

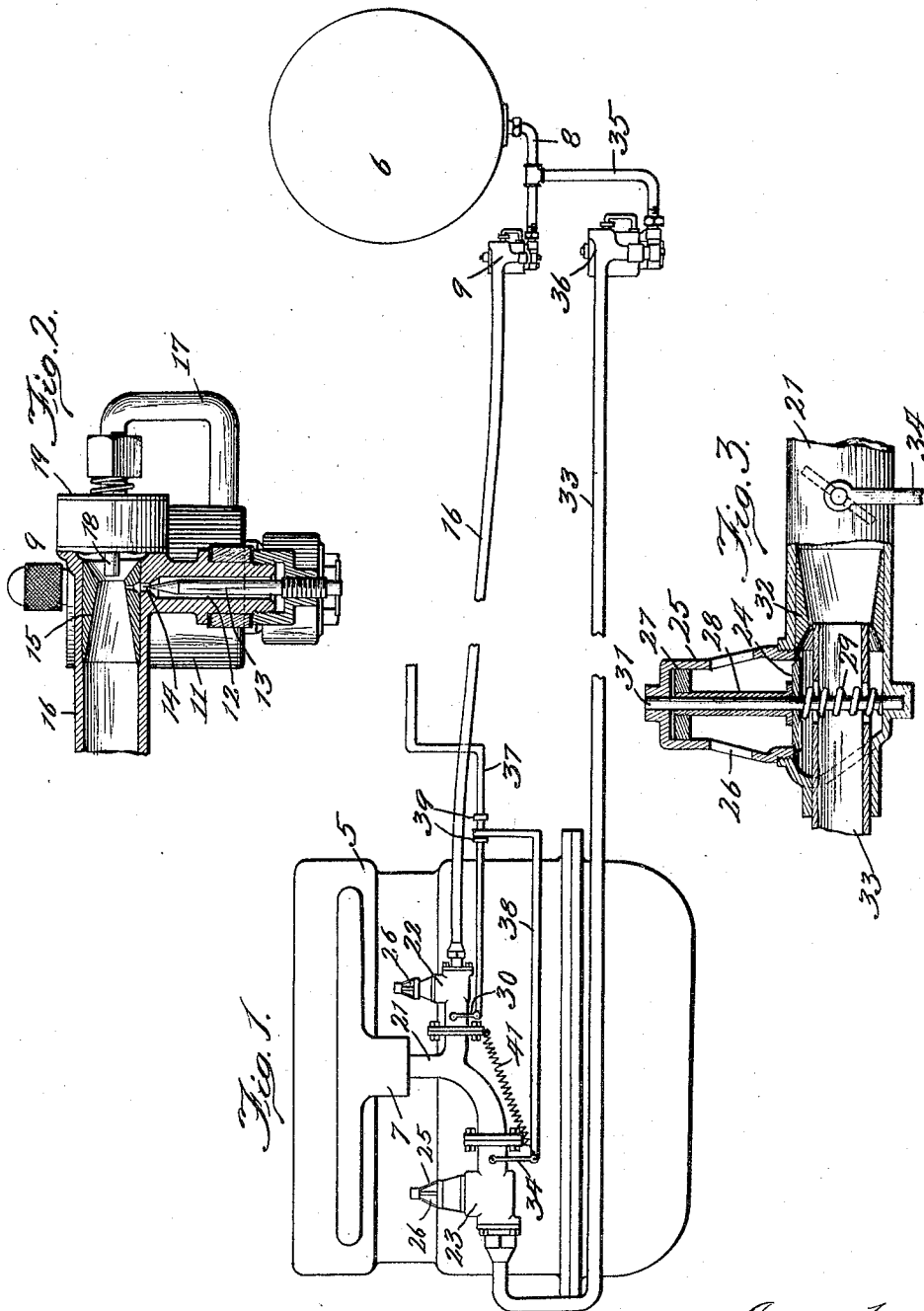
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DUPLEX FUEL SUPPLYING APPARATUS FOR INTERNAL COMBUSTION ENGINES

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This invention pertains to apparatus for mixing liquid fuel with air, and delivering the resultant mixture to the cylinders of internal combustion engines; and while the principles of my invention may be utilized for many purposes, the invention is particularly advantageous in connection with high power internal combustion engines having a large cylinder displacement.

I have illustrated on the accompanying drawings a preferred embodiment thereof, from which, when considered in connection with the following description, my invention and many of its inherent advantages should be readily appreciated.

Referring to the drawings:

Fig. 1 is a side elevation of a motor and fuel supply tank with my invention attached thereto;

Fig. 2 is a partial sectional view of one of the primary mixers; and

Fig. 3 is a sectional view of one of the secondary air valves and mixers.

On the drawings, reference character 5 indicates generally an internal combustion engine of any preferred construction, such, for instance, as is customarily used in an automobile, and 6 indicates the fuel or gasoline tank, customarily located at the rear end of the car in approximately the relation shown. The intake manifold of the engine in the present instance is shown as of the jacketed type, as indicated by reference character 7.

The fuel flows by gravity from the tank, 6, to a primary mixing device from which the fuel mixture is led to the engine intake manifold by means of a fuel mixture conduit having at a point intermediate the primary mixing device and the engine, means for admitting additional air to the primary mixture for producing the desirable combustible fuel mixture for discharge to the engine. Referring to the first of the two mixing devices indicated at 9, connection therefrom the tank, 6, is made by the pipe, 8, leading to the float bowl of said mixing device. This mixing device, as will be apparent from Fig. 2, comprises a float bowl 11, equipped with the usual float mechanism, which maintains the fuel level at a predetermined height therein. This level is also maintained in a passage or chamber 12 communicating with the float chamber, and in which a needle valve 13 is adjustably disposed, so as to regulate the flow of fuel through the supply opening 14, into a Venturi tube 15, which is located near the intake end of a relatively small pipe 16. A pipe 17, also communicating at one end with the float chamber, is

In accordance with the principles of my invention, the liquid fuel is preliminarily mixed with air in proximity to the fuel supply tank, and at a considerable distance from the engine, this mixture being fairly rich and of approximately the proper proportions for idling purposes. This mixture is conducted through a long and relatively small pipe to a point in proximity to the engine, where, when the engine is running at a moderate speed, additional air is admitted and thoroughly admixed with the preliminary mixture to produce a resultant leaner mixture of proper proportions for the speed at which the engine is then running.

My invention also contemplates the provision of auxiliary apparatus which is brought into operation only at higher speeds of the engine, and this apparatus comprises also a device located in proximity to the fuel supply tank, for producing an initial mixture of fuel and air, a pipe for conducting this mixture to the engine manifold, and an auxiliary air inlet valve similar to the primary air inlet valve, by which auxiliary air is admitted to the auxiliary mixture to reduce the same to the proper proportions before being delivered to the engine.

The primary object, therefore, of this invention is to provide a primary apparatus which will supply the fuel requirements of the engine up to a predetermined speed, and in addition, an auxiliary apparatus which will furnish an additional fuel mixture of the proper proportions, which in conjunction with the mixture delivered by the primary apparatus, will furnish an adequate fuel supply in proper proportions for the higher speeds of the engine.

For the purpose of facilitating an understanding of the principles of my invention,

equipped at its other end with a nozzle 18 disposed adjacent to the throat of the venturi. Air enters the venturi through an adjustable shutter 19, by which the quantity of air, and consequently the richness of the mixture produced, may be regulated. Under relatively low suction exerted upon the pipe 16, liquid fuel is delivered through the aperture 14 in regulated quantities determined by the adjustment of the needle valve, and is broken up and homogenized in the throat of the venturi by the inrushing air. As the vacuum in the throat of the venturi increases, by reason of increased suction on the pipe 16, further fuel is delivered through the pipe 17 and nozzle 18, thus maintaining the relative proportions of fuel and air delivered to the pipe 16 substantially constant.

At its forward end the pipe 16 is connected with one leg of a branch 21, in which there is disposed a secondary air valve 22. A sectional view of a similar but larger valve 23 is shown in Fig. 3, this valve being disposed in the other leg of the branch 21; and since these valves 22 and 23 are substantially identical in construction and differ only in size, a detailed description of one will be sufficient.

The valve comprises a casing provided with a seat, against which the valve disk 24 is adapted to seat to prevent an inflow of air into the casing. A shell 25, provided with openings 26 through which the air enters, projects above the casing and its upper portion forms a dashpot in which a plunger 27, connected by a stem 28 with the valve disk 24, is adapted to operate to obviate fluttering of the valve. The valve is normally urged against its seat by an expansion spring 29, surrounding a stem 31, which serves as a valve guide. Well known means may be employed for adjusting the tension of the spring 29, so that the secondary valve 24 is adapted to open and admit air to the interior of the casing only when the vacuum in the casing reaches a predetermined height.

In the branch member 21, just forwardly of each of the valves 22 and 23, there is positioned a Venturi tube 32 into which the mixture delivered by the pipe 16 or 33, as the case may be, is delivered. A throttle valve is disposed in each leg of the branch forwardly of the air valve, the throttle for the valve 22 being operated from a lever 30, and the throttle for the valve 23 being operated by the lever 34.

A branch pipe 35, leading from the pipe 8, communicates with the float bowl of an auxiliary mixing device 36, similar in all structural respects to the mixing device 9, previously described, except that the secondary device is somewhat larger and delivers into the pipe 33, which is also, as will be apparent from Fig. 1, somewhat larger than pipe 16. The secondary air valve 23, the details of which are shown in Fig. 3, dilutes the

mixture delivered from the auxiliary mixer 36, and the air admitted by this valve is thoroughly mixed in the venturi 32 with the mixture delivered by the pipe 33, producing a resultant mixture which is thoroughly homogenized and is of proper proportions for delivery to the engine cylinders.

Suitable operating means is provided for controlling the primary and auxiliary throttle valves, and while this means may be of any preferred construction, I have shown, for illustrative purposes merely, a rod 37, pivotally connected to the operating arm 30, and extending rearwardly into position accessible to the driver of the car, as is usual. A connecting rod 38 is attached at one end to the auxiliary throttle 34, and at its other end has a lost motion connection with the rod 37, the connection illustrated comprising a pair of collars 39, fixed upon the rod 37 in spaced relation, and between which the upturned end of the rod 38 encircles the rod 37. A tractile spring 41 normally urges the auxiliary throttle valve into closed position, as shown in Fig. 1.

The operation of my novel apparatus is substantially as follows. A predetermined liquid level is maintained in each of the mixing devices 9 and 36 by the float mechanism, previously mentioned, and upon initial opening of the primary throttle by moving the rod 37 toward the left, viewing Fig. 1, suction is exerted from the manifold upon the pipe 16, which draws air in through the adjustable shutter 19, and causes fuel to be delivered through the orifice 14 into the throat of the venturi 15, where it is broken up and homogenized, producing a mixture suitable for idling purposes. This mixture during its travel through the pipe 16, is further broken up, homogenized, and partially vaporized, and at idling speed of the engine is delivered directly to the cylinders through the manifold. As the throttle is opened further, the increased vacuum in the throat of the venturi 15 draws fuel through the nozzle 18, thereby increasing the quantity of fuel delivered. When a predetermined suction point is reached in the manifold, the secondary air valve 22 opens, admitting secondary air, which, flowing through the venturi corresponding to the venturi 32 in the valve 23, increases the suction upon the pipe 16, thereby increasing the quantity of air and fuel delivered by this pipe. The fuel mixture delivered by the pipe 16 into the venturi is thoroughly admixed therein with the secondary air entering through the valve 22, and the resultant thoroughly homogenized mixture is of the proper proportions and in suitable quantity for moderate speeds of the engine.

When the throttle is opened still further, the right-hand collar 39, acting upon the rod 38, swings the arm 34 to open the secondary

throttle. Suction from the manifold is thereupon exerted upon the pipe 33 to draw an auxiliary mixture of air and fuel from the device 36. This mixture is delivered directly into the manifold. Upon further opening of the throttle, the increased suction in the valve casing 23 will overcome the tension of spring 29, and permit the secondary valve disk 24 to open, thereby admitting secondary air, which is mixed in the venturi 32 with the primary mixture delivered by the pipe 33, producing a resultant homogenized mixture of substantially the same proportions as is delivered to the other leg of the branch member 21, and the combustible mixture from both legs of this branch member will be drawn through the manifold into the engine cylinders in sufficient quantities to supply the engine at extremely high speeds.

It will be apparent, therefore, that I have provided an apparatus which will supply a combustible mixture, embodying the proper proportions of air and fuel for all conditions of use, and for all speeds of the engine, ranging from a slow idling speed to extremely high speeds. The details of construction illustrated and described may obviously be varied within considerable limits, without departing from the essence of the invention, as defined in the following claims.

I claim:

1. In a duplex apparatus of the character described, the combination of an internal combustion engine and a source of fuel supply remote therefrom, of a primary fuel mixture producing apparatus comprising a mixing device in proximity to the fuel supply for producing a preliminary mixture of air and liquid fuel, a pipe through which the said mixture is conducted, a secondary air valve interposed in said pipe in proximity to the engine, and a throttle valve interposed between said air valve and the engine, an auxiliary fuel mixture producing apparatus comprising a mixer in proximity to the fuel supply for producing a preliminary mixture of fuel and air; a pipe through which said mixture is conducted, a secondary air valve interposed in said pipe in proximity to the engine, and a throttle valve between said secondary air valve and the engine, and an operating connection between said throttle valves whereby said auxiliary air apparatus is thrown into operation upon the operation of the primary apparatus at a predetermined capacity.

2. In combination with an internal combustion engine, a source of fuel supply, substantially duplicate primary and secondary apparatuses each consisting of a preliminary fuel mixture producing device, a fuel mixture conduit leading therefrom for discharge in the engine intake manifold, said fuel mixture conduit comprising an antecedent member and a discharge member of greater diameter than the antecedent member and an air valve

controlling the admission of air to said discharge member, said antecedent member being intruded into said discharge member for discharge therein at a short distance beyond said valve and a throttle valve interposed in the fuel mixture conduit between the said discharge of said antecedent member and the engine intake; and operating connections between the two throttle valves whereby the secondary of said duplicate apparatuses is brought into operation only upon the operation of the primary apparatus at a predetermined capacity.

3. A system for supplying fuel to an internal combustion engine comprising in combination with an engine intake manifold, a fuel source and a plurality of primary fuel mixture forming devices connected for deriving fuel from the fuel source and located remotely from the engine; primary fuel mixture conduits leading from said primary fuel mixture forming devices respectively for connections with the engine intake manifold; final fuel mixture conduits connecting said primary conduits respectively with the manifold, said final conduits comprising respectively separate and independent mixers consisting each of a venturi into which the primary mixture conduit discharges, said venturis having each an atmosphere inlet antecedent to the point of discharge of the primary mixture conduit in the venturi with a normally closed air inlet controlling valve for each of said inlets arranged to be opened automatically by the engine suction.

4. In the construction defined in claim 3, a throttle valve in each of the final fuel mixture conduits intermediate the venturi thereof and the connection with the intake manifold, and means for controlling said throttle valves at will.

5. In the construction defined in claim 3, a throttle valve in each of the final fuel mixture conduits intermediate the venturi thereof and the connection with the intake manifold, valve operating means for controlling said throttle valves respectively, said means being arranged for opening one of said throttle valves to a predetermined degree before beginning to open the other.

6. In the construction defined in claim 3, a throttle valve in each of the final fuel mixture conduits intermediate the venturi thereof and the connection with the intake manifold, valve operating means connected and arranged for opening one of said throttle valves in advance of the other and for causing said valve to be concurrently opened to different degrees.

7. In the construction defined in claim 3, the two primary mixers being at different levels, the primary mixture conduit leading from the one at the higher level being of less flow capacity than that leading from the lower primary mixing device.

8. In the construction defined in claim 3,
the primary mixture forming devices being
arranged to derive fuel supply by gravity
from the fuel source, one of said devices be-
5 ing at a lower level than the other, whereby
fuel is delivered to said lower device under
greater hydrostatic pressure than the other,
the fuel mixture conduit from said lower fuel
mixture forming device being of greater flow
10 capacity than the conduit leading from the
higher device.

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