Oct. 9, 1923. 1,470,484

E. A. ROCKWELL

PRESSURE FEED SYSTEM FOR INTERNAL COMBUSTION ENGINES

Original Filed Jan. 11, 1923 3 Sheets-Sheet 1

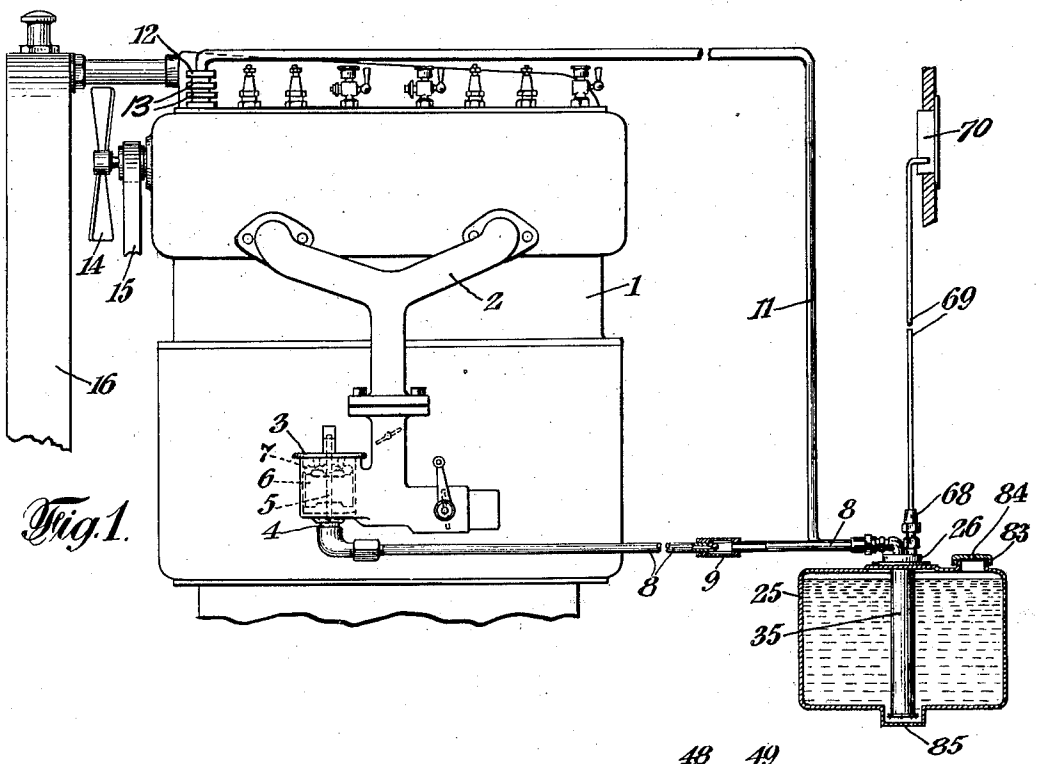

Fig. 1.

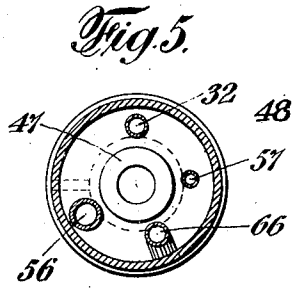

Fig. 5.

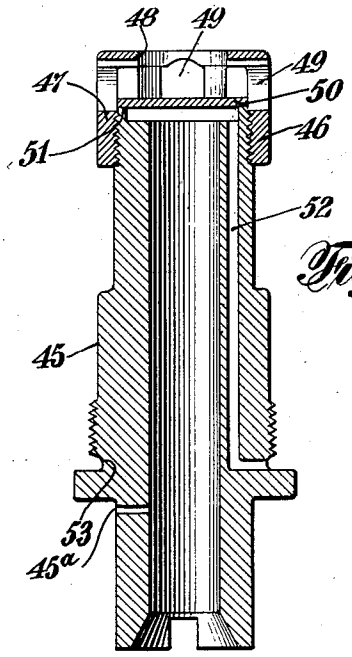

Fig. 6.

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Fig. 2.

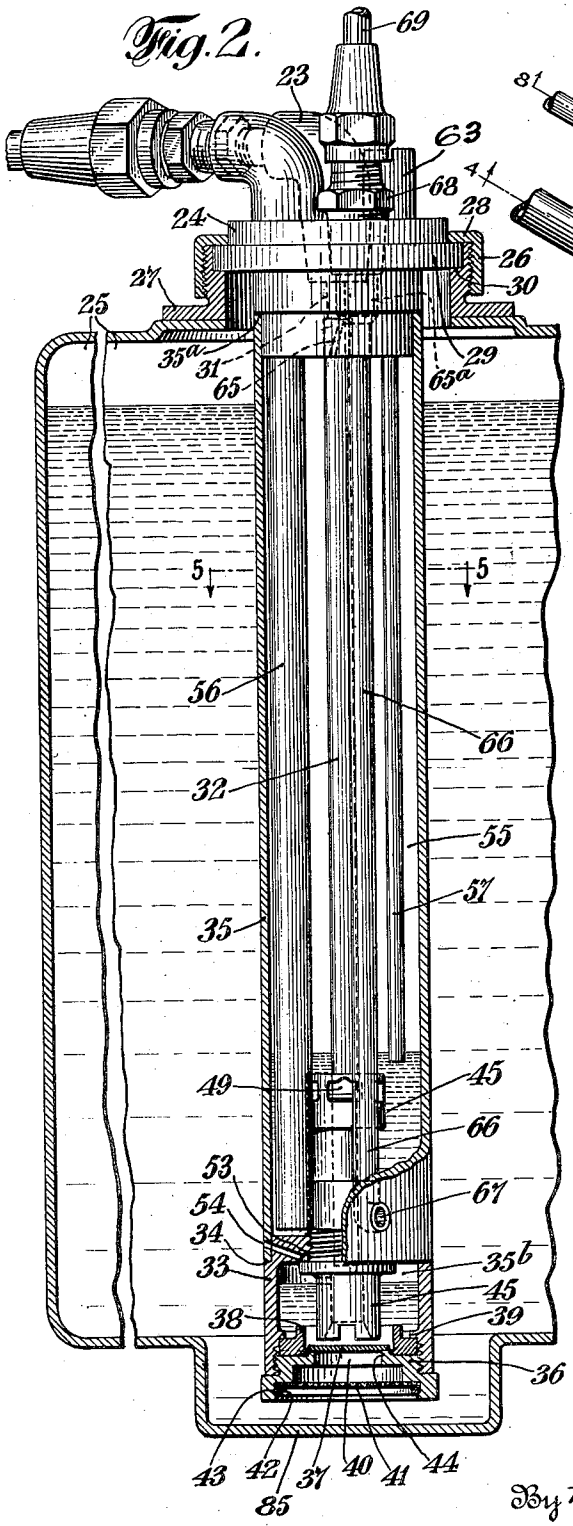


Fig. 3.

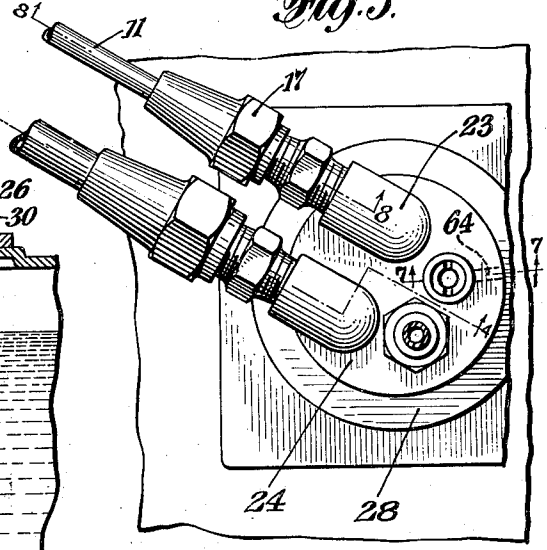
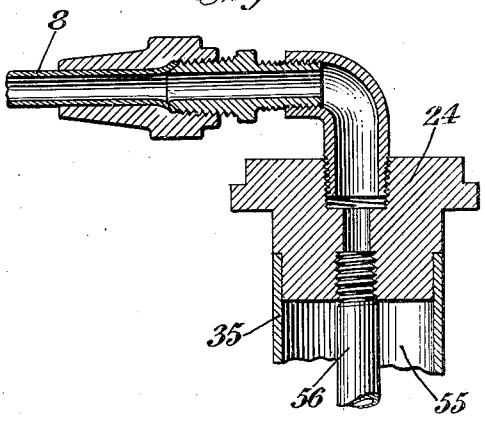


Fig. 4.



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PRESSURE FEED SYSTEM FOR INTERNAL COMBUSTION ENGINES

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Fig. 7.

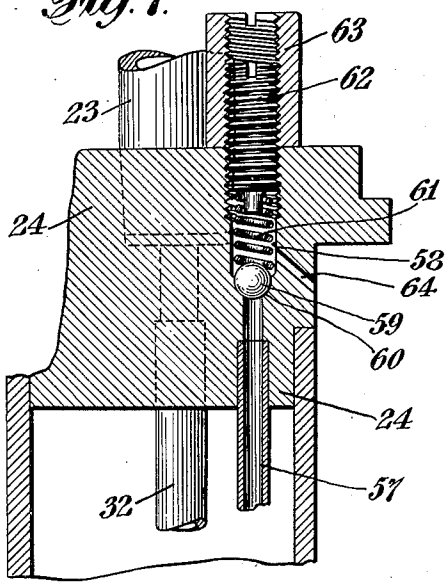


Fig. 8.

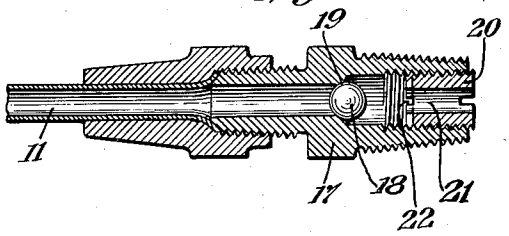
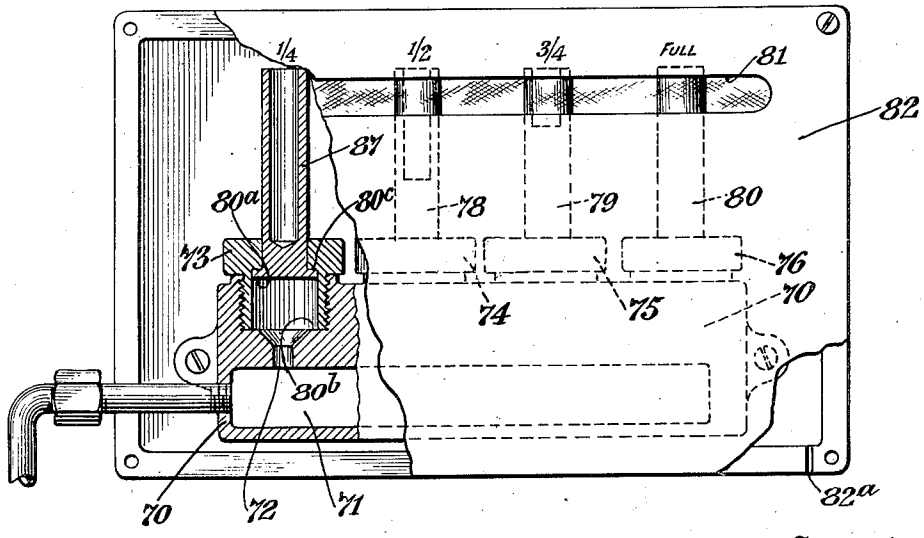


Fig. 9

Fig. 10.



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Patented Oct. 9, 1923. 1,470,484

UNITED STATES PATENT OFFICE.

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PRESSURE-FEED SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

Application filed January 11, 1923, Serial No. 611,948. Renewed September 11, 1923.

To all whom it may concern:

Be it known that I, EDWARD A. ROCKWELL, a citizen of the United States, a resident of Kew Gardens, L. I., in the county of Queens and State of New York, have invented a certain new and useful Pressure-Feed System for Internal-Combustion Engines, of which the following is a specification.

My invention relates particularly to an apparatus by means of which internal combustion engines may be supplied with gasolene in an effective manner and with the aid of a simple apparatus, but it is applicable, also, to the pumping of any desired kind of liquid. It involves also elements for indicating the height of the gasolene level in the fuel supply reservoir.

The object of my invention is to provide an apparatus of this kind which will at all times supply an internal combustion engine with the needed amount of fuel, irrespective of the type of engine. Hitherto, difficulty has been experienced in operating engines with vacuum feed systems for the reason that some engines operate with a very low degree of vacuum, also, because of the fact that nearly all internal combustion engines afford such a low degree of vacuum when ascending hills of unusual length as to cause the operation of the vacuum feed to stop temporarily. Furthermore, previously it was found difficult, and ofttimes impossible, to supply the necessary amount of gasolene to some types of engines when operating at a high speed due to the insufficient quantity of gasolene fed to the engine by the vacuum feeding system. Again, another object of my invention is to provide a feeding system in which floats and valved mechanisms operated thereby are eliminated, thus avoiding a large percentage of the cost of manufacture and eliminating complication in the construction, operation and maintenance of the apparatus. The object of my invention is therefore to provide a system which will obviate all of these difficulties. A further object is to provide a feeding system which can be manufactured at an extremely low cost and which occupies a comparatively small amount of space on the automobile. A further object is to provide elements in the feeding apparatus with the aid of which the height of the gasolene in the gasolene supply reservoir may be indicated to the driver of the car in a simple and effective manner.

Further objects of my invention will appear from the detailed description thereof hereinafter.

While my invention is capable of being carried out in many different ways for the purpose of illustration I have shown only certain ways of carrying out the same in the accompanying drawings, in which—

Figure 1 is a diagrammatic side elevation of a pressure feed system made in accordance with my invention,

Figure 2 is a vertical section, enlarged, of a portion of the apparatus which is associated with the main supply tank.

Figure 3 is a top view of the apparatus.

Figure 4 is a section thereof taken on line 4—4.

Figure 5 is a horizontal section of the apparatus taken on line 5—5 of Figure 2.

Figure 6 is a vertical section of a portion of the same showing one of the valves.

Figure 7 is a large vertical section of the upper portion of the apparatus taken on line 7—7 of Figure 3 and showing the pressure regulating means,

Figure 8 is a longitudinal section of a check valve,

Figure 9 is an elevation of a screw plug therein for limiting the amount of pressure delivered to the apparatus, and

Figure 10 is a front elevation partly in section of the indicator.

In the drawings, I have shown an internal combustion engine 1 which may, for example, be an engine such as is used on automobiles having a manifold 2 supplied with fuel from a carburetor 3. The carburetor 3 may be of any desired type but may, for example, comprise a carburetor having a fuel feed opening 4 the flow of fuel to which is regulated or controlled by a pin-valve 5 operated by means of a float 6 connected to the valve 5 by means of a lever 7. The supply of fuel to the carburetor through the feed opening 4 is obtained from a conduit 8 having a check valve 9 leading to the rear of an automobile. A second conduit 11 is connected to the interior of one of the cylinders of the engine, as, for example by introducing the same into a petcock opening at the upper portion thereof. Preferably the conduit 11 is connected to the

cylinder of the engine which is nearest to the front of the same by means of a cooling device 12 having cooling flanges 13 located in the rear of a fan 14 driven by a belt 15 in any suitable manner from the engine, the fan 14 being the usual fan carried by an automobile engine in the rear of the radiator 16 to assist in the cooling of the water passing through the radiator. In the conduit 11 there is a check valve 17 comprising a ball 18 adapted to seat against a valve seat 19 in the direction towards the engine and to contact with a screw plug 20 in the other direction which is provided with a central passageway 21 and small lateral notches or slits 22 so as to permit only a limited amount of gas under pressure to pass through the same to the feeding apparatus. The check valve 17 is screw-threaded into an elbow fitting 23 which in turn is screw-threaded into a die-casting 24. The die-casting 24 is fastened in the top of a supply reservoir 25 for gasolene by means of an annular cover 26 screw-threaded to an annular fitting 27 brazed or soldered to the top of the tank 25. For this purpose the annular cover 26 is provided with an inwardly directing flange 28 which fits over an annular projection 29 on the die-casting 24 and which is seated against a shoulder 30 on the annular fitting 27. The interior of the fitting 23 communicates with a passageway 31 in the die-casting 24 and through the passageway 31 with a tube 32, the lower end of which passes through and is fastened into a housing 33 provided with a shoulder 34 for receiving the lower end of a main housing 35 fastened at its upper end to the die-casting 24 where it is seated against a shoulder thereon 35^a. The housing 33 forms a primary chamber 35^b, the lower end of which is provided with a screw-threaded retainer 36 to hold in place a circular flat valve 37 located in said chamber 35^b carried within a retaining member 38 which is seated against a shoulder 39 in the housing 33. The retainer 36 has a vent opening 40 to permit the access of the liquid to the valve 37 and said opening 40 is closed with a screen 41 held in place by a slit ring 42 located in a groove 43 located on the inside of the passageway 40. The movement of the valve 37 in a lower direction is limited by an annular extension 44 on the retainer 36 and in an upward direction by contacting with the lower end of a tube 45 which is screw threaded into the upper end of the housing 33. The tube 45 has a venting port 45^a in its lower portion and for the chamber 35^b at its upper end is provided with an upper valve retaining member 47 having a central opening 48 and a plurality of laterally directed openings 49 to permit the passage of the liquid when a disk-shaped valve 50 is not seated against its valve seat 51 located at the upper end of the tube 45. In order to relieve any excess pressure conveyed to the apparatus from the engine cylinder to the chamber 35^b and to permit the entry of the fuel into said chamber 35^b a passageway 52 extends downwardly within the wall of the tube 45 and thence outwardly to connect with an annular passageway 52 located on the housing which in turn leads to the outside of the feeding apparatus and into the interior of the reservoir 25 through an opening 54. Also the rearward movement of the valve 18 to its seat 19 permits a slight reaction of the pressure from the chamber 35^b. The fuel which enters the chamber 35^b past the valve 37 is forced through the tube 45 past the valve 50 into a secondary chamber 55 in which the valve 50 is located formed by the main housing 35. The liquid accumulates there at the bottom of the chamber and the gas which has entered the chamber with the liquid accumulates above the level thereof in such a manner as to continually force the liquid out of the chamber 55 through a pipe 56 to the pipe 8 and thence to the carburetor connected to the engine. In order to regulate or control the feed of fuel also to prevent the accumulation of excess pressure in the secondary chamber 55 and to control the level of the liquid therein although if desired this feature may be omitted I have provided a pipe 57 which extends upwardly in the chamber 55 from the level of the liquid therein and is secured in the die casting 24 where it communicates with a valved chamber 58 having a ball valve 59 which is pressed against its seat 60 by means of a spring 61, the pressure of which may be regulated by a screw plug 62 screw-threaded in the die casting 24 and having a lock nut 63 screw-threaded to the upper end of the plug 62. Communicating with the valve chamber 58 there is a laterally directed passageway 64 which passes out of the die casting and communicates with the interior of the reservoir 25. Leading from the interior of the chamber 55 there is a vertical passageway 65 located in the die casting communicating with a chamber 65^a therein connecting with a tube 66 which passes downwardly from the passageway 65 to a port 67 located in the side of the housing 35 near the lower end of the same. In the upper end of the chamber 65^a there is screw-threaded a fitting 68 which is connected by a tube 69 to a gasolene level indicator 70 located at any suitable point but preferably on the dash of the automobile. The indicator 70 comprises a casting 70^a having a horizontal passageway 71 which communicates with four or more upwardly directed passageways 72 leading to four cylinders 73, 74, 75 and 76 carrying plungers 77, 78, 79 and 80 which are of the same size but have progressive differences

in weights due to the coring out of the same as shown in dotted lines, indicating respectively the one-fourth, one-half, three-quarters and full positions of the gasolene level in the fuel supply reservoir 25. Each of the plungers has a piston 80^a located thereon the movement of which is limited in a downward direction by a shoulder 80^b in the casting 70^a and the upper movement of which is controlled by an annular projection 80^c at the upper end of the cylinder. The shoulder 80^b and annular projection 80^c operate as valve seats also to prevent the escape of the gas under pressure in the indicator. The upper ends of the plungers 77, 78, 79 and 80 preferably project above a gas covered slot 81 in dust proof housing 82 having a small vent 82^a mounted on the dash so that by observing the positions of the respective plungers the level of the gasolene in the main supply tank will always be known to the driver of the car. The gasolene reservoir 25 is provided with the usual cap 83 having a vent opening 84 and preferably at the bottom of the tank there is a depression 85 for receiving the lower end of the feeding apparatus.

In the operation of my invention immediately that the engine 1 is turned over for the purpose of starting the same the compression produced in the cylinder to which the conduit 11 is connected will be conveyed to the conduit 11 and when the engine cylinder is firing the explosion gases will be conveyed in this way to the conduit 11 after having been cooled by the cooling device 12. The gases in the conduit 11 will continue past the ball valve 18 and through the notches 22 on the plug 20 to the pipe 32 and thence into the primary chamber 35^b which has been previously supplied by gravity with gasolene from the reservoir 25 through the opening 42 owing to the venting of said chamber through the passageways 51, 53 and 54 leading to the interior of the reservoir 25. The gases under pressure in the chamber 25 will force the gasolene therefrom through the tube 45 and past the valve 50 into the chamber 55, a small portion of the gases and liquid which pass through the tube 45 being forced outwardly through the passageways 51, 53 and 54 to the gasoline reservoir, thus serving as a cushion against any excessive pressure conveyed to the chamber 35^b from the engine. The gases and liquid in the chamber 55 separate to form a body of liquid at the bottom of said chamber and a body of gas at the upper portion thereof and the level of the liquid in the chamber and the pressure of the gas therein are both regulated by the presence of the tube 57 leading from the point in the chamber 55 at which the liquid level is to be maintained upwardly to the pressure regulating valve 59, the pressure on which may be adjusted by adjusting the position of the screw plug 62. It will thus be understood that by means of the tube 57 which is connected in this way to the interior of the reservoir through the tube 64, any excessive pressure of gas in the chamber 55 is conveyed away from the same as well as any quantity of the gasolene which may accumulate therein above the level of the lower end of the tube 57. In this way uniform conditions of pressure and quantity of liquid in the chamber 55 are maintained so as to provide a gasolene feed through the tube 56 to the carburetor of the engine which will be maintained uniform at all times. It will be understood that when the valve 5 is seated by the float 6 owing to the float chamber containing an adequate supply of gasolene, the gasolene will cease feeding through the tube 56 and the resulting excess of gas and liquid which may reach the chamber 55 will pass outwardly therefrom into the interior of the reservoir 25. Otherwise it would be conveyed past the valve 5.

Consequently there will be within the tube 66 a pressure of gas which will be determined by the height of the gasolene level above the gas pressure outlet 67 and this pressure within the tube 66 acts upon the plungers 73, 74, 75 and 76 so as to indicate the corresponding level of the gasolene in the reservoir 25. In this way the disappearance of the plunger 76 from view will indicate that the reservoir is only three-quarters full. When the plunger 75 can no longer be seen this will indicate a reservoir that is one-half full. The lowering of the plunger 74 will show that the tank is only one-quarter full and the disappearance of the plunger 73 will indicate that the reservoir is less than one-quarter full and should therefore be filled immediately.

It is to be understood that many changes may be made in the apparatus as above described. For example, pressure for the pipe 11 need not necessarily be obtained from the interior of the engine cylinder but may be secured by the operation of an engine in any other suitable manner.

Also, it will be understood that various different parts of the apparatus may be omitted, if desired, while still securing a feed of the desired character to the engine.

Also, it is understood that any other type of gauge may be used for operation by the pressure variations above referred to.

While I have described my invention above in detail I wish it to be understood that many changes may be made therein without departing from the spirit of the same.

I claim:

1. A fuel feeding apparatus for an internal combustion engine having a chamber provided with an inlet valve adapted to re-

ceive fuel from a reservoir, means comprising connecting and controlling devices for applying from a combustion cylinder of the engine during the operation of the same intermittent pressure impulses by means of a gaseous medium which acts directly on the fuel in said chamber, so as to determine by said combustion cylinder impulses periods of filling for said chamber while said impulses are not being applied thereto and means for maintaining a separate body of said fuel with the aid of the pressure from said gaseous medium, adapted for the effective operation of the engine carburetor.

2. A fuel feeding apparatus for an internal combustion engine having a chamber provided with an inlet valve adapted to receive fuel from a reservoir, means comprising connecting and controlling devices for applying from a combustion cylinder of the engine during the operation of the same intermittent pressure impulses by means of a gaseous medium which acts directly on the fuel in said chamber so as to determine by said combustion cylinder impulses periods of filling for said chamber while said impulses are not being applied thereto, and means for maintaining a separate body of said fuel with the aid of the pressure from said gaseous medium, adapted for the effective operation of the engine carburetor, said chamber having a vent leading to the interior of the fuel reservoir.

3. A fuel feeding apparatus for an internal combustion engine having a chamber provided with an inlet valve adapted to receive fuel from a reservoir, means comprising connecting and controlling devices for applying from a combustion cylinder of the engine during the operation of the same intermittent pressure impulses by means of a gaseous medium which acts directly on the fuel in said chamber so as to determine by said combustion cylinder impulses periods of filling for said chamber while said impulses are not being applied thereto and means for maintaining a separate body of said fuel with the aid of the pressure from said gaseous medium, adapted for the effective operation of the engine carburetor, said pressure conveying means having a valve to prevent the flow of fuel rearwardly therethrough.

4. A fuel feeding apparatus for an internal combustion engine having a chamber provided with a normally open vent, a conduit leading from a reservoir to fill the chamber by gravity and a connection from a cylinder of said engine to said chamber adapted automatically to apply intermittent pressure thereto to feed the fuel out of the chamber in the intervals between the filling thereof by gravity.

5. A fuel feeding apparatus for an internal combustion engine having a primary chamber adapted to be supplied with fuel from a reservoir and a secondary container connected therewith and maintained under greater than atmospheric pressure, said primary chamber having a vent leading to the interior of the fuel reservoir.

6. A fuel feeding apparatus for an internal combustion engine having a primary chamber adapted to be supplied with fuel from a reservoir and a secondary container connected therewith, said primary chamber having a vent leading to the interior of the fuel reservoir below the level of the liquid therein.

7. A fuel feeding apparatus for an internal combustion engine having a primary chamber adapted to be supplied with fuel from a reservoir, means for applying intermittent gas pressure directly to the liquid therein independent of the liquid level therein and a secondary container connected therewith and maintained under greater than atmospheric pressure, said primary chamber having a vent to vent the chamber in the intervals between the application of pressure.

8. A fuel feeding apparatus for an internal combustion engine having a reservoir, a chamber adapted to be charged automatically with fuel intermittently therefrom, a connecting means from the engine cylinder to said chamber having a relatively small passageway to feed the fuel out of the same by gas pressure acting directly thereon and adapted to conduct only a relatively small amount of the gas from the engine cylinder.

9. A fuel feeding apparatus for an internal combustion engine having a primary chamber adapted to be supplied with fuel from a reservoir, means for applying gas pressure thereto directly to the liquid therein and a secondary container connected therewith to receive gas and liquid therefrom and maintained under greater than atmospheric pressure, the primary chamber being connected to a source of gas under pressure, the gas pressure connections therefor having a valve restricting the opening when seated in one direction.

10. A fuel feeding apparatus for an internal combustion engine having a primary chamber adapted to be supplied with fuel from a reservoir, means for applying gas pressure thereto directly to the liquid therein and a secondary container connected therewith to receive gas and liquid therefrom and maintained under greater than atmospheric pressure, the primary chamber being connected to a source of gas under pressure, the gas pressure connections therefor having a valve restricting the opening when seated in one direction that will act as a check valve in the other direction.

11. A fuel feeding apparatus for an in-

ternal combustion engine having a primary chamber adapted to be supplied with fuel from a reservoir and a secondary container connected therewith and maintained under greater than atmospheric pressure both said chamber and container being located in the fuel reservoir.

12. A fuel feeding apparatus for an internal combustion engine having in combination with an engine carburetor having a shut-off valve, a primary chamber adapted to be supplied with fuel from a reservoir, means for applying gas pressure directly to the liquid therein independent of the liquid level therein and a secondary container connected therewith and maintained under greater than atmospheric pressure and said secondary container being connected directly to the engine carburetor.

13. A fuel feeding apparatus for an internal combustion engine having a primary chamber adapted to be supplied with fuel from a reservoir, means for applying gas pressure intermittently thereto directly to the liquid therein independent of the liquid level therein, a secondary container connected therewith maintained under greater than atmospheric pressure, and means to regulate the flow of fuel supplied from a secondary container varying with the consumption thereof.

14. A fuel feeding apparatus for an internal combustion engine having a primary chamber adapted to be supplied with fuel from a reservoir, means for applying gas pressure intermittently thereto independent of the liquid level therein and directly to the liquid therein in the intervals between the charging thereof and a secondary container connected therewith and maintained under greater than atmospheric pressure, the primary chamber being connected to an engine cylinder as a source of gas under pressure.

15. A fuel feeding apparatus for an internal combustion engine having a primary chamber adapted to be supplied with fuel from a reservoir, a secondary container, means for supplying a gas directly to the liquid in the primary chamber for feeding the fuel therefrom to the secondary container and a discharge port for gas from said secondary container into the fuel reservoir.

16. A fuel feeding apparatus for an internal combustion engine having a primary chamber adapted to be supplied with fuel from a reservoir and a secondary container connected therewith and means for maintaining the liquid therein at substantially constant level under greater than atmospheric pressure, said means comprising a single conduit for conducting away any excess liquid and relieving excess pressure.

17. A fuel feeding apparatus for an internal combustion engine having a primary chamber adapted to be supplied with fuel from a reservoir and a secondary container connected therewith, means for maintaining the liquid therein at substantially constant level under greater than atmospheric pressure, said means comprising a conduit for conducting away any excess liquid and relieving excess pressure, said conduit being provided with a valve and means for adjusting the action of the valve to regulate the presure at which said relief occurs.

18. A fuel feeding apparatus for an internal combustion engine having a source of fuel supply vented to the air, a chamber adapted to be supplied with fuel therefrom and means for applying gaseous pressure to act directly on the fuel in said chamber for conveying the same therefrom to a carburetor and for applying pressure to any excess of fuel so conveyed from said chamber so as to circulate the said excess of fuel again through the feeding system.

19. A fuel feeding apparatus for an internal combustion engine having a feeding device having a connection supplying gas thereto from an engine cylinder and an air cooling device for cooling located in said connection adjacent to the engine fan.

20. A fuel feeding apparatus for an internal combustion engine having a fuel reservoir, a primary chamber located therein, a valve located between the fuel reservoir and the primary chamber, a secondary container, a valve located between the primary and secondary container, a valved outlet for excess gas and liquid from the secondary container to the reservoir, and a connecting means for supplying intermittent gas pressure from an engine cylinder directly to the liquid in the primary chamber and coordinated with the filling intervals of the same.

In testimony that I claim the foregoing, I have hereunto set my hand this 10 day of January, 1923.

EDWARD A. ROCKWELL.