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CARBURETOR AND FUEL FEEDING SYSTEM THEREFOR

Original Filed Oct. 21, 1920

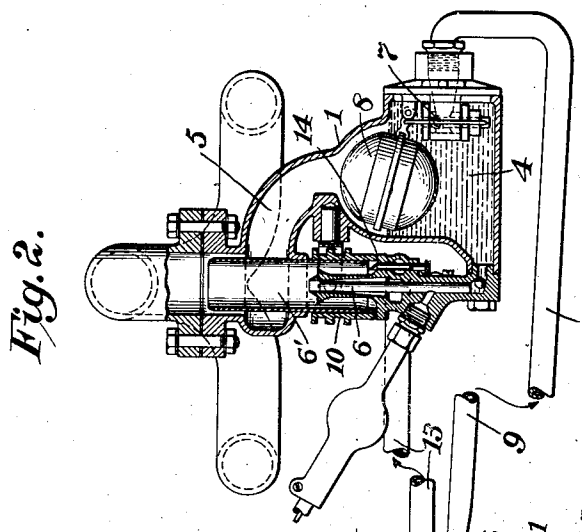

Fig. 2.

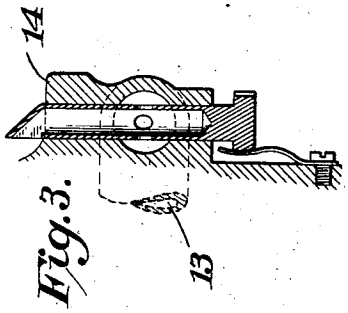

Fig. 3.

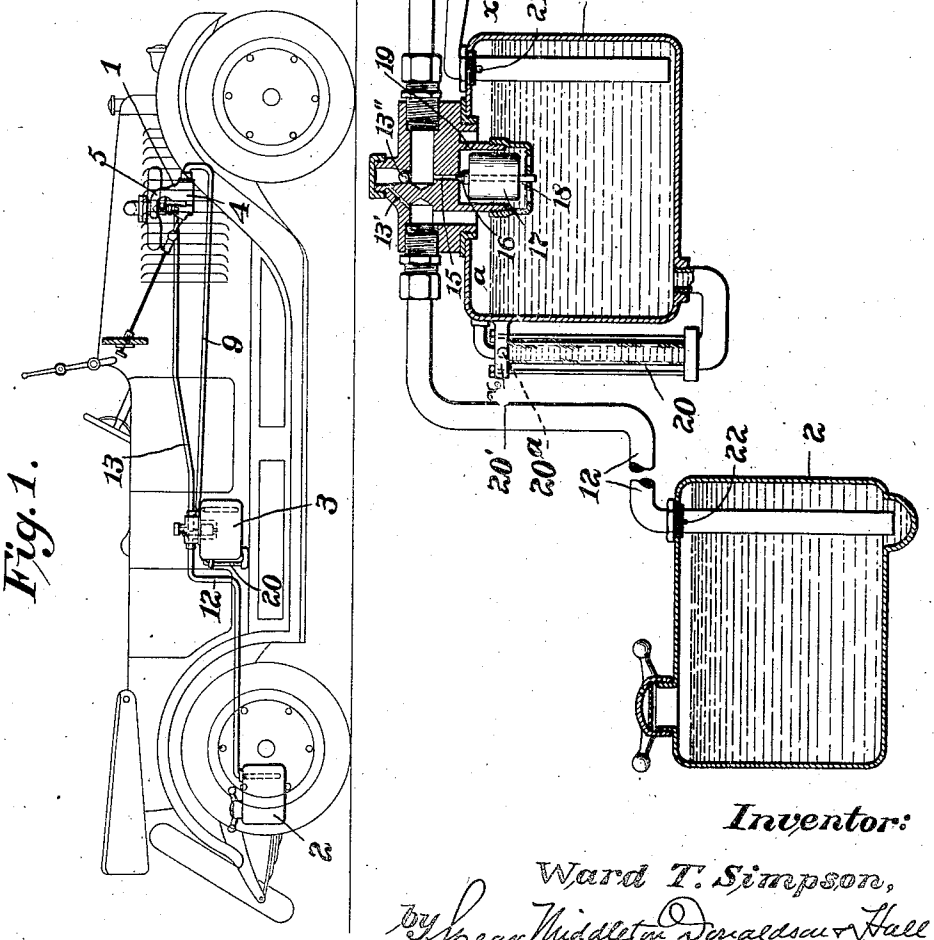

Fig. 1.

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UNITED STATES PATENT OFFICE.

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CARBURETOR AND FUEL-FEEDING SYSTEM THEREFOR.

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One object of the invention is to provide a system for supplying fuel to a carburetor from a low tank.

The invention is shown in the accompanying drawings in which:

Fig. 1 is a view in the nature of a diagram of the invention in place on an automobile.

Fig. 2 is a sectional view of the carburetor, the two tanks and the connections between them.

Fig. 3 is a detail.

In these drawings 1 indicates the carburetor, 2 the main fuel tank and 3 an intermediate air tight fuel tank.

The carburetor has its fuel chamber 4 connected with the engine intake by a passage 5 so as to be subjected to the depression in the engine manifold, and the lower part of the fuel chamber is connected to the jet nozzle 6 which directs the fuel into the mixing chamber 6′. The inlet of fuel to the fuel chamber 4 is controlled by a valve 7 which is of a balanced character, being subject to the depression within the fuel chamber acting in both directions on the valve. A float 8 controls the valve according to the level of the fuel in the fuel chamber.

The fuel is fed to this fuel chamber by a pipe 9 leading from the top of the tank 3 arranged intermediate the carburetor and the main tank 2, both of which tanks may be at levels lower than that of the carburetor, the main tank being lower than the intermediate tank. The intermediate tank 3 receives its supply from the main tank 2 through a pipe 12 connecting with the top of the intermediate tank. A pipe 13 extends from the top of the intermediate tank to a part of the carburetor or engine manifold at which, in one application of my invention, there is a different degree of depression than that existing in the fuel chamber. For instance, this pipe may connect with the mixing chamber 6′ of the carburetor at the point where the air supply enters the mixing chamber through the seat 14 of the throttle valve and where the depression is less than in the fuel chamber.

I do not limit myself however, to this position of the connection as a means for getting less depression in the pipe 13 in respect to that in the fuel chamber and supply pipe 9. An adjustable nozzle at the end of pipe 13, where it enters the carburetor, might be used to get this difference in the depression between pipes 13 and 9, the adjustment of the nozzle being such that it will receive more or less of the air from the body of air rushing past it.

The small port 15 leading from the intermediate tank to the pipe 13 is controlled by a valve 16 operated by a float 17 in a compartment 18 which is open at its lower end to the interior of the intermediate tank. This float is of less diameter than that of the compartment. The pipe 13 is connected by a by-pass port 13′ with the port leading from the pipe 12 to the intermediate tank. This by-pass is controlled by a check valve 13″ closing towards the pipe 13.

For filling the intermediate tank the throttle valve is closed, and then cranking is performed. The fuel which is drawn by the suction of the carburetor from the main tank passes through the intermediate tank into the fuel chamber 4 of the carburetor, the depression here at this time being about four inches of mercury.

As soon as the fuel chamber 4 is filled to the prescribed level, the intermediate chamber then completes its filling. This is due to the closing of the fuel inlet valve by the rise of the float 8 and by the continued depression in the intermediate chamber caused by the suction through the pipe 13 leading from the top of the intermediate tank to the carburetor or manifold.

During this filling action of the intermediate tank, the valve at the top of the intermediate tank controlling the suction pipe 13 will of course be open, due to its float resting in its lowest position by gravity, the greater suction being through pipe 9 and not through pipe 13, and also due to the fact that the suction when cranking is not strong enough to close the valve in the intermediate tank.

The intermediate tank having filled up to a level approximately indicated by the line x—x, the float valve 16, due to its buoyancy, will close the port 15 leading to the pipe 13 and cut off the suction from the carburetor or manifold, and there will be left a space a at the top of the intermediate chamber above the line x—x. In this space a some depression will exist.

If the depression in the carburetor, or

rather pipes 9, 13, is now maintained to the degree that the fuel will be drawn from the main tank through the intermediate tank and fuel pipe 9 to the fuel chamber of the carburetor. Under these conditions, the float valve 16 will remain seated because the level of the fuel in the intermediate tank will be maintained, as much fuel being drawn in from the main tank as is drawn out therefrom by the suction from the carburetor through the pipe 9.

In starting with the intermediate tank filled, the throttle valve 6 is nearly closed and upon cranking the engine the fuel will be drawn through the intermediate tank 3 from the main tank 2, it then forming a part of the direct conduit from the main tank to the fuel chamber of the carburetor. This condition is maintained during idling or running with wide open throttle, provided, as above stated, the depression is maintained sufficient to lift the fuel from the low main tank.

For instance:

During the normal average operation of an automobile and after the intermediate tank has been filled, the check valve 13″ of the pipe 13 and the float valve 16 will be closed, but if an occasion should arise, for instance, at full or near full throttle and at low engine revolutions, when the suction through pipe 13 caused by the motor becomes insufficient to hold the check valve seated, the contents of the intermediate tank will be available to the carburetor, and in order that this may happen, the by-pass 13′, with check valve 13″, is provided to act as a pressure equalizing means between the pipe 13 and the upper portion *a* of the intermediate tank, thereby enabling the carburetor, through its connection 9, to obtain its fuel, with the low depression then existing, and until such time as the depression in the pipe 13 shall again be great enough to replenish the fuel in the intermediate tank to its maximum level, at which time the float valve will again seat itself and the check valve 13″ being already seated, then the suction will automatically be induced through pipe 9 alone and until a repetition of the low depression condition again exists.

The point in the carburetor from which the control of the check valve and float is exerted is the point where pipe 13 connects with the carburetor. In the arrangement described above, this is in the lower part of the mixing chamber and because the depression here is less than in the fuel chamber, the lessening of this depression will allow the check to open and the float valve to fall.

To state the operation in another way: As long as the normal conditions above noted prevail, the depression in the carburetor fuel chamber will draw the fuel through the intermediate tank and while this is going on the ball valve will remain on its seat and the float valve will also remain seated, because the inflow to the intermediate tank will maintain the normal fuel level. When, however, the conditions as to the degree of depression in the carburetor or manifold change, that is, the depression becomes less than normal, there will take place an equalization of the depression in the pipe 13 and the space *a* in the intermediate tank by the opening of the ball valve and then as this equalization of depression results in a sufficient differential pressure between space *a* and the fuel chamber, the depression in the latter being greater, the fuel will be drawn from the intermediate tank into the fuel chamber, and the float valve will fall and open port 14.

During the time that this rare condition exists, the fuel will be supplied to the carburetor from the intermediate tank, but there will be no replenishing of the fuel from the main tank. This abnormal condition, however, will be but temporary, and as soon as the depression in the carburetor increases again to normal, the ball valve will close but the float valve will remain open. The fuel will now be drawn in from the main tank by the suction from pipe 13 and the port of the float valve, and fuel will be drawn into the intermediate tank from the main tank until the float lifted by the rise of the fuel to the level *x*—*x* will close this valve and stop the suction through the pipe 13. The tank now having been replenished, the operation will go on as before.

It will be noted that the intermediate tank is not open to the atmosphere and is thus not subject to explosion from fire, differing from those systems in which the intermediate tank is open to the atmosphere.

If air should get into the intermediate tank through leakage or from another cause, such as the use of air introduced into the pipe 12 for lightening the fuel column, this air will be evacuated through the ports 19 and 15, when the float valve is opened, due to the fall of the level of the fuel caused by the presence of this air in the space *a*.

The intermediate tank may be placed at any height where room may be found to accommodate it. If placed below the level of the fuel chamber of the carburetor the suction pipe 13 must connect with the mixing chamber or manifold where the depression is less than that in the fuel chamber. If it is placed at the same level or higher than the fuel chamber, the pipe 13 may connect with the fuel chamber or passage 5, where the depression is the same as that in the fuel chamber.

A gauge 20 is used on the intermediate tank to indicate the height of the fuel therein. If the fuel gets below a prescribed level, the operator may know that his main tank

is empty and that he has only the amount left in his intermediate tank with which to get on to a station to get a new supply.

When this condition is indicated to the operator by the gauge means, and if the main supply tank be of a definite capacity, when full, say 10 gallons, it will be seen that the operator has positive means with which to check his fuel purchases and consumption. I therefore make the main tank of a size to take a unit, or a multiple of units, of the measure which is used at all fuel stations, and in this way the car user, when his main tank has been refilled, will know that he has gotten this unit of measure or the multiple thereof, and will be satisfied to pay accordingly.

This gauge performs a plurality of functions. It may have within it a float 20ª which, when in its uppermost position, is arrested by the upper member 20′ which will act as a shield to hide it. This shield is slightly below the fuel level in the tank 3 and hence as long as the float remains out of sight, the operator can feel assured either that he has fuel in the main tank or that he still has at least the contents of the intermediate tank. As soon, however, as the float or fuel level appears below the shield, the operator will know that the main tank has become exhausted and he will then know how much he has left to reach the next fuel station.

Further, this will indicate the height of the fuel in the intermediate tank, as this is being used.

Instead of running the pipe 9 from the bottom of the intermediate tank to the fuel chamber, I prefer to introduce this pipe through the top of the tank and carry it down to near the bottom thereof and at the point where the pipe crosses the space *a* I may place an air hole at 21 so as to lighten the fuel column and permit it to be readily drawn into the fuel chamber of the carburetor. To get this result I would also place an air inlet opening at 22 in the pipe within the main tank so that the air lifting quality would be effective here to lighten the fuel column between the main tank and the intermediate tank. This air introduced at opening 22 will get into the space *a* and from here into the fuel chamber of the carburetor and will go through the vacuum passage 5 and strike the baffle consisting of the mixing chamber tube, where it crosses the mouth of said passage, and any liquid fuel which has been carried along with this air will be separated therefrom and will drain back into the fuel chamber to be delivered therefrom through the nozzle.

My invention is adapted for use not only in automobiles but also in motor boats and the like.

One feature of my system is that the intermediate tank is at all times under the suction from the carburetor. When the float valve and check valve closes, the pipe 13, suction will take place through the fuel chamber and pipe 9 alone. At other periods in the operation, when the float valve is open, valve and check valve closes the pipe 13, and some suction will continue to take place through pipe 9, and thus substantially at all times the whole system back to the main tank will be under suction.

The action is also such that fuel will be flowing into the intermediate tank from the main tank at the same time that the fuel is being drawn from said intermediate tank by the depression in the fuel chamber.

The air passing into the fuel pipe at the intermediate tank will be disposed of after reaching the fuel chamber by passing off through the vacuum passage and any fuel which is carried off from the body of fuel by this passing air will be separated from the air by striking the portion of the mixing tube which extends across this vacuum passage.

The air hole 22 performs an important function besides aiding the lifting of the fuel column, that is, if the check valve 13″ or float valve 16 should leak, this air let in at 22, which passes through the conduit 12 from main tank 2 with the fuel, will seek the uppermost part of the intermediate tank 3 and will be in contact with said check valve and float valve at all times and pass through the leak, which will not interfere with the engine.

Now if there was no air let in at 22 and the check valve and float valve leaked, fuel would pass to the engine and interfere with its operations. I prevent this undesirable feature by the introduction of the air at 22 and at the same time aid the lifting of the fuel.

I claim:

1. In combination in a fuel feed system for automobiles, a carburetor of the vacuum feed type having its fuel chamber subjected to the vacuum depression from the manifold, a main fuel tank, a tank intermediate the main tank and the carburetor, a pipe for supplying fuel from the main tank to the intermediate tank, a pipe extending from the lower part of the intermediate tank to the fuel chamber of the carburetor, a float valve in the fuel chamber controlling the inlet from the said last mentioned pipe, a second pipe connected with the carburetor at a point where there is less vacuum than in the fuel chamber, and with the intermediate tank through a port at the top of the latter whereby there will be a preponderance of vacuum depression in the fuel chamber in respect to that in the intermediate tank and a float valve controlling said port, for cutting off communication between the said in-

termediate tank and the carburetor through said port, substantially as described.

2. In combination, a carburetor, a main fuel tank below the level of the carburetor, an air tight intermediate tank to which the main tank delivers the fuel, a pipe for delivering fuel from the intermediate tank to the fuel chamber of the carburetor, communication means for placing the upper part of the air tight intermediate tank in communication with a part of the carburetor where the depression is less than in the fuel chamber, and valve means consisting of a check valve closing towards the carburetor and controlling said communication to equalize the depression in the top of the intermediate tank with that of said carburetor part when the depression lessens, whereby the fuel in said intermediate tank alone is available for supplying the fuel chamber of the carburetor, and additional float valve means for allowing said communicating means to create suction in the intermediate tank for replenishing its fuel supply from the main tank when the depression in the carburetor is restored to normal and for thereafter closing said communication when the fuel level in the intermediate tank reaches the prescribed level.

3. In combination in a fuel supply system for automobiles and the like, a carburetor, a main fuel tank, below the level of the carburetor, a tank intermediate the main tank and the carburetor and receiving its supply from the main tank, a fuel connection from the lower part of the intermediate tank to the carburetor, a connection from the upper part of the intermediate tank to a part of the carburetor where the depression is less than in the fuel chamber, valve means for controlling the said connection whereby at times the suction in the carburetor will draw fuel from the said intermediate tank and at the same time draw from the main tank into the intermediate tank, when the depression in the fuel chamber of the carburetor is normal, and a gauge on the intermediate tank to indicate the height of the fuel therein, substantially as described.

4. In combination, a carburetor having a fuel chamber, a passage communicating the same with the engine manifold, a mixing chamber, a fuel conduit leading to the mixing chamber, a fuel supply tank arranged at a lower level than the fuel chamber, a fuel pipe leading from said tank to the fuel chamber, and having a port for the entrance of air to lighten the fuel column, the air after reaching the fuel chamber from said fuel pipe passing off through the said passage to the engine manifold, and baffle means in said passage to separate the liquid fuel from the air, said baffle means comprising the mixing tube extending across said passage.

5. In combination, a carburetor having a fuel chamber, a passage communicating the same with the engine manifold, a mixing chamber, a fuel conduit leading to the mixing chamber, a fuel supply tank arranged at a lower level than the fuel chamber, a fuel pipe leading from said tank to the fuel chamber, and having a port for the entrance of air to lighten the fuel column, the air after reaching the fuel chamber from said fuel pipe passing off through the said passage to the engine manifold, a main fuel tank at a lower level than the tank first mentioned, a fuel pipe between the tanks having a port for admission of air to lighten the fuel column and a connection leading from the first mentioned tank subject to the suction from the engine for evacuating said tank of the air used for lightening the fuel column.

In testimony whereof I affix my signature.

WARD T. SIMPSON.