy

upon an automobile, with one embodiment of my invention applied thereto.

Fig. II is a view corresponding to Fig. I, but showing a different connection with the fuel tank.

Fig. III is a longitudinal, vertical, sectional view of a combined air compressor and oil pump employed in my invention, showing the pistons at the ends of their compression strokes.

Fig. IV is a similar view showing the pistons at the ends of their suction strokes.

Fig. V is a plan view of the same structure but showing the oil exit pipe in horizontal section.

Fig. VI is a vertical, central, sectional view through a pumping chamber, which is attached to the bottom of the main fuel tank.

Fig. VII is a vertical sectional view taken substantially on the line VII—VII, Fig. VI.

Fig. VIII is a vertical, central, sectional view through a modified form of pumping chamber together with its connections.

Fig. IX is a cross section taken on the line IX—IX, Fig. VIII.

Similar reference characters refer to like parts throughout the views.

Referring to the drawings, 10 indicates a gas engine having a crank case 11. 12 is a casting having a flange 13 through which extend machine screws 14 for securing the casting to the crank case 11. The casting is formed with a pair of aligned cylinders 15 and 16, which as illustrated, may be of different diameters. That part of the cylinder 15 which is to the rear of flange 13 extends through an opening in the wall of the crank case.

The cylinder 15 contains a piston 17 which is hollow except at its rear end. A piston 18 slides in the forward cylinder 16. These two pistons are both fixed upon a rod 19 to reciprocate together. The rod passes through an opening in the center of a partition 20 between the two cylinders, the opening being of a diameter sufficiently greater than the diameter of the rod to preclude any danger of friction between the rod and the sides of the opening due to small inaccuracies in the machining or grinding of the different parts. In order to make the joint oil tight however, I mount upon the rod with an oil tight, sliding engagement, a collar 21 having an elongated hub. This collar forms an abutment for one end of a coil spring 22,

the opposite end of which abuts against the solid end wall of the piston 17. The spring is so designed that even when the piston is in its rearwardmost position, illustrated in Fig. IV, it still retains enough strength to hold the collar tightly against the partition 20, thus preventing the leakage of oil.

In communication with the forward end of the cylinder 15 is a valve chamber 23 containing a ball check 24 which seats itself in the upper end of a nipple 25, upon which is threaded a clamping nut 26, by means of which the oil tube 27 is held in place. The latter at its lower end communicates with an oil reservoir in the bottom of the crank case. The ball check 24 is prevented from rising too far off its seat by a pin 28 mounted in one wall of the valve chamber. Opening out of the upper part of the cylinder 15, in vertical alignment with the valve chamber 23, is a short passage 29 out of which open two valve chambers 30 and 31 containing spring pressed ball checks 32 and 33 respectively. Nipples 34 and 35 are threaded into the outer ends of the valve chambers and on their outer ends receive threaded clamping nuts 36 and 37, by means of which oil exit pipes 38 and 39 are attached to the casting.

The head 40 of the air cylinder 16 is threaded in place as shown. It has a central cavity 41 constituting a chamber for a flat check valve 42 provided with serrated edges. A spring 43 at its rear end bears against the check valve 42 tending to hold it seated, while at its forward end the spring bears against a hollow plug 44 centrally bored at 45 to provide communication with the atmosphere. The cavity 41 is connected with the interior of the cylinder by a passage 41' through which the forward reduced end 19' of the piston rod 19 is adapted to protrude when the piston is at the forward limit of its motion in order to dislodge check valve 42 from its seat as shown in Fig. III.

The forward end of the cylinder 16 at its upper side has a projection 46 with a central opening communicating with the interior of the cylinder. Into this projection is threaded a nipple 47 which receives a clamping nut 48 on its outer end for attachment to an air conduit or pipe 49. At the lower side of the cylinder is a projection 50 containing a valve chamber 51 in communication with the interior of the cylinder, this chamber being partially closed by a centrally bored plug 52, in the upper end of the bore of which a ball check 53 seats itself.

In the top of the cylinder 16 is a slot 54 constituting an air inlet port which is uncovered by the piston when in its rearwardmost position. Near the rear of the cylinder 16 is a breather opening 55, for a purpose which will be obvious to those skilled in the art.

The piston 17, together with the rod 19 and the piston 18, are adapted to be moved forward by a cam 56 fixed upon a shaft 57 which may be driven from the engine. The rearward motion of the pistons is accomplished by the action of the spring 22 against the piston 17.

The air which is compressed by the piston 18 is forced through pipe 49 to the top of a pumping chamber which is so arranged that fuel from a fuel tank 60 may flow into the pumping chamber by gravity. It will be noted that my invention differs in this respect from the ordinary pressure feed system, which was for a time employed to some extent upon automobiles. In that system the entire main fuel tank was put under pressure in order to raise the fuel. In my system the main fuel tank remains under atmospheric pressure, while air under higher pressure is forced into a pumping chamber below the level of fuel in the tank for raising the fuel to the carbureter. In the drawings I have illustrated two somewhat different forms which this pumping chamber may assume, one shown in Figs. VI and VII to be attached to the bottom of the tank and the other shown in Figs. VIII and IX to be attached to the top of the tank, but to extend down into the tank to a position just above the bottom thereof.

Referring to Figs. VI and VII, 61 represents a socket such as is ordinarily provided in the bottom of a fuel tank for the reception of a drain plug. An upwardly extending arm 62 of the casting, in which this modification of my pumping chamber is formed, is threaded into the socket 61. This arm contains a vertical passage 63. A drain opening closed by a threaded plug 64 communicates with the lower end of passage 63. Also communicating with the lower end of this passage is a horizontal passage 65 which leads to a valve chamber 66 in which is mounted an upwardly opening flat check valve 67. The valve chamber is closed at its upper end by a threaded plug 68 which has a depending projection to prevent the valve from rising too far off its seat. The valve chamber 66 communicates by a passage 69 with a pumping chamber 70. A tube 71 extends downwardly into the bottom of chamber 70. At the upper end this tube extends into a valve chamber 72 and forms a seat for a ball check 73. The valve chamber 72 communicates with a horizontal passage 74 located at the inner end of a threaded opening into which is screwed a nipple 75 which receives a clamping nut 76 for attachment to a pipe 77 leading to the carbureter 78.

The top of the pumping chamber 70 is provided with a short passage 79 leading to a horizontal opening in the casting, into which is threaded a nipple 80 carrying a clamping

nut 81, by means of which the pipe 49 from the air compressor is fastened in place.

In the modification illustrated in Figs. VIII and IX a hole is made in the top of the tank 60. Fitted therein is a collar 82, into which is threaded a small casting 83. The top and side of the latter are connected by suitable nipples and clamping nuts as shown, to the fuel pipe 77 and the air pipe 49 respectively. Two concentric tubes 84 and 85 are supported in casting 83, the tube 84 being in communication with pipe 77 and the tube 85 with pipe 49. To the bottom of the tube 85 is threaded a depending bowl 86 open at its bottom, the edge of the bowl around the opening being turned upwardly and inwardly to provide a seat for an inwardly opening flat check valve 87. The inner tube 84 also supports a bowl or cup 88 of smaller size, likewise open at its lower end and provided with a seat for an upwardly opening ball check 89.

Operation.

While the engine is running, circulation of oil by means of the oil pump herein disclosed is continuous. Oil is drawn up from the reservoir in the bottom of the crank case through pipe 27 and forced out through passage 29, past check valves 32 and 33, through pipes 38 and 39 to parts of the engine needing lubrication, after which the oil flows back by gravity to the reservoir.

Now, assuming that there is some fuel in the float chamber of the carbureter, as will practically always be the case, the engine may be started in the usual manner, and thus the cam 56 will be rotated to reciprocate piston 18 in cylinder 16. At each compression stroke, that is, each movement of the piston forward from the position shown in Fig. IV to that shown in Fig. III, ball check 53 will be closed, as will also, under normal conditions, check valve 52. This movement of the piston forces air under pressure through pipe 49.

When the engine is not running, fuel will stand in pipe 49 (Fig. I) or in tube 85 (Fig. VIII) at the same level as that in the tank 60. Now, the pressure impulse transmitted through the air in pipe 49 or in tube 85 as the case may be, forces a charge of fuel up through tube 71 past ball check 73 (Figs. VI and VII) or through bowl 86 up past ball check 89 (Fig. VIII) and thus out through pipe 77 in the first modification or through tube 84 and pipe 77 in the second modification, up towards or into the carbureter 78. When the piston 18 nears the end of its forward stroke the projecting end 19' of the piston rod contacts check valve 42 and opens it, as illustrated in Fig. III, which permits the excess of pressure in pipe 49 to be relieved. This enables gravity to force a charge down into the pumping chamber to

take the place of the fuel raised past check valve 73 or 89, as the case may be. The fuel in thus moving from the main tank lifts check valve 67 in the first modification or 87 in the second.

On the return stroke of the piston 18, caused by spring 22, check valve 42 closes. Then ball check 53 opens to permit air to enter the cylinders. Some force is necessarily required to lift ball 53, so that a very slight vacuum may result in the cylinder and the pipe 49 until the piston uncovers port 54, whereupon atmospheric pressure is immediately restored. Upon the next forward stroke of the piston fuel is again raised, and this action continues until the fuel in the carbureter reaches a level such that the float is caused to close the needle valve. Thereafter upon each pressure stroke of the piston 18 pressure is built up in the cylinder and pipe 49 until it becomes great enough to overcome the action of spring 43 and open valve 42, which thus constitutes a safety valve.

It will be noted that the cross section of the cylinder 16 is great in comparison to that of pipe 49 or the annular space between the tubes 85 and 84. Consequently a comparatively short movement of the piston 18 produces a considerable movement of the fuel in pipe 49 or tube 85. This tends to clear the pipe 49 or the tube 85 of fuel, and when the engine is running at average speed it is believed that these conductors are free of fuel after a few strokes of the piston. The tendency for fuel to return into these conductors is produced by gravity only, and hence causes a slower movement. I do not desire to be limited to the exact shape of the cam 56 shown in the drawings, as it may be found advisable to employ other shapes. With the one illustrated the compression impulse caused by the piston continues for a time corresponding to something less than 90 degrees of the rotation of the shaft 57. This is for the purpose of giving more time to the refilling of the pumping chamber by gravity than is given to the exertion of pressure upon the fuel in the pumping chamber for raising the fuel out of that chamber. At the present time I consider this a desirable arrangement.

I am aware that the particular embodiment of my invention above described and illustrated in the accompanying drawings is susceptible of considerable variation without departing from the spirit thereof, and therefore I desire to claim my invention broadly as well as specifically as indicated by the appended claims.

I claim as my invention:

1. In a fuel feed system, a main tank, a carbureter, a valved pumping chamber adapted to be fed by gravity from said main tank, a fuel conduit extending from said

pumping chamber to said carbureter, an air compressor, a conduit from said compressor leading to the top of said pumping chamber, and a safety valve for relieving the pressure produced by said compressor when the needle valve of the carbureter is closed.

2. In a fuel feed system, a main tank, a carbureter, a valved pumping chamber adapted to be fed by gravity from said main tank, a fuel conduit extending from said pumping chamber to said carbureter, a positive pressure pump for compressing air, a conduit from said pump leading to the top of said pumping chamber, a safety valve in said pump for relieving pressure when the needle valve of the carbureter is closed, and mechanical means for opening said valve at the end of each compression stroke of the pump.

3. In a fuel feed system, a main tank, a carbureter, a valved pumping chamber adapted to be fed by gravity from said main tank, a fuel conduit extending from said pumping chamber to said carbureter, an air compressor comprising a cylinder and a piston, an inwardly opening check valve for admitting air to said cylinder during the suction stroke of the piston, a safety valve in the head of the cylinder for relieving excess pressure when the needle valve of the carbureter is closed, a projection upon the piston for opening said valve at the end of each compression stroke, and a conduit connecting said cylinder with the top of said pumping chamber.

4. In a fuel feed system, a main tank, a carbureter, a valved pumping chamber adapted to be fed by gravity from said main tank, a fuel conduit extending from said pumping chamber to said carbureter, an air compressor, a connection between said compressor and the top of said pumping chamber, means for relieving the pressure in the compressor at the end of each compression stroke, and means for connecting the compressor with the atmosphere during each suction stroke.

5. In a fuel feed system the combination of a main tank; a carbureter; a valved pumping chamber adapted to be fed by gravity by said main tank; a fuel conduit extending from said pumping chamber to said carburetor; an air compressor; a conduit from said compressor leading to the top of said pumping chamber; and means for relieving pressure in the conduit between the pumping chamber and carburetor when communication from said conduit to the carburetor is closed.

6. In a fuel feed system the combination of a main tank; a valved pumping chamber directly connected to said tank adapted to be fed by gravity by said main tank; an air compressor; a safety valve in said compressor adapted to relieve abnormal pressure therein; and a conduit from said compressor leading to the top of said pumping chamber.

In testimony whereof, I affix my signature.

ERNEST R. HUNTLEY.