

Oct. 8, 1935.

W. H. SCHULZE ET AL

2,016,580

VACUUM PRESSURE FUEL PUMP SYSTEM

Filed June 13, 1934

2 Sheets-Sheet 1

Fig. 2.

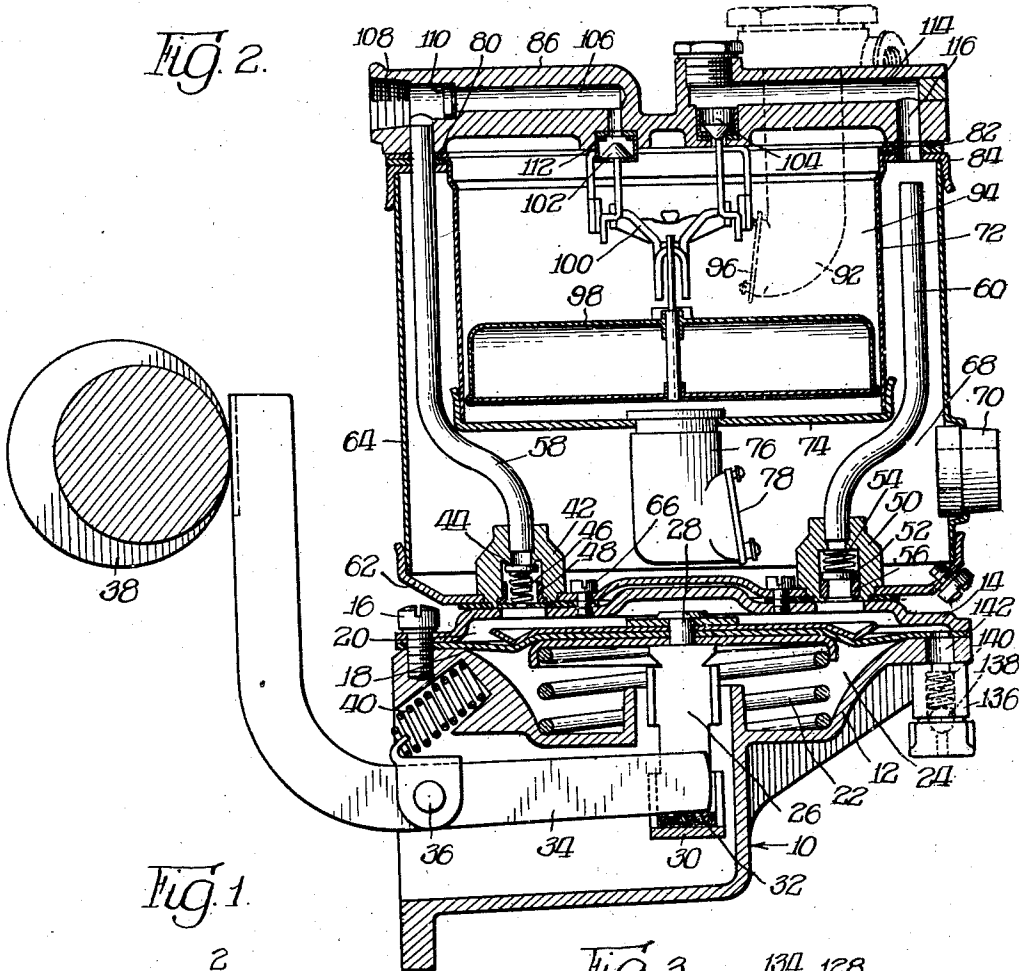


Fig. 1.

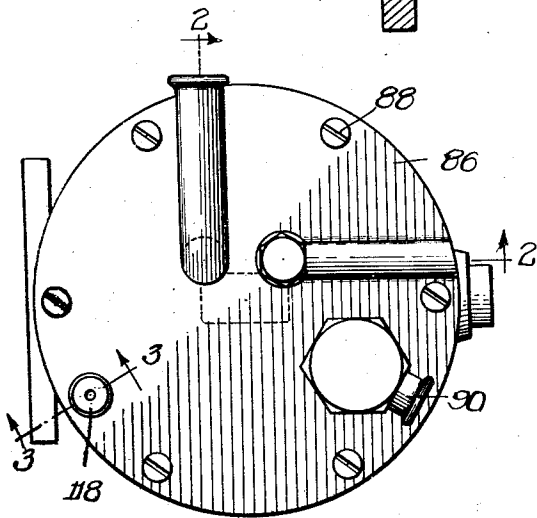
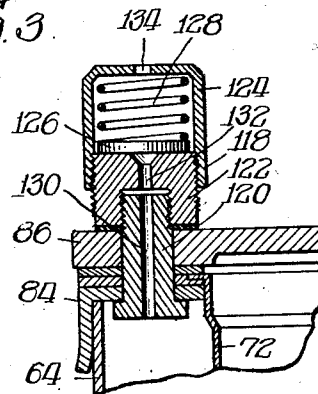


Fig. 3.



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Fig. 4

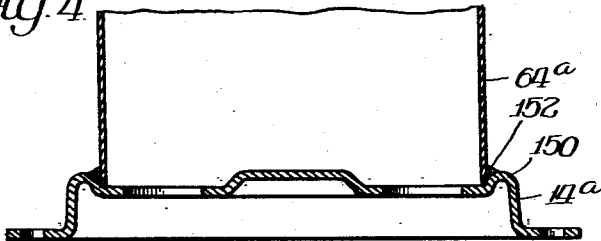


Fig. 5

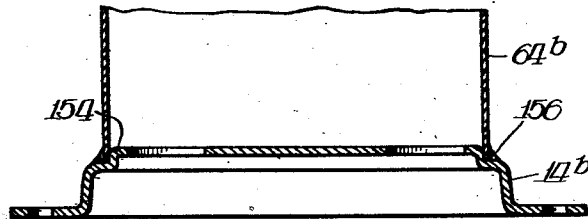


Fig. 6

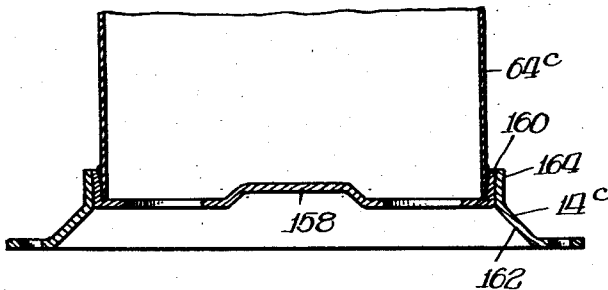


Fig. 7

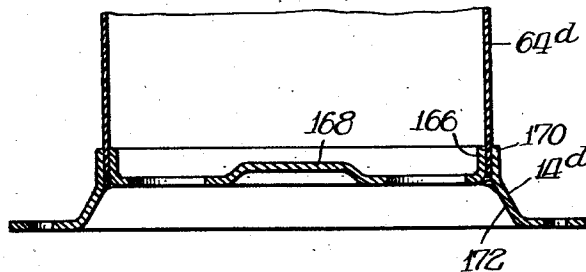
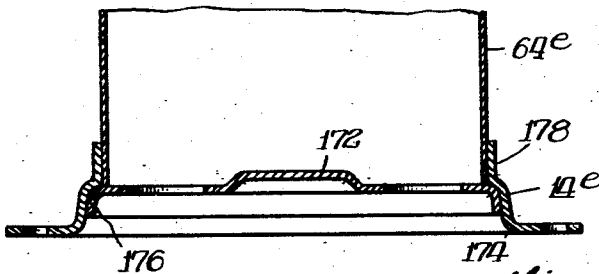


Fig. 8



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UNITED STATES PATENT OFFICE

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VACUUM PRESSURE FUEL PUMP SYSTEM

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10 Claims. (Cl. 103—236)

This invention relates to improvements in a vacuum pressure fuel feed system, principally adapted for use on a motor vehicle for feeding the fuel from the low supply tank at the rear of the vehicle to the carburetor which is now customarily positioned above the motor.

In the ordinary vacuum tank fuel feed system the intake manifold vacuum is utilized for lifting the fuel from the supply tank up to the vacuum tank and the fuel is then fed by gravity to a carburetor at the lower level from the vacuum tank. This system cannot be used when the carburetor is positioned so high on the engine that the vacuum tank cannot be positioned higher than the carburetor so that it may be fed by gravity thereto and the use of intake manifold vacuum alone is unsatisfactory since at times the vacuum may be insufficient. In recent years the vacuum tank has been displaced by the fuel pump, mechanically-operated from the engine. The fuel pump is customarily positioned at the lower part of the engine to receive its drive from the cam shaft of the engine. The fuel during the operation of the pump is sucked into the pumping chamber and delivered under pressure to the carburetor at a high level. The fuel pump system has some disadvantages, principally due to the formation of vapor in the fuel line which may cause a vapor lock and destroy the pumping action or affect the carburetor efficiency.

It is an object of the present invention to disclose a fuel feed system which combines the advantages of the vacuum tank fuel feed system and the fuel pump feed system and avoids the disadvantages of these prior systems.

It is further an object of the present invention to provide a fuel feed system including an associated vacuum tank and pressure tank, the fuel being lifted by vacuum from the supply tank to the vacuum tank, dropped into the pressure tank and delivered from the pressure tank under a pressure limited to a desired maximum for delivery to the float bowl of the carburetor.

A further object of the present invention resides in a construction employing intake manifold vacuum as the source of suction but including an associated pumping unit which boosts the vacuum should the intake manifold vacuum be insufficient and the utilization of the same pumping unit as a means of developing air pressure for feeding the fuel from the pressure tank to the carburetor.

A still further object of the present invention is to provide a unitary device including a vacuum tank a pressure tank and a mechanically-operated pumping unit, the device having a connection to the intake manifold of the engine, an inlet connection from the fuel supply tank, an outlet connection to the carburetor and an out-

wardly protruding lever adapted to engage a cam on the cam shaft of the engine for mechanical operation of the pumping unit.

Further objects and advantages of the present improvements will be more readily apparent from the following description taken in connection with the attached drawings, in which—

Figure 1 is a plan view of the device;

Figure 2 is a section taken on the plane indicated 2—2 in Figure 1

Figure 3 is a detail section on the plane indicated 3—3 in Figure 1, and

Figures 4 to 8, inclusive, are detail sections illustrating modifications which may be employed in connecting the pressure tank to the cap member of the pumping unit.

The device as illustrated in Figures 1 and 2 includes at its base a pump casing 10, which is similar in design to present-used fuel pumps but is intended to pump air or a mixture of air and fuel vapor rather than liquid fuel. The pumping unit 10 includes a base 12 and a cap 14 secured together at their marginal edges by the cap screws 16 and having clamped therebetween a flexible diaphragm 18 which cooperates with a pumping chamber 20 on the upper side thereof. The diaphragm 18 is urged for its pressure stroke by a relatively stiff spring 22 positioned in a recess 24 beneath the diaphragm. The diaphragm is moved for its suction stroke by means of a stem 26 riveted at 28 to the diaphragm and forming a yoke 30 at its lower end having a cushioning abutment 32 adapted to be engaged by the inwardly extending arm of a lever 34, pivoted at 36 upon the base 12 and operated by 35 having its outwardly extending arm in thrust engagement with a rotatable cam 38. The lever 34 is urged into contact with the cam 38 by the provision of a follower spring 40.

The inlet valve casing 42 includes the inlet check valve 44 urged to its seated position by a spring 46. A sleeve 48 is provided to limit the opening movement of the valve and to prevent displacement thereof. The outlet valve casing 50 has an outlet check valve 52 urged to its seated position by a spring 54, a sleeve 56 being inserted in the casing 50 to act as a valve seat. Air is drawn into the pumping chamber 20 through an inlet tube 58 and delivered under pressure through an outlet tube 60.

The valve casings 42 and 50 are carried by the bottom cap 62 of a pressure tank 64. The cap 62 is secured to the cap 14 of the pumping unit by cap screws 66. The tank 64 forms a chamber 68 adapted to receive liquid fuel, which is delivered through the outlet connection 70 under pressure to the carburetor. The pressure tube 60, it will be noted, communicates with the pressure chamber 68 at the upper end thereof so as to maintain 60

air under pressure above the level of the liquid fuel.

Positioned within the fuel tank 64 is a vacuum tank 72, the bottom cap 74 of which carries a discharge connection 76 provided with a delivery check valve 78. The upper edge of the tank 72 is outwardly flanged as at 80 and held together with gaskets 82 between a flange ring 84 secured to the top of the pressure tank 64 and a head member 86, the parts being held together by cap screws 88. The head member 86 has an inlet connection 90 adapted to receive fuel from the fuel supply tank and having a tubular extension 92 for delivering the fuel into the vacuum chamber 94 of the vacuum tank 72, past an inlet check valve 96.

Positioned within the vacuum chamber 94 is a float 98 having connected thereto suitable linkage 100 for controlling a vacuum valve 102 and a pressure valve 104. The vacuum valve 102 cooperates with a passage 106 leading to a threaded connection 108 adapted to be connected to the intake manifold of the engine. The tube 58 leading to the pumping chamber of the pumping unit also communicates with the passage 106 and a restriction 110 may be placed in the passage 106 between the communication of the tube 58 and the valve seat 112 of the vacuum-controlled valve 102. This restriction 110 prevents disturbance of the mixture in the intake manifold due to sudden inrushes of air. The pressure valve 104 controls a passage 114 which communicates with a vertical passage 116 leading into the upper end of the pressure chamber.

As shown in Figure 3 a pressure relief valve, generally indicated 118, may be provided for limiting the maximum pressure developed in the pressure chamber 68. A tubular member 120 is provided extending through the flange ring 84 and the cap member 86, and having threaded to its protruding end a nut 122 which, in turn, has threaded thereto a cap member 124. The cap member 124 forms a valve housing adapted to receive a relief valve 126 urged to normal seated position by a spring 128, the tension of which can be adjusted by adjusting the nut member 124 up or down. The member 120 has a passage 130 communicating with a passage 132 in the nut member 122 and the cap member 124 has a relief opening 134.

The pumping unit may be provided with a snifter valve, generally indicated 136, including a ball valve 138 normally urged to its seated position by a spring 140 and controlling a passage 142 through which air may be sucked into the pumping chamber from time to time as conditions require.

It is desirable in the commercial design of such devices to have a construction as inexpensive as possible and we have shown in Figures 4 to 8, inclusive, certain detail modifications according to which the cylinder 64a, 64b, 64c, etc., which forms the pressure chamber may be secured to a specially formed cap member 14a, 14b, 14c, etc., which forms the head of the pumping unit. Thus, in Figure 4 the head of the pumping unit 14a has an upwardly directed marginal head 150 and the cylinder 64a seats within the head 150 and may be welded thereto as indicated at 152. In Figure 5 the cylinder 64b is attached to the cap member 14b by being positioned on the exterior of an annularly flanged portion 154 of the cap member and may be welded thereto as indicated at 156. In Figure 6 the head or cap member of the pumping unit 14c is made in two parts including

a central disk 158 having an upwardly directed annular flange 160, within which is received the lower end of the cylinder 64c and a marginal ring 162 which has an annular portion 164, spot-welded to the flange 160 of the disk 158. In Figure 7 the construction is similar to Figure 6 except that the cylinder 64d is welded between the flange 166 of the central ring 168 and the flange or annular portion 170 of the marginal ring 172 which compose the head 14d. In Figure 8 the head 14e is also composed of two parts including a central disk 172 and a marginal ring 174. The ring 172 has a downwardly directed annular flange 176 received within the ring 174 which provides an upwardly directed annular portion 178 welded to the cylinder 14e.

The operation of a fuel feed system employing a device such as disclosed herein is as follows: The operation of the engine develops a vacuum which acts within the vacuum chamber 94 so long as the float is in lowered position and the vacuum valve 102 is open to draw fuel from the supply tank through the inlet connection into the vacuum chamber. At the same time the diaphragm 18 is being reciprocated by the engine to boost the vacuum existing in the vacuum chamber should the intake manifold vacuum be insufficient. As the fuel level rises in the vacuum chamber the float is raised and finally the vacuum valve 102 is closed and the pressure valve 104 is opened. This results in a balancing of the pressure between the pressure chamber 68 and the vacuum chamber 94 and the liquid fuel in the vacuum chamber will flow past the check valve 78 into the pressure chamber until the fuel levels in the two chambers have equalized. The float will be lowered sufficiently to again close the pressure valve and open the vacuum valve. The fuel which reaches the pressure chamber 68 is kept under a pressure developed by the action of the pumping diaphragm and is delivered under that pressure to the carburetor through the outlet connection 70. The pressure relief valve which has been described serves to limit the maximum pressure which may be developed in the pressure chamber so that flooding of the carburetor cannot occur. If the intake manifold vacuum is sufficiently high there may be little flow of air, or rather a mixture of air and fuel vapor through the tube 58 past the check valve 44 and into the pumping chamber 20. In such case the snifter valve device 136 will operate to allow air to be drawn directly into the pumping chamber 30 so that sufficient air is always obtainable for being pumped into the pressure chamber for feeding the fuel to the carburetor.

In general, the pump will tend to pump the air in a circuit—from the pumping chamber to the pressure chamber past valve 52 to the vacuum chamber past valve 104 and back to the pumping chamber past valves 102 and 44. Therefore, the same air will be used over and over and little disturbance will be caused by the small amount of air drawn into the intake manifold.

The device is not subject to the deficiencies of the formerly-used vacuum tank and is further not subject to the deficiencies and disadvantages of the present-used fuel pump system, since liquid fuel is not pumped by the pumping unit and therefore there is no trouble caused by formation of fuel vapor in the fuel feed lines. The system is operative to deliver at all times sufficient fuel to take care of the demands of the engine and the fuel is delivered at a desired maximum pressure.

We claim:

1. A fuel feeding system for an internal combustion engine comprising a first chamber, a valved inlet connection to said chamber from a source of fuel supply, a valved outlet connection from the bottom of said chamber, a second chamber into which the fuel is delivered from said first chamber, a delivery connection from said second chamber adapted to deliver the fuel to the carburetor of the engine, air pumping means operated by the engine for drawing air from said first chamber to lift fuel from said source into said chamber and to deliver air into said second chamber under pressure for delivery of fuel from said second chamber under pressure to the carburetor, a passage connecting the upper portions of said chambers and float-operated means in said first chamber for intermittently closing the connection between said first chamber and said pumping means and for opening communication through the upper passage between said chambers whereby the pressure in said chambers is balanced and the fuel in said first chamber is delivered into said second chamber.

2. A fuel feeding system for an internal combustion engine, comprising a first chamber, a valved inlet connection to said chamber from a low level source of fuel supply, a valved outlet connection from the bottom of said chamber, a second chamber into which said valved outlet connection extends for delivery of fuel into said second chamber from said first chamber, a delivery connection from said second chamber for feeding the fuel to the carburetor, an air pump operated by the engine, a valved inlet passage leading from said first chamber to said pump, a valved outlet passage leading from said pump to said second chamber, a passage leading between the top portions of said chambers, float-operated valve means in said first chamber controlling the inlet passage communicating therewith and the passage leading between the top portions of said chambers, whereby, when one of said passages is open and the other of said passages is closed, air is drawn from said first chamber by said pump while fuel is delivered into said first chamber from said fuel source and said air is delivered by said pump into said second chamber, and when the valve means in said first chamber are reversed by the action of the float, air passes from said second chamber to said first chamber and fuel is delivered from said first chamber into said second chamber.

3. A fuel feeding system for an internal combustion engine comprising a first chamber, a valved inlet connection to said chamber from a low level source of fuel supply, a valved outlet connection from the bottom of said chamber, a second chamber into which said valved outlet connection extends for delivery of fuel into said second chamber from said first chamber, a delivery connection from said second chamber for feeding the fuel to the carburetor, an air pump operated by the engine, a valved inlet passage leading from said first chamber to said pump, a valved outlet passage leading from said pump to said second chamber, a passage leading between the top portions of said chambers, float-operated valve means in said first chamber controlling the inlet passage communicating therewith and the passage leading between the top portions of said chambers, whereby when one of said passages is open and the other of said passages is closed, air is drawn from said first chamber by said pump while fuel is delivered into said first chamber from

said fuel source and said air is delivered by said pump into said second chamber, and when the valve means in said first chamber are reversed by the action of the float, air passes from said second chamber to said first chamber and fuel is delivered from said first chamber into said second chamber and a connection adapted to lead to the intake manifold for additionally drawing air from said first chamber.

4. A fuel feeding system for an internal combustion engine comprising a first chamber, a valved inlet connection to said chamber from a low level source of fuel supply, a valved outlet connection from the bottom of said chamber, a second chamber into which said valved outlet connection extends for delivery of fuel into said second chamber from said first chamber, a delivery connection from said second chamber for feeding the fuel to the carburetor, an air pump operated by the engine, a valved inlet passage leading from said first chamber to said pump, a valved outlet passage leading from said pump to said second chamber, a passage leading between the top portions of said chambers, float-operated valve means in said first chamber controlling the inlet passage communicating therewith and the passage leading between the top portions of said chambers, whereby when one of said passages is open and the other of said passages is closed, air is drawn from said first chamber by said pump while fuel is delivered into said first chamber from said fuel source and said air is delivered by said pump into said second chamber, and when the valve means in said first chamber are reversed by the action of the float, air passes from said second chamber to said first chamber and fuel is delivered from said first chamber into said second chamber and a pressure relief valve connected to said second chamber for limiting the pressure under which the fuel is delivered to the carburetor.

5. A fuel feeding system for an internal combustion engine comprising a first chamber, a valved inlet connection to said chamber from a low level source of fuel supply, a valved outlet connection from the bottom of said chamber, a second chamber into which said valved outlet connection extends for delivery of fuel into said second chamber from said first chamber, a delivery connection from said second chamber for feeding the fuel to the carburetor, an air pump operated by the engine, a valved inlet passage leading from said first chamber to said pump, a valved outlet passage leading from said pump to said second chamber, a passage leading between the top portions of said chambers, float-operated valve means in said first chamber controlling the inlet passage communicating therewith and the passage leading between the top portions of said chambers, whereby when one of said passages is open and the other of said passages is closed, air is drawn from said first chamber by said pump while fuel is delivered into said first chamber from said fuel source and said air is delivered by said pump into said second chamber, and when the valve means in said first chamber are reversed by the action of the float, air passes from said second chamber to said first chamber and fuel is delivered from said first chamber into said second chamber, said first chamber being positioned in said second chamber and said second chamber being mounted on said air pump.

6. A fuel feeding system for an internal combustion engine comprising a first chamber, a

valved inlet connection to said chamber from a low level source of fuel supply, a valved outlet connection from the bottom of said chamber, a second chamber into which said valved outlet connection extends for delivery of fuel into said second chamber from said first chamber, a delivery connection from said second chamber for feeding the fuel to the carburetor, an air pump operated by the engine, a valved inlet passage leading from said first chamber to said pump, a valved outlet passage leading from said pump to said second chamber, a passage leading between the top portions of said chambers, float-operated valve means in said first chamber controlling the inlet passage communicating therewith and the passage leading between the top portions of said chambers, whereby when one of said passages is open and the other of said passages is closed, air is drawn from said first chamber by said pump while fuel is delivered into said first chamber from said fuel source and said air is delivered by said pump into said second chamber, and when the valve means in said first chamber are reversed by the action of the float, air passes from said second chamber to said first chamber and fuel is delivered from said first chamber into said second chamber, a connection adapted to lead to the intake manifold for additionally drawing air from said first chamber and a pressure relief valve connected to said second chamber for limiting the pressure under which the fuel is delivered to the carburetor, said first chamber being positioned in said second chamber and said second chamber being mounted on said air pump.

7. In a fuel feed system for motor vehicles, a chamber adapted to be connected to the fuel supply tank, a reservoir into which said chamber extends adapted to be connected to the carburetor of the motor vehicle, pumping means operated by the engine having its inlet passage connected to the top of said chamber for sucking the fuel from said supply tank into said chamber and having its delivery passage extending adjacent to the top of said reservoir for feeding of fuel from said reservoir to said carburetor under super-atmospheric pressure, a passage adapted to place the top portions of said reservoir and chamber in communication, a passage whereby the fuel in said chamber may be delivered into said reservoir, and control valves for the passages which connect with the top portions of said chamber operated as the level of the fuel in said chamber changes to intermittently open one of said passages and close the other of said passages.

8. A fuel feeding device for motor vehicles comprising a tank from which the fuel is adapted to be delivered under pressure to the carburetor, a chamber positioned within said tank adapted to receive fuel from the supply tank of the motor vehicle, a passage connecting the lower portion of the chamber and the tank, a pair of passages communicating with the top of said chamber, a float in said chamber, a pair of control valves operated by said float to intermittently open and close said passages, a connection to one of said passages from the intake manifold of the engine, the other of said passages being connected to the top of said tank outside of said chamber, engine-operated pumping means attached to the bottom of said tank, a conduit leading from said intake manifold connection to the inlet valve of said pumping means whereby said pumping means

is operative to boost the vacuum in said chamber should the intake manifold vacuum be insufficient for drawing the fuel from the supply tank into said chamber and a conduit leading from the outlet valve of said pumping means leading into said tank to a point adjacent the top thereof for producing pressure upon the fuel in said tank for delivery of said fuel to the carburetor.

9. A fuel feed device for motor vehicles comprising a pump casing, pumping means in said casing including a reciprocable diaphragm, means for actuating said diaphragm from the engine, a pumping chamber, inlet and outlet valves associated with said pumping chamber, a tank mounted on the upper side of said pump casing forming a reservoir from which fuel is supplied to the carburetor, said tank having a head for closing the top of said reservoir, a chamber suspended within said reservoir from said head, a valved inlet connection leading through said head into said chamber through which fuel is supplied to said chamber from the fuel supply tank of the motor vehicle, a valved outlet passage leading from the lower portion of the chamber to the tank, a pair of float-operated control valves in said chamber, a passage communicating with said chamber controlled by one of said valves and connected for suction to the intake manifold and the inlet side of said pumping means, a passage in said head controlled by the other of said valves and communicating with the top of said reservoir for intermittently balancing the pressure between said chamber and said reservoir to permit discharge of fuel from said chamber into said reservoir and a delivery passage from the outlet valve of said pumping means for directing the air pumped by said pumping means into the top of said reservoir, whereby fuel in said reservoir is placed under pressure for delivery to the carburetor.

10. In a fuel feeding device for an internal combustion engine, an engine-driven air pump including a casing, a pumping chamber therein and inlet and outlet valved passages leading through said casing into said pumping chamber, a cylindrical member secured at its lower edge to the top of said casing surrounding said valved passages and forming a fuel-receiving compartment, of which the top of said pump casing forms the bottom wall, a head member attached to and enclosing the top of said cylindrical member, a fuel-receiving receptacle suspended within said chamber and closed at the top by said head, a valved fuel inlet passage to said receptacle, a valved fuel passage from said receptacle to said compartment, a fuel outlet passage from said compartment, an air intake passage leading from said receptacle to said valved inlet passage of said pump, an air exhaust passage leading from said pump into said compartment, an air passage leading from said compartment to said receptacle and means in said receptacle for periodically and alternately closing and opening the air passages which communicate with said receptacle, whereby the fuel is drawn into said receptacle while said air intake passage is open and is delivered from said receptacle into said compartment while said air intake passage is closed and the air passage between said compartment and receptacle is open.

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