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B. H. SAVAGE

VACUUM FUEL FEED APPARATUS

Filed June 14, 1927

FIG. 1.

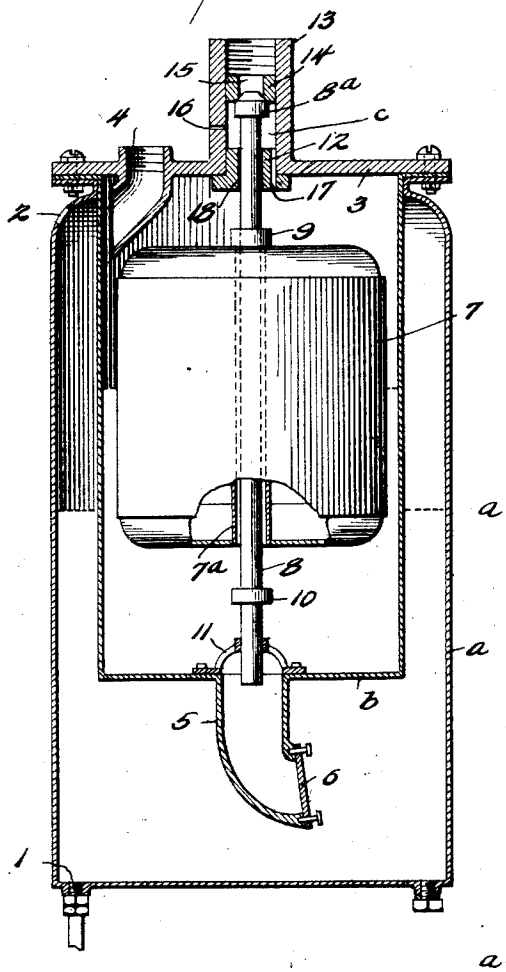


FIG. 2.

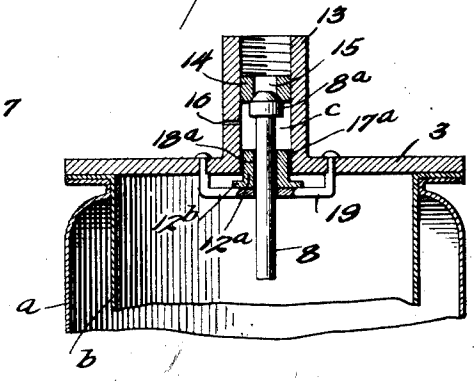
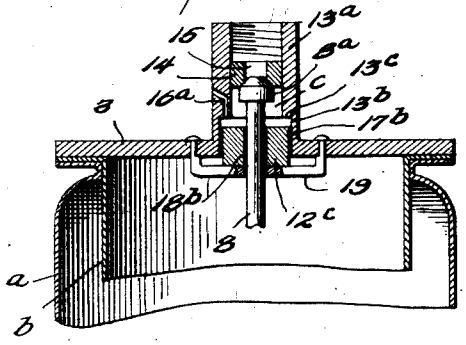


FIG. 3.



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VACUUM FUEL-FEED APPARATUS.

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This invention relates to improvements in vacuum fuel feed apparatus for use in connection with internal combustion motors. The purpose of the invention is to provide an apparatus of this kind in which the fuel replenishing operations are carried on automatically with the fewest possible moving parts. In carrying out the invention, I provide the usual main and auxiliary tanks, the latter having an inlet for the liquid fuel and a suction-controlled outlet, said outlet having a port of relatively large area. Between said port and the auxiliary tank, I provide a venting and mixing chamber having a restricted air passageway leading to the atmosphere, and another restricted passageway leading to the auxiliary tank. I also provide a float valve in the auxiliary tank, having a valve stem which extends into said chamber and has a valve at its upper end adapted to close said port when the float is raised to a given height by the incoming liquid fuel, and to open said port when the float descends.

In one form of the invention, a small quantity of air constantly flows into the mixing chamber, this air mingling with the vapor drawn from the auxiliary reservoir and passing to the intake of the motor when the float valve is off its seat, and flowing into the auxiliary reservoir to vent the latter when the float valve is seated. The quantity of air thus admitted does not materially lower the pressure in the auxiliary reservoir while the latter is being exhausted, and as it mingles with the vapors carried to the intake of the motor, the vapors are diluted and make, with the air, a combustible mixture.

In another form of the invention, I provide means for automatically restricting the communicating passageway between the mixing and venting chamber and the auxiliary reservoir during the fuel replenishing operation, and for enlarging this passageway, after said operation, to vent said reservoir. In still another form of the invention, I provide means for closing the air passageway and for restricting the vapor passageway leading to the auxiliary reservoir during the fuel replenishing operation, and for opening the air passageway and enlarging the fuel passageway at the completion of said operation.

In the accompanying drawing,

Fig. 1 is a central section through a vacuum fuel feed apparatus, in which the auxiliary reservoir is in constant communication with the atmosphere through restricted passageways leading to an intermediate mixing and venting chamber;

Fig. 2 is a similar view through the upper part of an apparatus in which a suction-controlled valve varies the inlet from the auxiliary reservoir to the mixing chamber; and,

Fig. 3 is a view similar to that in Fig. 2 of an apparatus in which a suction-operated valve controls the air passageway as well as the vapor passageway leading to the mixing chamber.

Referring to the drawing, *a* represents the main reservoir of a vacuum fuel feed system for internal combustion motors, and *b* represents the auxiliary reservoir. The main reservoir has an outlet connection 1 by which the contents of said reservoir may drain into the carbureter, and it has an air vent 2, at its upper end. The auxiliary reservoir is arranged within the main reservoir and closes the latter, and a cap 3 closes the auxiliary reservoir. The auxiliary reservoir has the usual inlet opening 4, adapted for connection by a suitable conduit to the supply tank which, on an automobile, is usually arranged at the back of the vehicle and below the level of the reservoirs. The auxiliary reservoir also has an outlet connection 5, leading to the main reservoir, and provided with a check valve 6, which opens by the weight of the liquid to permit fuel to flow from the auxiliary to the main reservoir, and which closes by gravity to prevent the return flow when the auxiliary reservoir is exhausted. Within the auxiliary reservoir is arranged a float 7, having a tube 7^a extending vertically through it, and a valve stem 8 extends through this tube. The float is slidably mounted upon the stem, and the latter is provided with collars 9 and 10, spaced to permit a limited movement of the float relatively to the stem.

The valve stem, which is preferably made very light in weight, is slidably mounted in a guide 11 at the bottom of the auxiliary reservoir and in a bushing 12 (Fig. 1), which is fixed within the suction outlet 13, which outlet is adapted to be connected to the intake of the motor. Within the suction outlet, and spaced from the bushing 12, is a valve seat 14, having a relatively large port 15. A valve

8^a, on the valve stem, is adapted to close the port when the stem is raised by the float. The space within the suction outlet between the valve seat and bushing 12 constitutes a venting and mixing chamber *c*. This chamber, in Fig. 1, is in constant communication with the atmosphere through a small perforation or passageway 16, and it is in constant communication with the auxiliary reservoir through a restricted passageway 17 in the bushing and also through the bore 18, in which the valve stem is guided, a certain amount of leakage necessarily taking place through this bore in which the valve stem moves freely.

In Fig. 2, the structure is the same as in Fig. 1 except that the bushing 12^a is a loose fit in the suction outlet connection and is normally supported by a stop 19, connected to the cap-piece 3, and the restricted passageway 17, shown in Fig. 1, is omitted from Fig. 2. In Fig. 2, when the bushing 12^a rests against the stop, communication between the venting and mixing chamber *c* and the interior of the auxiliary reservoir is established through the restricted annular space 17^a between the bushing and the interior wall of the outlet connection 13, as well as through the bore 18^a through which the valve stem extends. The restricted air passageway 16 is constantly open. In this figure of the drawing, when the valve 8^a is off its seat and the motor is in operation, the bushing 12^a, which constitutes a valve, lifts by atmospheric pressure until its annular shoulder 12^b rests against the cap-piece 3, and this shoulder closes the restricted annular passageway 17^a, so that the only communication between the venting and mixing chamber and the auxiliary reservoir is through the restricted passageway 18^a. When the suction is cut off by the seating of the valve 8^a, the valve 12^a drops to its stop and opens the passageway 17^a, thus allowing freer communication between said chamber and the auxiliary reservoir.

In Fig. 3, the suction outlet fitting 13^a has a cylindrical bore 13^b at its lower end, of larger diameter than that in the upper part of the fitting, and this provides an annular shoulder 13^c against which a cylindrical valve 12^c abuts when said valve is raised. This valve fits freely within the socket formed by the bore 13^b so that it can be raised by suction from its stop 19 and dropped by gravity when the suction ceases. The inner end of the air passageway 16^a terminates at the shoulder 13^c, as shown. When the valve 12^c lifts, it closes this passageway and it also closes the annular passageway 17^b, and when the valve drops it opens both of these passageways.

The operation of the structure shown in Fig. 1 is as follows: As the main reservoir is constantly vented through the vent opening 2, the fuel in said reservoir drains through the outlet 1 into the carbureter of the motor, in accordance with the requirements of the motor. The auxiliary chamber is also in communication with the atmosphere, through the restricted passageways 16 and 17, and the liquid in the latter reservoir seeks the level of the liquid in the main reservoir through the outlet 5. When the motor starts, assuming the float and its valve to be in a lowered position, a partial vacuum is created in the auxiliary reservoir and liquid fuel is drawn into said reservoir through the supply inlet 4. A small stream of air flows through the restricted air passageway 16 into the mixing and venting cahmber *c*, where it mingles with the vapors drawn through the passageway 17, and passes to the intake of the motor. This small air leakage has no appreciable effect upon the pressure in the auxiliary chamber, where the outlet port 15 is relatively large, as shown in the drawing. The fuel drawn into the auxiliary reservoir lifts the float and its valve 8^a then closes the port 15, stopping the further exhaustion of the auxiliary reservoir and the flow of liquid into said reservoir. The auxiliary reservoir is then vented by the flow of air through the passageways 16 and 17, and the liquid from said reservoir flows into the main reservoir. The drop in the level of the liquid in the auxiliary reservoir permits the float to slide down on the valve stem while the latter is held by atmospheric pressure in its upper position with the valve 8^a against its seat. When the float is lowered to a point where it bears against the collar 10, the weight of the float causes the valve stem to drop and open the suction outlet 13. The filling operation is then automatically repeated, and is continued until the float has moved the valve 8^a to its seat. The vapors drawn from the auxiliary reservoir through the passageway 17 while the latter reservoir is being exhausted are diluted by the air which flows through the passageway 16, making a combustible mixture, so that these vapors do not unduly enrich the mixture flowing to the motor from the carbureter. It will be seen that the air from the constantly open air passageway flows to the motor during the filling periods and at other times it flows into the auxiliary reervoir, to vent the latter and permit the fuel therein to discharge into the main reservoir.

In Fig. 2, the operation is the same as in Fig. 1, except that the bushing 12^a operates as a valve to close the restricted passageway 17^a between the chamber *c* and the auxiliary reservoir during the periods when the float valve is off its seat and said reservoir is being exhausted. When the liquid drawn into the auxiliary reservoir moves the float valve to its seat, the valve 12^a drops, opening the passageway 17^a, and the auxiliary reservoir is quickly vented by air flowing through the

passageways 16 and 17^a, thus permitting fuel from the latter reservoir to flow into the main reservoir.

In Fig. 3, the operation is the same as in Fig. 2 except that the valve 12^c, when raised, closes the air port 16^a as well as the annular passageway 17^b. During the periods when the float valve is off its seat, both of these passageways are open, and the air and vapor drawn into the mixing chamber flow to the motor. When the liquid drawn into the auxiliary reservoir causes the float to raise and seat the float valve, the valve 12^c drops and opens the ports 16^a and 17^b, and air then flows into the auxiliary reservoir to vent the same.

What I claim is:

1. In a vacuum fuel feed system for internal combustion motors, a main reservoir having an outlet to the carburetor and having an air vent, an auxiliary reservoir having a valve-controlled outlet leading to the main reservoir, said auxiliary reservoir having a fuel inlet and having a suction outlet provided with a relatively large outlet port and a venting and mixing chamber between said port and the auxiliary reservoir, said chamber having constantly open restricted passageways leading therefrom to the atmosphere and to the auxiliary reservoir, a float valve in the latter reservoir, a valve stem carried by the float, said stem extending into said chamber and having a valve adapted to close said port when the float is raised.

2. In a vacuum fuel feed system for internal combustion motors, a main reservoir having an outlet to the carbureter and having an air vent, an auxiliary reservoir having a valve-controlled outlet leading to the main reservoir, said auxiliary reservoir having a fuel inlet and having a suction outlet provided with a relatively large outlet port and a venting and mixing chamber between said port and the auxiliary reservoir, said chamber having constantly open restricted passageways leading therefrom to the atmosphere and to the auxiliary reservoir, a float valve in the latter reservoir, a valve stem carried by the float and movable relatively thereto, said stem having stops for limiting such movement and having a valve within said chamber adapted to close said port when the float is raised.

3. In a vacuum fuel feed system for internal combustion motors, a main reservoir having an outlet to the carbureter and having an air vent, an auxiliary reservoir having a valve-controlled outlet leading to the main reservoir, said auxiliary reservoir having a fuel inlet and having a suction outlet provided with a relatively large outlet port and a venting and mixing chamber between said port and the auxiliary reservoir, said chamber having a constantly open restricted passageway leading therefrom to the atmosphere and two restricted passageways leading from said chamber to the auxiliary reservoir, a normally open suction-controlled valve adapted to close one of the latter passageways, a float in the auxiliary reservoir and a valve carried by the float and adapted to close said port when the float is raised.

In testimony whereof I hereunto affix my signature.

BASIL H. SAVAGE.