Jan. 3, 1928. 1,654,622

L. H. WHEELER

FUEL MIXTURE FORMING AND FEEDING SYSTEM

Filed April 24, 1925 2 Sheets-Sheet 1

Fig 1

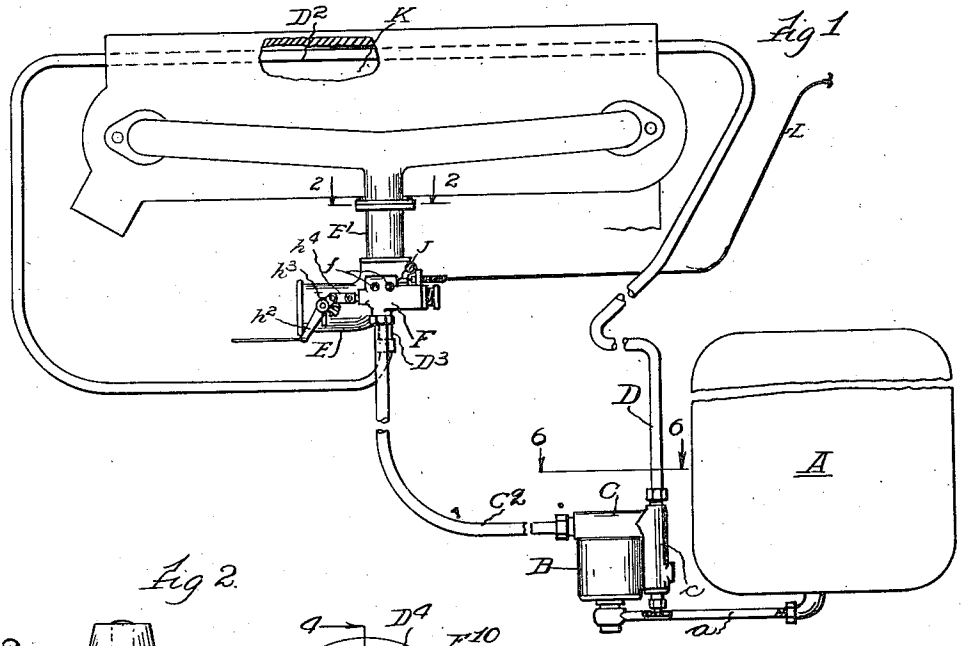


Fig 2.

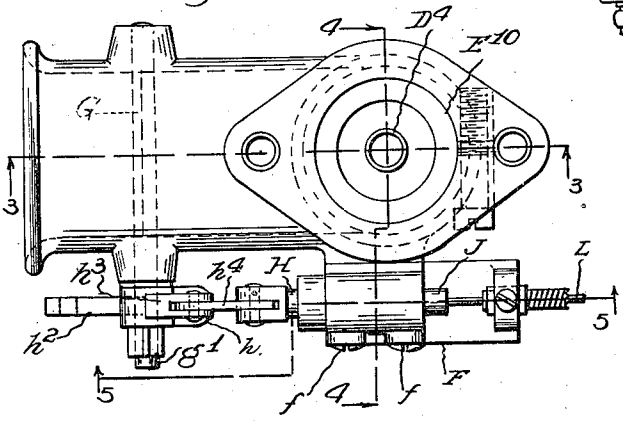


Fig 3.

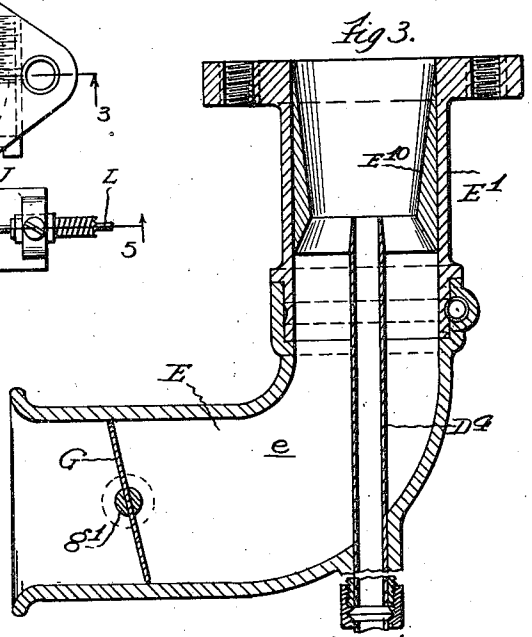
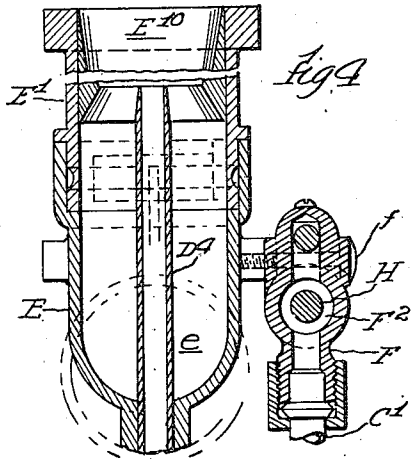


Fig 4



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FUEL MIXTURE FORMING AND FEEDING SYSTEM

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Fig 6

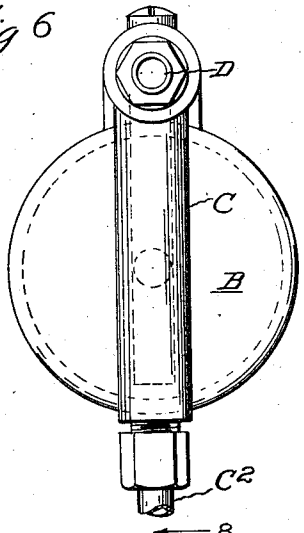


Fig 5

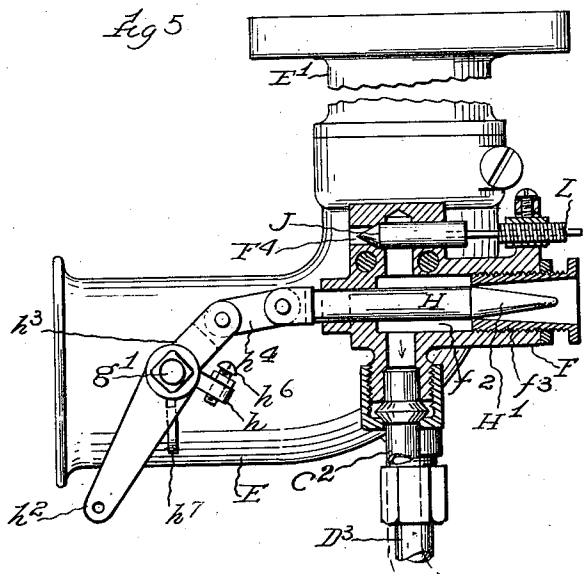


Fig 7

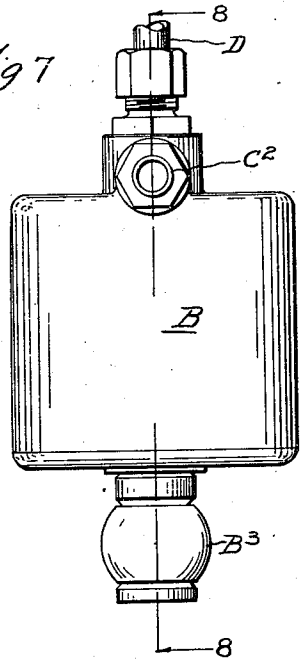
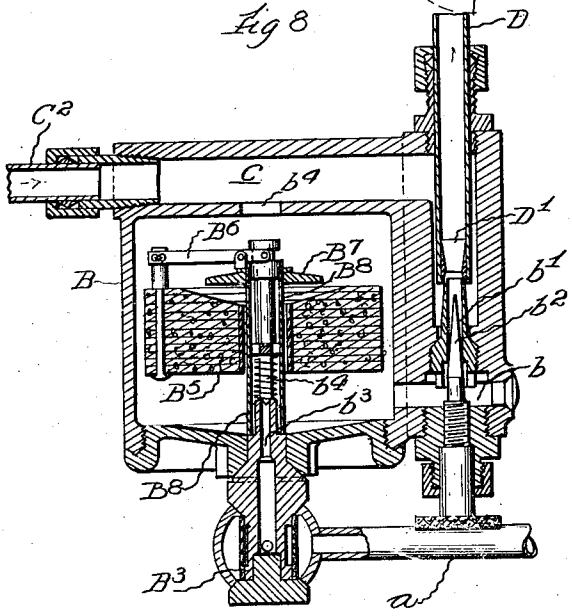


Fig 8



Witness
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Patented Jan. 3, 1928. 1,654,622

UNITED STATES PATENT OFFICE.

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FUEL-MIXTURE FORMING AND FEEDING SYSTEM.

Application filed April 24, 1925. Serial No. 25,556.

The purpose of this invention is to provide an improved system and apparatus for forming and feeding the fuel mixture supply to an internal combustion engine. It consists in the elements and features of construction shown and described as indicated in the claims.

In the drawings:

Figure 1 is a diagrammatic view showing the several parts of the system embodying this invention in relation to the intake and exhaust manifolds of the engine served thereby.

Figure 2 is a section at the line 2—2 on Figure 1 showing in the plan view the element of the fuel mixture forming and feeding system which is directly attached to the engine intake.

Figure 3 is a section at the line 3—3 on Figure 2.

Figure 4 is a section at the line 4—4 on Figure 2.

Figure 5 is a section at the line 5—5 on Figure 2.

Figure 6 is a top plan view of the level governing chamber which constitutes the immediate source of fuel for supplying the engine.

Figure 7 is a forward side elevation of the same.

Figure 8 is a section at the line 8—8 on Figure 7.

In the construction shown in the drawings the main fuel supply tank is seen at A. B is the level governing chamber or float bowl which constitutes the immediate source of fuel for the engine, being itself supplied by gravity flow from the main tank, A, as hereinafter more particularly described. C is a portion of the primary air supply conduit which is formed in an integral boss on the float bowl, B. D is a primary fuel mixture pipe which at one end is intruded into the final vertical portion, c, of the primary air supply duct as seen in Figure 8, and at the other end has its terminal, D^4, intruded into the main air supply pipe, E, at the elbow, e, thereof to which the terminal fitting, E^1, of said main air supply pipe is secured, having the Venturi sleeve, E^{10}, at the constriction of which the said fuel mixture pipe terminal, D^4, terminates for discharge of the primary fuel mixture into the main air stream for producing the final fuel mixture for delivery to the engine. The liquid fuel supply for the fuel mixture is discharged from the float bowl, B, by way of the passage, b, and nozzle, b^1, controlled by the needle valve, b^2, into the receiving end of the primary fuel mixture pipe, D, at which said fuel mixture pipe is provided with a venturi, D^1, proximate to whose constriction the nozzle, b^1, discharges. The float bowl is supplied with fuel from the main tank, A, through the pipe, a, connected to the central fitting, B^3, of the float bowl and mounted in the bottom thereof for delivery of the fuel up through the axial aperture, b^3, of said fitting whose discharge is controlled by a valve, b^4, seating downwardly to check the inflow of the liquid upon the float bowl being filled to a predetermined level correspondingly lifting the float, B^5, causing it to operate the valve as stated through the medium of the lever, B^6, which is fulcrumed upon the spreader disk, B^7, mounted upon the upper end of a sleeve, B^8, extended up rigidly from the fitting, B^3, all in a manner which is familiar with respect to float-control of fuel supply to carburetor float bowls.

The primary air supply duct, whose terminal portion, C, is formed as stated in the integral boss on the float bowl, comprises as its precedent portion a pipe, C^2, which extends from the float bowl, where it is connected to said duct, C, to an intake fitting, F, which is mounted laterally directly upon the intake fitting of the main air supply pipe being the elbow heretofore mentioned into which the fuel mixture pipe terminal, D^4, protrudes. The primary air supply intake fitting, F, is secured rigidly to said elbow main supply intake fitting by bolts, f, f, as may be understood from Figures 2, 4 and 5, so that the air intake passage, F^2, of the fitting, F, extends substantially parallel to the axis of the entrance limb of the elbow fitting, E. Into the entrance end of the air intake passage, F^2, there is screwed a sleeve, F^3, adapted at its inner end to constitute a seat for a needle valve, H, for whose guidance the fitting is bored through axially with respect to said sleeve valve seat, the valve member, H, being inserted through the opposite end, from which it protrudes for operating connections as will be explained. In the horizontal entrance limb of the elbow constituting the main air supply intake E there is

mounted a throttle valve, G, of the butterfly type having its stem, g^1, protruding transversely of the elbow limb for operating connection in any customary manner not shown except that said valve stem is shown provided with a downwardly projecting lever arm, h^2, to which any desired operating connection may be made. Upon the protruding end of the stem there is mounted a lever arm, h^3, rigid therewith, and a link, h^4, is provided connecting this lever arm with the protruding end of the valve, H, the lever arm and link connection being proportioned and related as to their directions so that the movements of the two valves for opening and closing may be simultaneous and suitably correlated with each other, their relation as to the degree of opening and closing of the valve, H, with respect to the main throttle valve, G, being variable by the adjustment of the sleeve, f^3, by screwing it more or less into the fitting, F. The purpose of this sleeve, f^3, being adjustable as described, is to enable the operator to make perfect adjustment for idling. To make such adjustment the valve, G, is first set to leave a very small opening, and the sleeve, f^3, is then screwed in or out to regulate the amount of primary air according to the requirements for satisfactory idling or low speed work. The relation between the primary air and the air admitted past the throttle valve, G, or more particularly the variation in the relation of the two air quantities effected by the adjustment of the valve member, H, is obviously determined by the taper of the tapered terminal or valve proper, H^1, and a specific merit of the construction shown is that this relation can be rendered suitable to the particular engine and the character of the work demanded of it by the simple expedient of varying the taper of the valve, H^1, without disturbance or reconstruction of any other part; and such modification of the taper can be effected by a simple hand tool upon the removal of the part, H, which removal is facilitated by the construction or by the substitution of a selected substitute part; and this part may be made in various forms, i. e., with the terminal of various tapers, so that the most effective taper for the purpose can be determined by successive substitutions and operations of the engine under desired conditions in each instance until proper efficiency is obtained; and in case of subsequent change of working conditions requiring a different relation to be established between the primary and secondary air supply, a different form of the part, H, having a different taper for the terminal, H^1, can be substituted.

A short lever arm, h, on the throttle valve has set through it an adjusting screw, h^6, for stopping against the stop lug, h^7, which projects from the outside of the intake limb of the elbow, E, the adjustment of the screw, h^6, determining the limit to which the throttle valve can be closed.

The primary fuel mixture pipe, D, in its course from the fuel receiving end adjacent the float bowl, to the fuel-mixture-discharging end in the venturi at the discharge end of the main fuel supply pipe, is extended through the exhaust gas region of the engine; and, most conveniently, directly through the exhaust manifold itself, as intended to be indicated in Figure 1 wherein the exhaust manifold is indicated at K.

The operation of the structure thus described may be understood from the description of the same to be substantially as follows:

The suction of the engine operating through the intake manifold and tending to produce air inflow through the main air supply pipe, E, causing thereby a condition of sub-atmospheric pressure at the discharge end of the terminal, D^4, of the fuel mixture pipe at the constriction of the venturi, E^1, causes a still further reduction of pressure at the intake end of the fuel mixture pipe at the constriction of the venturi, D^1, therein, causing the fuel to be drawn from the nozzle, b^1, and intermixed with a limited quantity of air derived through the primary air supply pipe, C, so that a rich mixture, designed, in proportioning of the parts, to be suitable for operating the engine idling or under slight load, to be delivered for further air admixture controlled, as to quantity of added air, by the adjustment of the throttle valve, G, said relatively rich fuel mixture being in its course through its conduit passed through a heating region causing the aspirated liquid fuel carried in suspension in the air current, to be vaporized, so that upon discharge through the venturi, E^{10}, for taking additional air, not only is the mixture of the fuel with said additional air very thorough, but also the heated mixture is cooled without causing condensation of the vaporized fuel, so that the mixture ultimately delivered to the engine is unimpaired for power development by reason of the heating which vaporized the fuel. Upon opening the throttle widely, for operating the engine at speed under load, the primary air supply controlling valve. H, is opened correspondingly to the main throttle valve so that the primary fuel mixture is suitably modified by the increase of air flow through the primary air supply pipe.

In order to provide for starting the engine without opening the valve, H, which could only be done concurrently with opening the throttle valve more widely than suitable for starting, there is provided in the primary air supply intake fitting, F, an air inlet passage, f^4, opening into said fitting beyond the seating of the valve, H; and a

valve, J, is provided for controlling at will this air inlet passage, said valve, J, being connected for operation from the driver's seat by any convenient means, as for example, by the Bowden wire, L, extended from the valve by any convenient course to position where it may be operated by the driver.

It may be understood that while the float bowl, B, is illustrated as positioned for receiving fuel supply by gravity from the tank, A, this relation of level is not obligatory; on the contrary, it may be understood that since the float bowl has no outside atmospheric vent, its only vent being by way of the aperture, b^4, through the pipe, C^2, which leads from a point in the air inlet passage ahead of the throttle valve, that throttle, G, being closed, the suction of the engine may operate not only for lifting from the float bowl, but also for lifting fuel into the float bowl. And it will be understood also that the degree of suction operating through the sleeve, f^3, obstructed by the taper valve, H^1, is controlled by said taper, and the parts may be proportioned and adjusted for such degree of closing of the valve, H^1, relatively to the throttle valve, G, as to ensure lift of fuel not only from but into the float bowl.

I claim:—

1. In combination with an internal combustion engine, a fuel mixture forming and feeding apparatus which comprises a primary air supply pipe and a main air supply pipe; means for discharging fuel within the primary air passage to produce a fuel mixture and for conducting said mixture to, and discharging it in, the main air discharge pipe; valves controlling the air entrance through said primary and main pipes respectively, and connections between said valves for their simultaneous and correlated operation; the primary air pipe having an air inlet beyond the valve of said primary air pipe, a throttle valve controlling said inlet adapted for operation at will; and means for such operation.

2. In combination with an internal combustion engine, a fuel mixture forming and feeding apparatus which comprises a primary air supply pipe and a main air supply pipe; means for discharging fuel within the primary air passage to produce a fuel mixture and for conducting said mixture to, and discharging it in, the main air discharge pipe; valves controlling the air entrance through said air pipes respectively, and connections between said valves for their simultaneous and correlated operation; the primary air pipe fitting having an air inlet beyond the throttle valve thereof, a valve controlling said inlet adapted for operation at will, and means for such operation, the fuel mixture pipe being extended through the exhaust region of the engine in its course from the fuel discharge into it and its own discharge into the main air supply pipe.

3. In combination with an internal combustion engine, a fuel mixture forming and feeding apparatus which comprises a fuel source situated remotely from the engine, a main air supply conduit having its intake passage and entire extent adjacent to the engine intake; a primary air supply pipe extending adjacent to the fuel source, the primary fuel mixture conduit having its intake within the primary air supply conduit and adjacent to the fuel source, a fuel supply duct delivering liquid fuel into the intake of the primary fuel mixture conduit proximate to the intake of the latter; said primary air supply conduit and said primary fuel mixture conduit extending from said remotely positioned fuel source to the main air supply conduit for intake of the primary air supply conduit and discharge of the fuel mixture conduit adjacent to the engine, and throttle valves controlling the intakes of the primary air supply conduit and main air supply conduit respectively connected for simultaneous and correlated adjustment.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 20th day of April, 1925.

LEONARD H. WHEELER.