J. C. COULOMBE.

SUCTION AUGMENTING DEVICE FOR VACUUM FEEDING SYSTEMS.

APPLICATION FILED DEC. 22, 1919.

1,374,491. Patented Apr. 12, 1921.

Fig. 1.

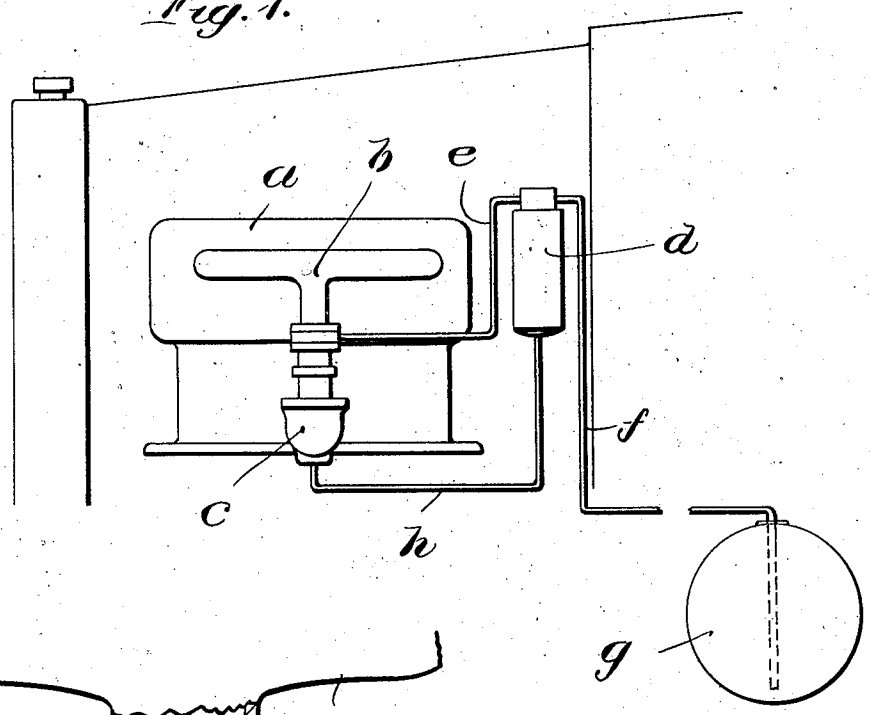
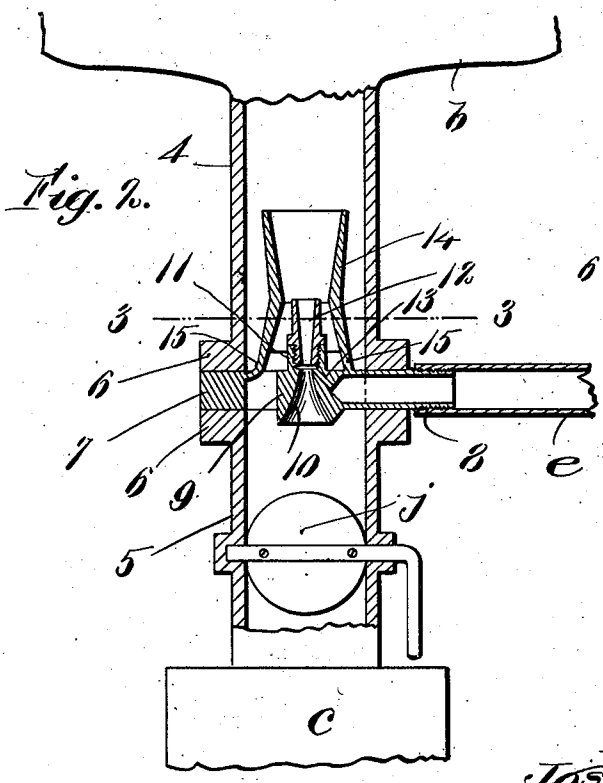


Fig. 2.



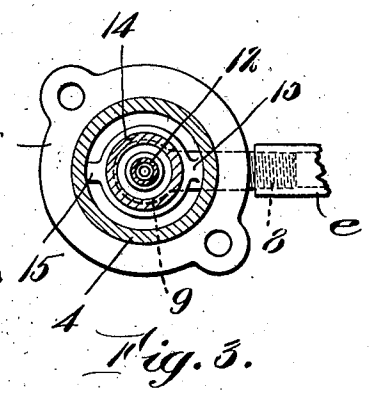


Fig. 3.

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SUCTION-AUGMENTING DEVICE FOR VACUUM FEEDING SYSTEMS.

1,374,491. Specification of Letters Patent. Patented Apr. 12, 1921.

Application filed December 22, 1919. Serial No. 346,719.

To all whom it may concern:

Be it known that I, JOSEPH C. COULOMBE, a citizen of the United States, and resident of Dracut, in the county of Middlesex and State of Massachusetts, have invented new and useful Improvements in Suction-Augmenting Devices for Vacuum Feeding Systems, of which the following is a specification.

This invention relates to liquid fuel feeding systems for internal combustion engines, and particularly to liquid fuel feeding systems of the kind having a vacuum chamber in which suction is induced by the operation of the engine to lift the liquid fuel from a storage tank or supply tank below the level of the carbureter to a point above the level of the carbureter into which it is delivered by gravity.

The principal object of the invention is to provide novel, simple and efficient means for augmenting the suction in the vacuum chamber and so insuring an adequate supply of fuel under conditions in which the normal unaided suction or vacuum created in the intake passages to the engine would be unsufficient.

In the accompanying drawings,—

Figure 1 is a diagrammatic view illustrating the application of the invention to an internal combustion engine on an automobile;

Fig. 2 is an enlarged sectional view of a preferred form of the suction augmenting device; and

Fig. 3 is a section and plan view of the same on line 3—3 of Fig. 2.

a indicates an internal combustion engine and *b* the intake manifold connected to the carbureter *c*. *d* indicates the vacuum feed device whose suction chamber is connected by a pipe *e* to the manifold *b*. Another pipe *f* connects the suction chamber of the vacuum feed device with liquid fuel supply tank *g*, which is usually carried on the rear of the car below the level of the carbureter. The distributing chamber in the bottom of the vacuum feed device *d* is connected to the carbureter by pipe *h*.

Suction induced in the manifold of the engine reduces the pressure in the suction chamber of vacuum feed device *d*, causing gasolene or other liquil fuel to be drawn from tank *g* into the suction chamber of vacuum feed device *d*. From this chamber it is periodically dumped into the distributing chamber, and from the distributing chamber it flows by gravity to the carbureter *c*.

The vacuum feed device *d* may be of any well known or preferred type, and as neither the vacuum system generally described above, nor the details of the vacuum tank *d*, of themselves constitute the present invention, no further description of the same will be necessary. Vacuum feeding systems of the type indicated are now well known in theory and practice.

Under conditions usually prevailing sufficient suction, that is a sufficient degree of sub-atmospheric pressure, will be induced in the manifold to lift the liquid fuel from supply tank *g* rapidly enough and in sufficient quantities to keep the carbureter supplied. Under certain conditions, however, the suction or sub-atmospheric pressure in the manifold is inadequate to maintain a proper fuel supply, and such conditions are usually the very ones demanding an increased fuel supply. For example, if the automobile is climbing a long hill in high speed, with the throttle wide open and the engine running comparatively slowly, the engine requires a large amount of fuel, the suction in the manifold is greatly reduced, and the distance the fuel has to be lifted from the supply tank at the rear of the car is increased, all of which factors combine against an adequate supply of fuel.

The principal object of the present invention is so to augment the suction in the vacuum feed tank as to maintain an adequate supply of fuel notwithstanding the suction in the manifold is reduced and the demand for fuel increased.

To this end I place an air line somewhere between the air intake to the carbureter and the inlet valves of the engine, and preferably in the line leading from the carbureter to the intake manifold, a constricted tube of the type of which the Venturi tube is an example, and connect to the constricted part of the tube the line leading to the suction chamber of the vacuum feed tank. As illustrated in the drawings, the line between the carbureter *c* and the manifold *b* is formed in two sections 4 and 5 each terminating in a flange 6. Between the flanges 6 is secured a fitting which carries the constricted tube or tubes. This fitting consists of a supporting annulus 7, clamped between the flanges 6, and made with a

tubular inlet pipe or nozzle 8, the end of which is screw threaded for connection to the suction pipe *e*. The inlet nozzle carries a hub member 9 concentric with the annulus, provided with a funnel-like passage 10 and a socket 11, into which is screwed another funnel-like member 12, the parts 10 and 12 together constituting a constricted tube. The suction passage through pipes *e* and 8 is connected to the constricted part of said Venturi-like tube by a small port 13 drilled through the body of hub 9 at an incline in the direction of the flow of gases through pipes 4 and 5. *j* is the usual butterfly valve in the line leading from the carbureter to the manifold.

The partial vacuum in manifold *b* induces the upward flow of the gases through pipes 4, 5, and also through the constricted tube 10, 12; part of the gases passing through the clear space around hub 9 and part passing through the tube. The part passing through the tube greatly augments the suction induced in pipe *e*, which communicates with the constricted part of the tube through passage 13, and consequently augments the suction induced in the vacuum tank *d*. Thus notwithstanding the sub-atmospheric pressure in the manifold *b* might be insufficient by reason of the conditions of operation, if connected directly to the vacuum device *d*, to maintain a fuel supply, the suction induced in *d* through the constricted tube will be materially increased.

In order still further to augment the suction in *d*, another constricted tube 14, mounted on the annulus 7 by spaced legs 15, is arranged with its constricted part acting on the delivery end of the first tube 10, 12. In many cases a single tube will be found sufficient, but if not, the action of the single tube may be supplemented and increased by the second tube acting on the first tube and forming in effect a double or compound Venturi tube.

The tube or tubes and the spaces around them are so proportioned as not to reduce the cross sectional area of the passage through pipes 4, 5 below the smallest area of the other parts of apparatus through which the gases flow; thus no obstruction is placed in the effective passage, only part of the air passes through the tube or tubes while the rest passes outside of the tubes, and the volumetric efficiency of the intake line is not reduced.

I claim:

1. The combination with an internal combustion engine, its gas intake line and carbureter, and a liquid fuel feeding system of the kind having a vacuum chamber in which suction is induced by the operation of the engine, of means for augmenting the suction in said vacuum chamber comprising a constricted tube in the intake line to the engine, filling only part of the transverse space in the intake line to permit the passage of gas outside of the tube, and a duct connecting the vacuum chamber to the tube in the region of its constricted part.

2. The combination with an internal combustion engine, its gas intake line and carbureter, and a liquid fuel feeding system of the kind having a vacuum chamber in which suction is induced by the operation of the engine, of means for augmenting the suction in said vacuum chamber comprising a plurality of constricted tubes in the intake line to the engine, one tube acting upon another, and a duct connecting the vacuum chamber to the inner tube in the region of its constricted part.

3. The combination with an internal combustion engine, its gas intake line and carbureter, and a liquid fuel feeding system of the kind having a vacuum chamber in which suction is induced by the operation of the engine, of means for augmenting the suction in said vacuum chamber comprising a pair of constricted tubes in the intake line to the engine, the delivery end of one tube terminating within and in the region of the constricted part of the other tube, and a duct connecting the vacuum chamber to the former tube in the region of its constricted part.

4. A suction augmenting device for vacuum feeding systems comprising a support adapted to be secured in the intake line of an internal combustion engine, a constricted tube within said support, and an inlet port extending from the exterior of said support to the interior of said tube in the region of its constricted part.

5. A suction augmenting device for vacuum feeding systems comprising a support adapted to be secured in the intake line of an internal combustion engine, a constricted tube within said support, and an inlet port extending from the exterior of said support to the interior of said tube in the region of its constricted part, and a second constricted tube surrounding the first tube and arranged with its constricted part in the region of the delivery end of the first tube.

Signed by me at Boston, Massachusetts, this seventeenth day of December 1919.

JOSEPH C. COULOMBE.