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FUEL SUPPLY APPARATUS.

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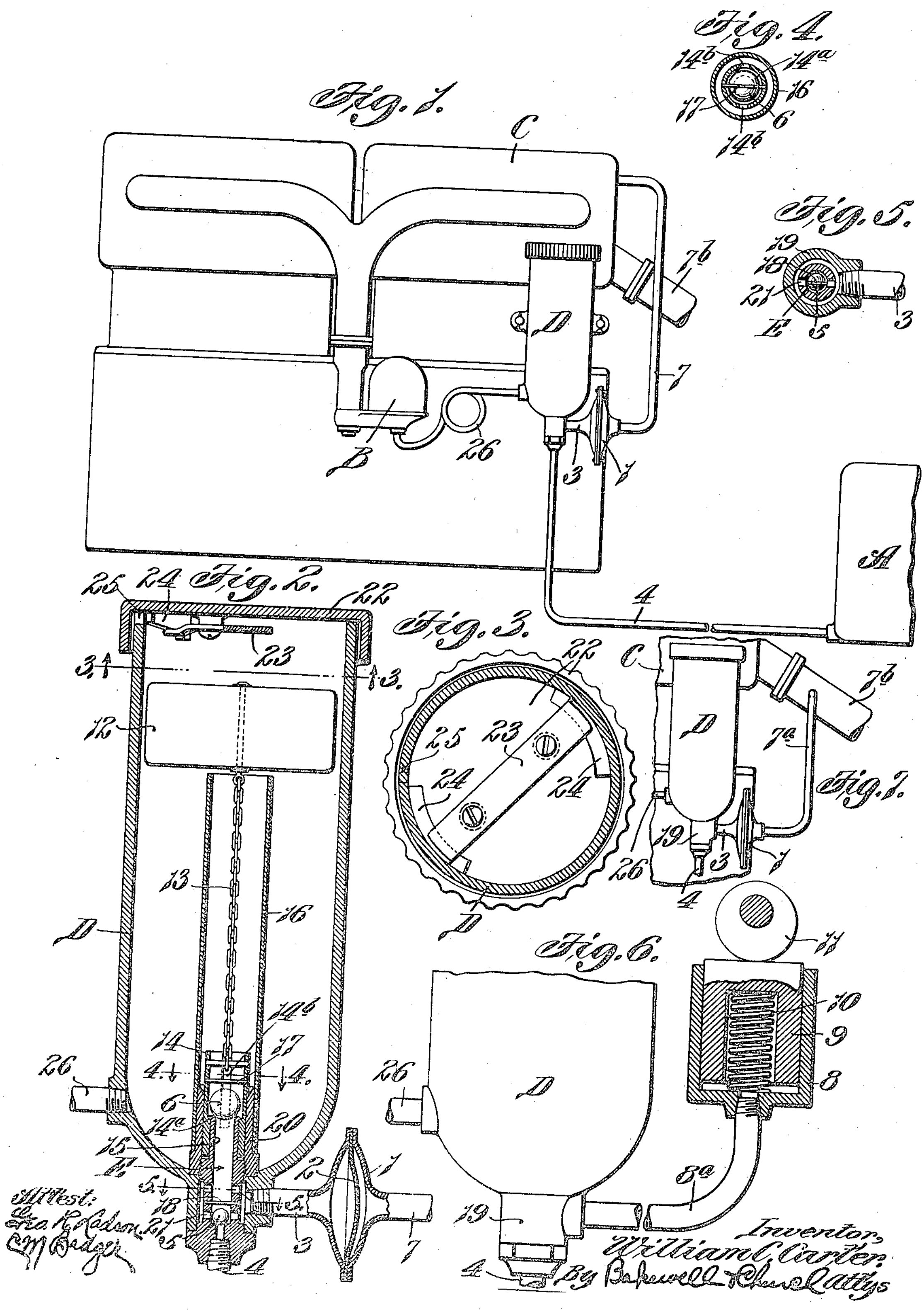

UNITED STATES PATENT OFFICE.

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FUEL-SUPPLY APPARATUS.

1,146,133. Specification of Letters Patent. Patented July 13, 1915.

Application filed March 16, 1914. Serial No. 825,130.

To all whom it may concern:

Be it known that I, WILLIAM C. CARTER, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Fuel-Supply Apparatus, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an apparatus for causing liquid fuel to flow from a supply tank to the carbureter of an internal combustion engine. At the present time the liquid fuel used to operate an internal combustion engine is fed to the carbureter by gravity from the supply tank or else pressure is created in the supply tank so as to force the fuel to the carbureter. A pressure-feed system is more or less dangerous, owing to the fact that the fuel in the supply tank is always under pressure; and, furthermore, such a system necessitates the use of a pressure-gage and a manually-operated pump in addition to the mechanically-operated pump which maintains the pressure in the supply tank when the engine is in operation. A gravity-feed system is less expensive and is safer than a pressure-feed system but is not as efficient for automobile engines in that it is not always possible or practicable to arrange the supply tank near enough to the engine to insure a supply of liquid fuel to the carbureter when the automobile is on an incline and the level of the fuel in the supply tank is low.

The main object of my invention is to provide an inexpensive and efficient liquid fuel supply apparatus or system for internal combustion engines that does not have the objectionable features of either the gravity-feed system or the pressure-feed system now in general use, and which comprises a reservoir from which the liquid fuel is supplied to the carbureter by gravity, and a pump for drawing the fuel from the supply tank and forcing it into said reservoir when the engine is in operation.

Another object is to provide a liquid-fuel-supply system or apparatus of the character described which is so designed that a certain quantity of fuel always remains in the reservoir, and the supply of fuel to said reservoir ceases automatically whenever the fuel in the reservoir rises above a certain level. And still another object is to provide a liquid-fuel-supply system for automobiles that comprises only a few parts of simple construction that are not apt to get out of order; that is perfectly safe and more efficient than the fuel-supply systems now in general use on automobiles; and which can be manufactured and sold at a much lower cost than a pressure-feed system.

Figure 1 is a side elevational view illustrating my improved fuel-supply system or apparatus for internal combustion engines; Fig. 2 is an enlarged vertical sectional view of the reservoir from which the fuel is supplied by gravity to the carbureter of the engine; Fig. 3 is a horizontal sectional view taken on the line 3—3 of Fig. 2, looking in the direction indicated by the arrow; Figs. 4 and 5 are horizontal sectional views taken on the lines 4—4 and 5—5, respectively, of Fig. 2; and Figs. 6 and 7 are views illustrating two different modifications of my invention.

Referring to the drawing, A designates a fuel-supply tank that holds a quantity of liquid fuel which is supplied to the carbureter B of an internal combustion engine C when the engine is in operation, and D designates a reservoir arranged intermediate the supply tank and the carbureter and in such a position that the fuel will flow from same to the carbureter by gravity. A pump is provided for drawing the liquid fuel out of the supply tank A and forcing it into the reservoir D, and means are provided for causing the supply of fuel to said reservoir D to cease automatically whenever the fuel in said reservoir rises above a certain level. This pump can be constructed and operated in various ways without departing from the spirit of my invention, and the means for governing the supply of fuel to the reservoir D can be formed in various ways.

In the preferred form of my invention as herein shown, a passageway or chamber provided with two check-valves is arranged intermediate the reservoir D and the supply tank A, and the pump is connected to said passageway or chamber in such a manner that a charge of liquid fuel will be drawn into said passageway from the supply tank and forced out of same into the reservoir D intermittently when the fuel in said reservoir is below a certain level, means being combined with one of said check-valves for causing the flow from the supply tank to be interrupted whenever the fuel in the reservoir rises above a certain level.

The pump that I prefer to use consists of a casing 1 having a diaphragm 2 arranged inside of same, as shown in Fig. 2, one side of said casing being connected by means of a pipe 3 with a passageway or chamber E arranged intermediate the reservoir D and the pipe 4 that leads from the supply tank A and provided with two check-valves 5 and 6, and the other side of said casing being connected by means of a pipe 7 with a means that exerts pressure on the diaphragm 2 in the casing. In the preferred form of my invention, as shown in Fig. 1, the pipe 7 leads to one of the cylinders of the engine so as to exert suction and pressure on the diaphragm 2 intermittently and thus cause a charge of fuel to be drawn into the passageway or chamber E and then forced into the reservoir D, but, if desired, a pipe 7^a can be run from one side of the casing of the pump to the exhaust pipe or manifold 7^b of the engine, as shown in Fig. 7, and the diaphragm of the pump can be constructed in such a manner that the force exerted on same by the exhaust gases will cause it to vibrate sufficiently to draw the liquid fuel into the passageway E and force it into the reservoir D so long as the fuel in said reservoir remains below a certain level. Instead of using a diaphragm pump of the character above-described any other suitable type of pump or device could be employed for drawing the fuel into the valved passageway E and forcing it out of said passageway intermittently into the reservoir D, for example, a mechanically-operated pump actuated by some moving part of the engine could be used successfully for this purpose, and in Fig. 6 of the drawing I have illustrated a piston pump whose cylinder 8 is connected by means of a pipe 8^a with the valved passageway E, and whose piston 9 is moved in one direction against the force of a spring 10 by means of a cam or other moving part 11 of the engine C, the movement of said piston causing charges of liquid fuel to be drawn into the passageway E and forced into the reservoir intermittently.

The check-valves that I prefer to use for controlling the flow of the liquid fuel into and out of the passageway E are ball check-valves 5 and 6, as shown in Fig. 2, the ball 5 normally resting in a seat at the lower end of the passageway E above the point where the pipe 4 is connected to said passageway, and the ball 6 normally resting on a seat at the upper end of the passageway E. A float 12 that is arranged inside of the reservoir D, is connected to one of said ball check-valves in such a manner that the supply of liquid fuel to the reservoir D will be interrupted or cut off whenever the fuel in said reservoir reaches a certain level. In the preferred form of my invention, as herein shown, the float 12 is connected by means of a chain or other suitable device 13 with a cage 14 that lifts the check-valve 6 from its seat whenever the fuel in the reservoir D rises above a certain level, said cage 14 being telescoped over the tubular-shaped member 15 that constitutes the valve passageway E, and being provided with a shoulder 14^a that engages the ball check-valve 6 and lifts it off its seat at the upper end of the member 15 when the float 12 is raised above a certain level by the fuel in the reservoir D. A tube 16 that projects upwardly through the reservoir D, and which is arranged in longitudinal alinement with the valved passageway E, receives the charge of fuel that is forced out of said passageway at each cycle of operations of the pump, the upper end of said tube terminating at a point below the normal level of the fuel in the reservoir D. A stop 17, consisting of a cross-pin in the cage 14, limits the upward movement of the check-valve 6 when said valve is unseated by the action of the pump, and a similar stop 18 is provided for limiting the upward movement of the check-valve 5. The tubular-shaped member 15 that constitutes the chamber or passageway E, projects upwardly through a boss 19 on the lower end of the reservoir D, and is provided with a shoulder that bears against the bottom face of said boss 19, as shown in Fig. 2. A sleeve 20, to which the lower end of the tube 16 is connected, is screwed onto a threaded portion of the member 15 and is seated in an annular recess in the bottom of the reservoir D so as to securely clamp the member 15 and the sleeve 20 to the reservoir when one of said parts is turned with relation to the other so as to screw the member 15 farther into the sleeve 20.

The cage 14 is guided between the sleeve 20 and the tubular-shaped member 15 which said cage surrounds, and an annular groove is formed in the outer surface of the portion of the member 15 that projects through the boss 19 on the reservoir so as to form an annular chamber at the point where the pipe 3 is connected to the reservoir D, said annular chamber being connected with the valved passageway E by means of a plurality of ports 21, as shown in Fig. 2. Vertically-disposed slots 14^b in the upper end portion of the cage 14 that terminate at a point below the shoulder 14^a on said cage, permit the fuel to flow laterally through the sides of the cage and thus compensate for the comparatively close fit between the cage and the check-valve 6. In other words, the cage 14 is of approximately skeleton construction so as to insure a free passage of the fuel around the check-valve 6. A cover 22 is provided for the upper end of the reservoir D, which cover is retained in position by means of a spring-clip 23 on the under side of the cover, whose ends engage inclined lugs

24 on the reservoir D, as shown in Fig. 3. The cover 22 is provided with a depending flange that surrounds the upper end portion of the reservoir D and which is of sufficient diameter to permit air to pass into a vent or air-opening 25 in the upper edge of the reservoir D, as shown in Fig. 2. A pipe 26, that leads from the lower end of the reservoir D to the float chamber of the carbureter B, conducts the liquid fuel by gravity from the reservoir D to the carbureter.

The reservoir D will be normally filled with liquid fuel to a point above the upper end of the tube 16, and when the engine is in operation a charge of fuel will be drawn into the passageway E and forced out of said passageway into the tube 16 at each cycle of operations of the pump, the suction stroke of the pump causing the check-valve 5 to unseat automatically, and the pressure stroke of the pump causing the check-valve 6 to unseat automatically. When the fuel in the reservoir D rises above a certain level the upward movement of the float 12 unseats the check-valve 6 and thereafter, while said check-valve remains unseated, the fuel in the passageway E and in the tube 16 merely surges back and forth at each cycle of operations of the pump, this, of course, being due to the fact that one of the check-valves for the passageway E is then open and consequently prevents the pump from exerting sufficient suction on the check-valve 5 to lift it from its seat. In other words, as soon as the float 12 rises high enough to unseat the check-valve 6, direct communication between the passageway E and the tube 16 in the reservoir is established, and consequently on the succeeding suction stroke of the pump the fuel in the passageway E and in the pipe 16 will surge toward the operating member of the pump, and on the pressure stroke of the pump said fuel will surge in the opposite direction, the check-valve 5 remaining seated and thus cutting off the flow of fuel to the chamber E so long as the float 12 holds the check-valve 6 unseated. As soon as the level of the fuel in the reservoir D drops sufficiently to permit the check-valve 6 to seat and thus cut off communication between the passageway E and the tube 16, the suction created in the passageway E on the succeeding suction stroke of the pump will unseat the check-valve 5 and thus cause a charge of fuel to be drawn into the passageway E, and on the succeeding pressure stroke of the pump this charge of fuel will be forced upwardly past the check-valve 6 into the tube 16 from which the fuel flows into the reservoir D.

As previously stated, I do not wish it to be understood that my invention is limited to a fuel-supply apparatus provided with check-valves and passageway E of the particular construction herein shown, nor to an apparatus in which a positive suction is exerted on the operating member of the pump for my broad idea consists in raising liquid fuel from a low level into a reservoir arranged at a higher level by means of a device that communicates with a valved passageway and which is so constructed that it will cause charges of fuel from the source of supply to be drawn into said passageway and discharged from same intermittently into the reservoir, the reservoir being equipped with means governed by the level of the fuel therein for causing the supply of fuel to said passageway to be cut off automatically when the fuel in the reservoir rises above a certain level.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A fuel-supply system for internal combustion engines comprising a reservoir separate and distinct from the fuel tank of the carbureter and from which fuel is supplied to said fuel tank by gravity, a passageway or chamber provided with inlet and outlet check-valves and arranged between said reservoir and a source of liquid fuel supply, a device for drawing charges of fuel into said passageway and forcing it into said reservoir intermittently, and means whereby the rising of the fuel in said reservoir above a certain level causes the supply of fuel to said passageway to be cut off.

2. A fuel supply system for internal combustion engines comprising a reservoir from which fuel is supplied to the engine by gravity, a passageway or chamber provided with inlet and outlet check-valves and arranged between said reservoir and a source of liquid fuel supply, a device coöperating with both of said valves for drawing charges of fuel into said passageway and forcing it into said reservoir intermittently, and means whereby said device fails to open said inlet valve when the fuel in said reservoir rises above a certain level, thereby causing the supply of fuel to said passageway to cease automatically.

3. A fuel supply system for internal combustion engines comprising a reservoir from which fuel is supplied to the engine by gravity, a passageway or chamber provided with check-valves and arranged between said reservoir and a source of liquid fuel supply, a device for drawing charges of fuel into said passageway and forcing it into said reservoir intermittently, and means in said reservoir governed by the level of the fuel therein that affects the action of one of the check-valves of said passageway and thus causes the supply of liquid fuel to the reservoir to be interrupted after a certain quantity of fuel has been forced into said reservoir.

4. A fuel supply apparatus for internal combustion engines comprising a reservoir

arranged in such a manner that fuel will flow from same by gravity to the engine, a passageway or chamber provided with an inlet valve for governing the flow of liquid fuel into said passageway and an outlet valve for governing the flow of fuel from said passageway into said reservoir, means for opening said inlet valve and drawing a charge of fuel into said passageway and thereafter unseating said outlet valve and forcing said charge of fuel into the reservoir intermittently when the engine is in operation, and means for unseating the outlet valve so as to interrupt the supply to said passageway when the fuel in said reservoir reaches a certain level.

5. A fuel supply apparatus for internal combustion engines comprising a reservoir arranged in such a manner that fuel will flow from same by gravity to the engine, a passageway or chamber provided with an inlet valve for governing the flow of liquid fuel into said passageway and an outlet valve for governing the flow of fuel from said passageway into said reservoir, a pump that opens said inlet valve automatically on its suction stroke and draws a charge of fuel into said passageway and thereafter unseats said outlet valve automatically on its discharge stroke and forces said charge of fuel into the reservoir intermittently when the engine is in operation, and means that cooperates with one of said valves to cause the supply of fuel to said passageway to be interrupted when the fuel in said reservoir is above a certain level.

6. A fuel supply apparatus for internal combustion engines comprising a reservoir arranged in such a manner that fuel will flow from same by gravity to the engine, a passageway or chamber provided with an inlet valve for governing the flow of liquid fuel into said passageway and an outlet valve for governing the flow of fuel from said passageway into said reservoir, means for exerting suction on said inlet valve to open same and draw a charge of fuel into said passageway and thereafter unseating said outlet valve and forcing said charge of fuel into the reservoir intermittently when the engine is in operation, and a float in said reservoir that holds said outlet valve unseated when the fuel in said reservoir is above a certain level and thus prevents the inlet valve from being unseated by the means that draws the fuel into said passageway and forces it out of same.

7. A fuel supply apparatus for internal combustion engines comprising a reservoir separate and distinct from the fuel chamber of the carbureter and from which liquid fuel is conducted by gravity to said fuel chamber, a movable device which sucks liquid fuel from a source of supply arranged in a lower level than said reservoir, an inlet valve and an outlet valve controlled by said device, means for exerting pressure on said device so as to force the fuel sucked by same from the source of supply into said reservoir, and means that acts on one of said valves and prevents said device from drawing fuel from the source of supply when the fuel in said reservoir exceeds a certain quantity.

8. A fuel supply apparatus for internal combustion engines comprising a passageway or chamber provided with an inlet valve and an outlet valve for governing the flow of liquid fuel into and out of said passageway, a suction device communicating with said passageway which exerts sufficient suction on said inlet valve to cause fuel to enter said passageway, means for exerting pressure on said device intermittently when the engine is in operation so as to force the fuel out of said passageway, and means for causing one of said valves to remain seated and the other to remain unseated under certain conditions.

9. A fuel supply apparatus for internal combustion engines comprising a reservoir for supplying liquid fuel to the fuel chamber of the carbureter of the engine by gravity, a passageway or chamber arranged intermediate said reservoir and a supply of liquid fuel and provided with check-valves that govern the flow of fuel into and out of said passageway, a pump connected to said passageway at a point intermediate said check-valves for drawing charges of fuel into said passageway and forcing the fuel out of said passageway intermittently into the reservoir, and means whereby the pump will cause the fuel to surge back and forth from said passageway into said reservoir and vice versa without drawing fuel from the source of supply when the fuel in said reservoir exceeds a certain quantity.

10. A fuel supply apparatus for internal combustion engines comprising a reservoir for supplying liquid fuel to the carbureter of the engine by gravity, a passageway or chamber arranged intermediate said reservoir and a supply of liquid fuel and provided with check-valves that govern the flow of fuel into and out of said passageway, a pump connected to said passageway at a point intermediate said check-valves for opening said valves and drawing charges of fuel into said passageway and forcing the fuel out of said passageway intermittently into the reservoir, and a float in said reservoir that acts on one of said check-valves and thus causes the supply of fuel into said passageway to be interrupted when the fuel in said reservoir rises above a certain level.

11. A fuel supply apparatus for internal combustion engines comprising a reservoir for supplying liquid fuel to the carbureter

of the engine by gravity, a passageway or chamber arranged intermediate said reservoir and a supply of liquid fuel and provided with automatic check-valves that govern the flow of fuel into and out of said passageway, a pump connected to said passageway at a point intermediate said check-valves for automatically drawing charges of fuel into said passageway and forcing the fuel out of said passageway intermittently into the reservoir, and a float in said reservoir for unseating the outlet valve from said passageway when the fuel in said reservoir is above a certain level, thereby preventing the inlet valve from being unseated by the suction of the pump.

12. A fuel supply apparatus for internal combustion engines comprising a reservoir, a passageway or chamber arranged intermediate said reservoir and a supply of liquid fuel and provided with check-valves, a diaphragm pump operated by the engine and connected to said passageway in such a manner that the vibrations of the diaphragm cause charges of fuel to be sucked into said passageway and forced out of same intermittently into the reservoir, and a device governed by the level of the fuel in said reservoir and coöperating with one of said valves for preventing the fuel from entering said passageway when the fuel in said reservoir is above a certain level.

13. A fuel supply apparatus for internal combustion engines comprising a reservoir arranged in such a manner that fuel will flow from same by gravity to the fuel chamber of the carbureter of the engine, a tube projecting upwardly into said reservoir from the bottom of same, a passageway or chamber at the lower end of said tube provided with an inlet valve for governing the flow of fuel from a source of supply into said passageway and with an outlet valve for governing the flow of fuel from said passageway into said tube, a device operated by the engine for creating suction and pressure in said passageway intermittently when the engine is in operation, and means for causing one of said valves to remain seated when the fuel in said reservoir exceeds a certain amount.

14. A fuel supply apparatus for internal combustion engines comprising a reservoir arranged in such a manner that fuel will flow from same by gravity to the carbureter of the engine, a tube projecting upwardly into said reservoir from the bottom of same, a passageway or chamber at the lower end of said tube provided with an inlet valve for governing the flow of fuel from a source of supply into said passageway and with an outlet valve for governing the flow of fuel from said passageway into said tube, a device operated by the engine for creating suction and pressure in said passageway intermittently when the engine is in operation, and a float in said reservoir for holding the outlet valve unseated when the fuel in said reservoir is above a certain level so as to prevent said device from exerting sufficient suction on said inlet valve to open same.

15. A fuel supply apparatus for internal combustion engines comprising a reservoir for supplying liquid fuel to the engine by gravity, a passageway or chamber at the lower end of said reservoir provided with an inlet check-valve for controlling the flow of fuel from a source of supply to said passageway and with an outlet check-valve for controlling the flow of fuel from said passageway, a tube projecting upwardly into said reservoir and arranged in such a manner that the fuel from said valved passageway will enter same, a vibrating or reciprocating device communicating with said passageway at a point between the valves thereof, a float in said reservoir, and means actuated by said float for unseating said outlet valve when the fuel in said reservoir reaches a certain level.

16. A fuel supply apparatus for internal combustion engines comprising a reservoir, a tubular-shaped member projecting upwardly through the bottom of the reservoir so as to form a passageway or chamber, a sleeve screwed onto said tubular-shaped member and bearing against the bottom of the reservoir for retaining said member in position, an inlet check-valve at the lower end of said passageway, an outlet check-valve at the upper end of said passageway, and a combined suction and pressure device communicating with said passageway intermediate said valves.

17. A fuel supply apparatus for internal combustion engines comprising a reservoir, a tubular-shaped member projecting upwardly through the bottom of the reservoir so as to form a passageway or chamber, a sleeve screwed onto said tubular-shaped member and bearing against the bottom of the reservoir for retaining said member in position, an inlet check-valve at the lower end of said passageway, an outlet check-valve at the upper end of said passageway, a combined suction and pressure device communicating with said passageway intermediate said valves, a cage that surrounds said outlet valve, and a float in said reservoir connected to said cage.

18. A fuel supply apparatus for internal combustion engines comprising a reservoir, a tubular-shaped member projecting upwardly through the bottom of the reservoir so as to form a passageway or chamber, a sleeve screwed onto said tubular-shaped member and bearing against the bottom of the reservoir for retaining said member in position, an inlet check-valve at the lower

end of said passageway, an outlet check-valve at the upper end of said passageway, a combined suction and pressure device communicating with said passageway intermediate said valves, a cage that surrounds said outlet valve, a float in said reservoir connected to said cage, and a tube connected to said sleeve and projecting upwardly into the reservoir.

19. A fuel supply apparatus for internal combustion engines comprising a reservoir provided with a tube arranged at such a level that fuel will flow from same by gravity to the carbureter of the engine, a passageway or chamber at the lower end of said reservoir provided with a ball check-valve that governs the flow of fuel from a source of supply into said passageway, a ball check-valve for controlling the flow of fuel from said passageway into said reservoir, a cage coöperating with said outlet check-valve, a float in said reservoir connected to said cage, and a device operated by the engine for creating suction and pressure in said passageway between said valves.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this fourth day of March 1914.

WILLIAM C. CARTER.

Witnesses:

WELLS L. CHURCH,

GEORGE BAKEWELL.