March 24, 1931. C. L. STOKES 1,797,485

LIQUID FEED SYSTEM

Filed March 8, 1923

Fig. 1.

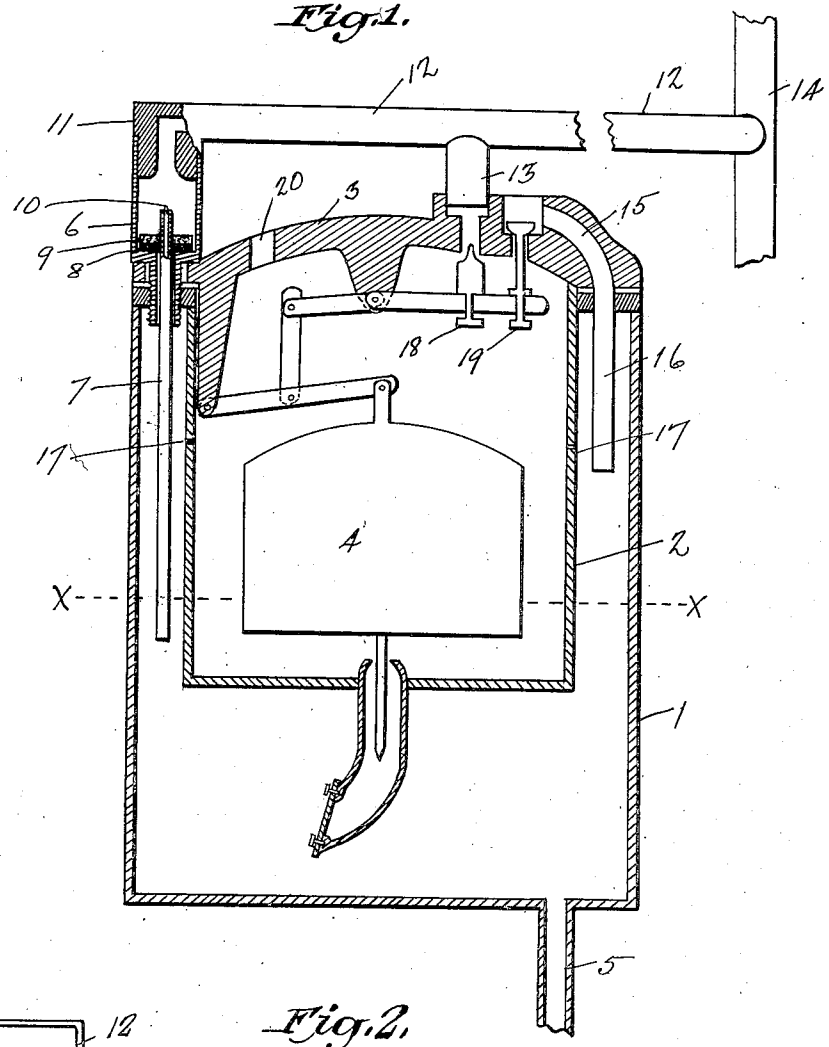
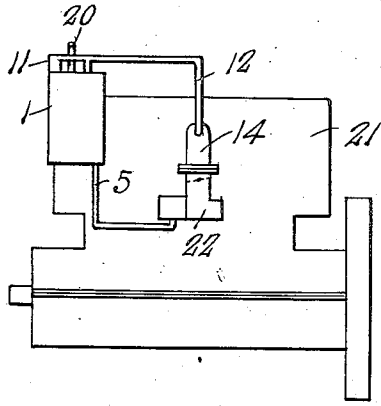
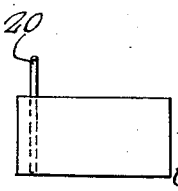


Fig. 2.





INVENTOR.

Charles L. Stokes

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UNITED STATES PATENT OFFICE

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LIQUID-FEED SYSTEM

Application filed March 8, 1923. Serial No. 623,687.

My invention relates to improvements in vacuum tanks, used for supplying liquid fuel to the carburetor of an internal combustion engine from a low level.

The principal object of my invention is to provide apparatus for increasing the pumping efficiency of the vacuum tank and at the same time continuously withdrawing normally waste vapors therefrom.

A further object of my invention is to provide a priming, or starting, apparatus in conjunction with the vacuum tank and the vapor withdrawing apparatus.

Another object of my invention is to provide improved evaporating apparatus in conjunction with the vacuum tank.

In the accompanying drawings which illustrate the invention,

Fig. 1 is a vertical section through a vacuum tank equipped with the present improvement.

Fig. 2 is an elevation showing the tank in operative relation with an engine and its carburetor.

With reference to the drawing of Fig. 1, 1 indicates the outer shell, or reservoir, of a well-known type of vacuum tank, known as the Stewart Warner vacuum tank, which is selected to illustrate my invention, although it is to be understood that the invention is not limited to the specific structure shown, but may be used in connection with many similar types of vacuum tanks. 2 is the inner chamber, or suction chamber, for the reception of fuel from a low level tank (not shown) through a passageway 20. 3 is a cap, circular in form, which is held together with 2 and 1 by a number of screws around the periphery thereof.

In place of one of the screws, I insert a fitting 6, in which is placed a floating valve comprising a hollow stem 7 to which is attached a disc 8, which has on its upper part a cushion of cork 9.

Inside of 2 is the usual float 4 which serves to operate suction valve 18 and air valve 19 depending on the liquid level in 2. The float operates the valves through the medium of levers and springs (not shown), but inasmuch as the general construction of the tank is well known in the art and is not herein claimed, it is not considered necessary to be enlarged upon. In Fig. 1, suction chamber 2 has just discharged its contents into 1 and air valve 19 is closed and suction valve 18 has just opened and the liquid fuel level is now shown as X—X.

As illustrated in Fig. 2, suction is applied to 2 from the inlet manifold 14 of an internal combustion engine 21 through a pipe 12, which is connected through 13 to the interior of 2 and through a fitting 11 it is connected through 6 into the interior of 1.

A passage 15 is generally cored out in 3 to supply air to 1 and I now extend 15 by a pipe 16, which pipe is so arranged that its lower extremity is just above the normal liquid level in 1.

Valve stem 7 is made of very thin and light tubing and has its lower end (when there is no suction applied through 12) about one-half inch below the normal liquid level in 1. The upper end of 7 is restricted by a small orifice 10, which governs the amount of liquid passing through 7 and thereafter the amount of air and vapors passing therethrough. Two small holes 17 are placed in the wall of 2, which holes are about the size of a No. 75 drill.

In my reissue Patent No. 14,701 dated July 29, 1919, and others, I have described a pioneer method of continuously withdrawing carburetted air from a vacuum tank, and in my co-pending application S. N. 512,187, filed November 2, 1921, and Patents Numbers 1,525,698 dated February 10, 1925, and 1,488,566, dated April 1, 1924, I have described different methods of continuously withdrawing air from the inner and outer chambers of a vacuum tank of a different type. My present invention shows an improved method of pumping fuel over said co-pending applications, inasmuch as I now considerably increase the pumping efficiency of the vacuum tank by maintaining a slightly greater vacuum in reservoir 1 over that contained in suction chamber 2 when the latter is not drawing liquid fuel thereto from a lower level. At the same time I increase materially the vaporization of light fractions

from the liquid fuel contained in 1 by passing thereover a constant stream of air (which may be heated air) and feed the same continuously to the engine, the air being used at the same time to vent the reservoir 1 and thereby permit liquid fuel to run by gravity through a discharge connection 5 to a carburetor 22 connected to manifold 14.

The operation is as follows:—

If it is assumed that the engine 21 is about to be started, upon cranking the engine vacuum applied through 12 to 2, is applied in the same degree to chamber 6, whereupon 7 is rapidly elevated, due to atmospheric pressure through 16 applied to the lower side of disc 8, and is seated in the lower part of 11. Liquid fuel is also elevated with 7, and the amount thereof is gaged by the size of the interior of 7 and the depth to which the lower part of 7 is immersed below the liquid level X—X.

The liquid fuel is then withdrawn rapidly through 10 and 12 to the engine, thereby furnishing a priming charge for starting it and, as soon as the liquid fuel in 7 is withdrawn, air is continuously withdrawn to the engine by its suction together with the normally waste vapors given off by the liquid fuel contained in 1.

As long as the engine operates, its suction holds 8 securely to its seat in the bottom of 11, and this seat is made substantially air tight by the addition of the cork gasket 9. It will be seen that the passage of air and vapors through 7 will be unrestricted except by orifice 10, because the lower end of 7 will be elevated above the liquid level X—X by the engine suction.

As soon as the application of suction is discontinued through 12, as when the engine is stopped, 8 and 7 fall to their seat in the lower part of 6, as shown in the drawing, by gravity.

The application of a draft of air across the surface of a body of gasoline materially increases the rate of vaporization, and I find by withdrawing the light fractions from gasoline, and mixing them again with heavy atomized fractions in an engine manifold, I am enabled to get great economy, as well as increased efficiency in the actions of an engine. Therefore pipe 16 is placed so as to be normally above the liquid level X—X.

With the intermittent type of vacuum tank as illustrated, during the greater time of engine operation, the discharging periods of 2 and 1, are much greater than the pumping period of 2, therefore, during such discharging periods, the application of engine suction through 7 to 1 is such that there is a slight degree of vacuum maintained in 1, over that maintained in 2 when 2 is open to atmosphere through 19. In this manner, after a quantity of gasoline has been drawn into 2 and when 18 is then closed and 19 opened, this slight degree of vacuum in 1 will hasten the discharge of liquid from 2 into 1 very materially and thus, in a given time, I am enabled to pass a greater quantity of liquid fuel through 2 than under normal conditions without my improvements.

At the same time, I continuously withdraw vapors from gasoline through holes 17, which are of such a size as to maintain the differential vacuum 1 and 2 already described. I find the amount of vacuum to be maintained in 1 is about one inch of gasoline vacuum.

It is obvious that fitting 6 and valve 7 may be placed in other positions in a liquid feed system, such as the float chamber of a carburetor, or in any position where the liquid to be fed to 7 is under substantially atmospheric pressure, but in the present instance 7 performs a double function of passing liquid fuel first and secondly carburetted air to the engine.

I claim:—

1. A vacuum tank having a suction chamber and a reservoir in combination with means to apply suction to the suction chamber and reservoir, means to continuously supply air to the reservoir, means to continuously withdraw air from the reservoir and means to intermittently withdraw air from the suction chamber through the reservoir.

2. A vacuum tank having a suction chamber and a reservoir in combination with means to apply suction to the suction chamber for drawing liquid fuel thereto, means to discharge liquid fuel from the suction chamber to the reservoir, means to discharge liquid fuel from the reservoir, means to supply air to the reservoir, means to apply suction to the reservoir, and means under influence of the same suction as applied to the suction chamber for withdrawing liquid fuel initially and air thereafter from said reservoir.

3. A vacuum tank having a suction chamber and a reservoir in combination with means to apply suction to the suction chamber for drawing liquid fuel thereto, means to discharge liquid fuel from the suction chamber to the reservoir, means to discharge liquid fuel from the reservoir, means to pass air close over the surface of the liquid fuel in the reservoir, means to apply suction, and means under influence of the same suction as applied to the suction chamber for withdrawing liquid fuel initially and air thereafter from said reservoir.

4. In a liquid feed system for internal combustion engines the combination with a reservoir for supplying liquid fuel to the engine of a conduit for applying the engine suction to the reservoir, an orifice for supplying air to the reservoir and a valve in the conduit actuated by the engine suction, said valve having communication with the reservoir and initially being in communication with the liquid therein, whereby a prede-

termined amount of the liquid fuel is initially fed to the engine and thereafter said air is continuously passed through said valve to the engine.

5. In a liquid feed system for internal combustion engines, the combination with a reservoir for supplying liquid fuel to the engine of a conduit for applying the engine suction to the reservoir, a passage adapted to supply air close over the surface of the liquid fuel in the reservoir and a valve in the conduit actuated by the engine suction, said valve having communication with the reservoir and initially being in communication with the liquid therein, whereby a predetermined amount of the liquid fuel is initially fed to the engine and thereafter said air is continuously passed through said valve to the engine.

6. A vacuum tank embodying a suction chamber and a reservoir, in combination with a conduit for applying suction to the suction chamber and reservoir to draw liquid fuel thereto, a valve for discharging liquid fuel from the suction chamber to the reservoir, a passage for supplying air to the reservoir and a valve in said conduit comprising a hollow stem having its lower end extending below the liquid level in the reservoir when atmospheric pressure prevails in said conduit and adapted to have its lower end raised above the liquid level when vacuum prevails in said conduit.

7. Means for priming an internal combustion engine including a liquid reservoir, an intake passage, a throttle in said passage, a suction pipe in communication with said intake passage above said throttle, a conduit leading from the reservoir to said suction pipe and means including a suction operated measuring valve in the conduit adapted to supply a predetermined quantity of liquid from the reservoir upon starting the engine.

8. Means for priming an internal combustion engine including a liquid reservoir, an intake passage, a throttle in said passage, a suction pipe in communication with said intake passage above said throttle, a conduit leading from the reservoir to said suction pipe and means including an automatically operated measuring valve in the conduit adapted to supply a predetermined quantity of liquid from the reservoir upon starting the engine.

9. Means for providing excess fuel for starting an internal combustion engine, comprising a liquid fuel reservoir, a conduit leading from the reservoir to a suction pipe of the engine, said reservoir having an air inlet, and means including an automatically operated valve in said conduit adapted to initially supply excess fuel from the reservoir upon starting the engine and thereafter to supply air to the engine from the reservoir.

10. Means for providing excess fuel for starting an internal combustion engine, comprising a liquid fuel reservoir, a suction pipe, a conduit leading from the reservoir to said suction pipe, said reservoir having an air inlet, and movable means for initially supplying an excess of liquid fuel from the reservoir to said suction pipe upon starting the engine, said means being adapted to be disconnected from the liquid fuel by said suction for thereafter supplying air to the engine.

11. Means for providing excess fuel for starting an internal combustion engine, comprising a liquid fuel reservoir, a conduit leading from the reservoir to a suction pipe of the engine, said reservoir having an air inlet, and an automatic valve having a hollow stem adapted to pass excess liquid fuel and air to the engine responsive to its suction upon starting the same.

12. Means for providing excess fuel for starting an internal combustion engine, comprising a liquid fuel reservoir, a conduit leading from the reservoir to a suction pipe of the engine, said reservoir having an air inlet and a valve having a hollow stem adapted to pass excess liquid fuel and air to the engine responsive to its suction upon starting the same and adapted to be cut off from the liquid fuel by said suction for thereafter supplying air to the engine.

13. Means for priming an internal combustion engine comprising a liquid fuel reservoir, a conduit leading from the reservoir to a suction pipe of the engine, said conduit having a valve seat, and an automatic valve having a hollow stem adapted initially to pass liquid fuel from the reservoir to the engine and operable by the suction of the engine to engage said seat after a predetermined amount of liquid fuel has been measured by said valve upon starting the engine.

14. Means for priming an internal combustion engine comprising a liquid fuel reservoir, a conduit leading from the reservoir to a suction pipe of the engine, said conduit having a valve seat, and an automatic valve having a hollow stem adapted initially to pass liquid fuel from the reservoir to the engine and operable by the suction of the engine to engage said seat after a predetermined excess of liquid fuel has been measured by said valve upon starting the engine; said valve being engaged with said seat substantially while engine suction continues and supplying air to the engine while in such position.

15. A vacuum tank for an internal combustion engine comprising a suction chamber and a reservoir, in combination with means to apply engine suction to said chamber to draw liquid fuel thereinto, means to discharge liquid fuel from said chamber to said reservoir, means to supply air to the reservoir, means to apply suction to the reservoir, and means under influence of the engine suction and ini-

tially connected with the liquid fuel in the reservoir for passing an excess of fuel temporarily to the engine and movable to cut off communication with said liquid and for passing air thereafter from the reservoir to the engine.

16. Apparatus for passing an excess of liquid fuel to an internal combustion engine, including a liquid fuel reservoir and a valve movable by the engine suction; said valve having a portion to be seated, a hollow stem and an orifice at its discharge end for controlling the rate of passage of liquid fuel therethrough.

17. In combination, an internal combustion engine having an intake passage, a liquid reservoir, a suction pipe between said reservoir and intake passage, and means for priming said engine, said means comprising a slidable tube having one end below the liquid level in said reservoir during the non-operation of the engine and having its opposite end in communication with said suction pipe, said tube being automatically movable by the engine suction to a position above said liquid level during the operation of the engine.

18. Means for introducing a priming charge to an internal combustion engine including a liquid fuel reservoir having a passage and a valve in said passage movable by engine suction for controlling the flow of priming charge to the intake manifold of the engine, and means associated with the valve for metering the quantity of fuel admitted during each priming period.

Signed at Wilmington, in the county of Los Angeles and State of California, this 20th day of February A. D., 1923.

CHARLES LAWRENCE STOKES.