

[54] CARBURETOR APPARATUS
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261/116
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261/1, 19; 239/118

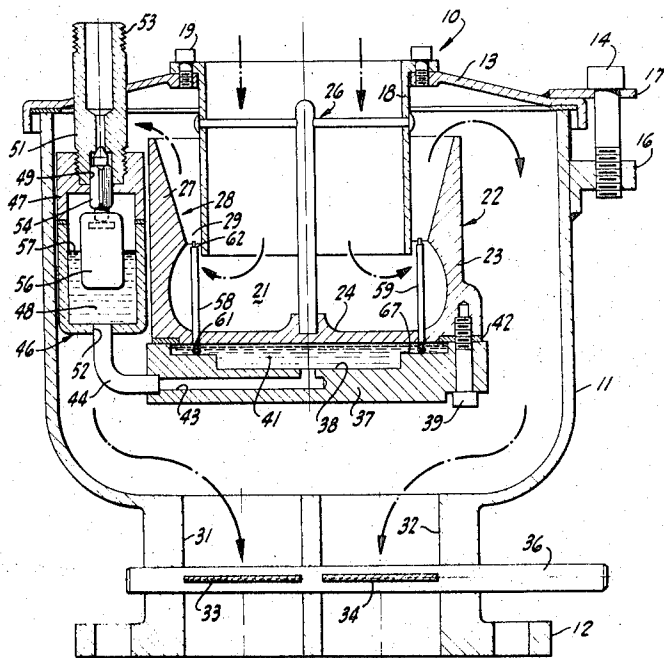
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[57] **ABSTRACT**
Carburetor apparatus for vaporizing and mixing a liquid fuel with a stream of gas. An incoming stream of gas is directed through an annular venturi. The outlet ends of a plurality of circumferential spaced-apart fuel jet tubes project into the throat portion of the venturi. The fuel jet tubes have their inlet ends in communication with a supply of fuel confined within a reservoir. Elongate inserts mounted within the tubes are radially spaced from the tube inner surfaces to define relatively small cross sectional area capillary fuel flow passageways. The inserts are adapted for both vertical and lateral displacement to dislodge any foreign matter which forms or deposits within the tube passageways. The end of each insert which projects into the fuel reservoir is reversely bent to form an enlarged portion serving to limit the vertical displacement of the insert.

2 Claims, 2 Drawing Figures



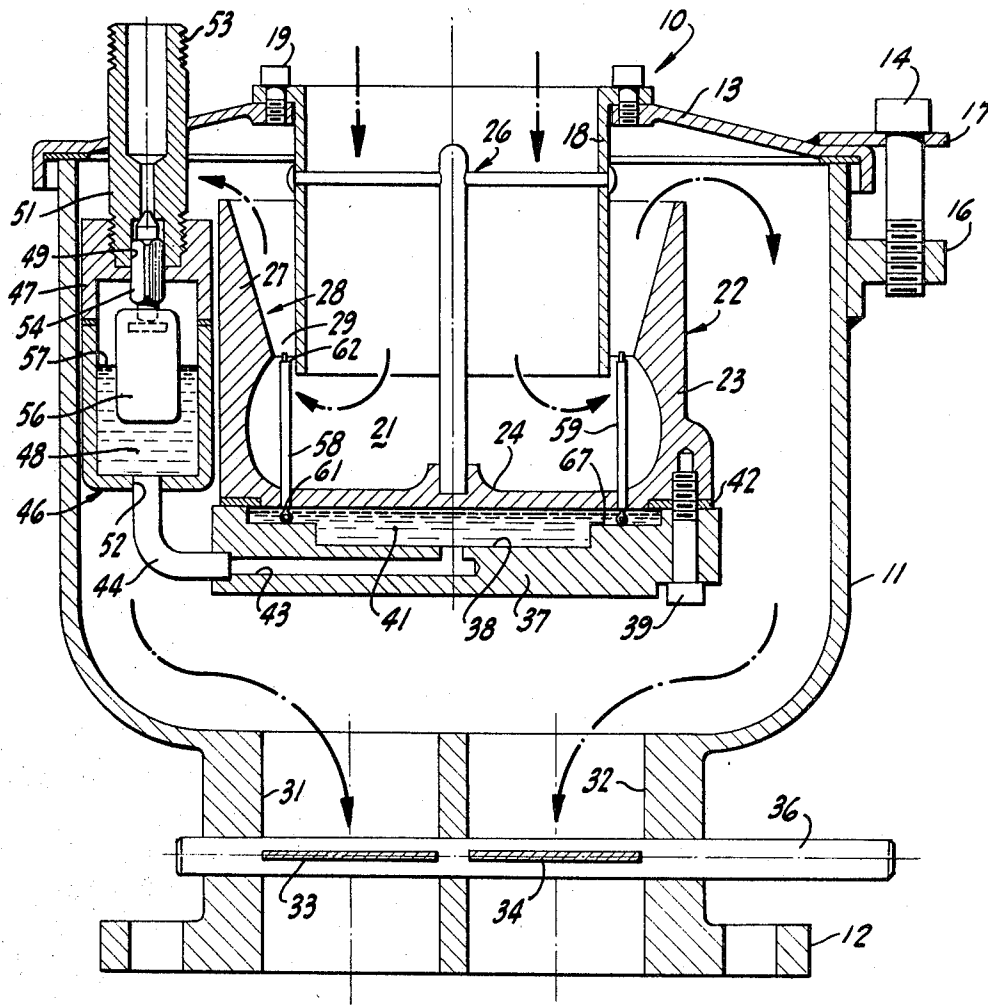


FIG-1

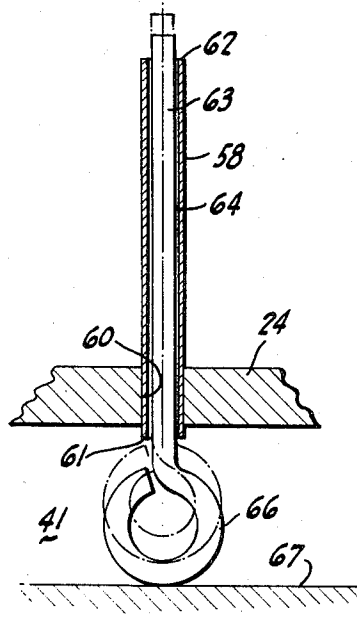


FIG-2

CARBURETOR APPARATUS

BACKGROUND OF THE INVENTION

Carburetors of known construction utilize various expedients to introduce and vaporize a liquid fuel into an incoming flow of air to form a combustible charge for induction into an internal combustion engine. In these known carburetors, a venturi flow passage is formed with metering fuel jets discharging into the air stream at the throat portion of the venturi.

In U.S. Pat. No. 3,325,975 issued to the present applicant, a carburetor is provided which creates a high degree of fuel vaporization and has provision for removal of fuel droplets through centrifugal action. The apparatus of the patent includes means forming an annular venturi with a plurality of circumferentially spaced-apart tubes or fuel nozzles arranged with their inlet ends disposed in the fuel supply and with their outlet ends disposed in the venturi throat. The mixture of vaporized fuel and air is directed by baffle means through a reverse flow path arranged to remove fuel droplets by centrifugal action so that a substantially droplet free combustion charge is inducted into the engine.

The tubular fuel jets utilized in known carburetors of the type described are subject to failure or reduced effectiveness for reasons which include the fact that foreign matter and contaminants in the fuels tend to lodge in or form deposits on the surfaces of the fuel tube or nozzles. Among the foreign matter which may be found in fuels of this nature are solid particulate matter such as dirt which may not be removed by a fuel filter, and dissolved contaminants which may gradually adhere to and form a gum or a varnish-like layer or deposit within the inner surfaces of the tube. The problem of foreign matter deposit becomes highly critical in carburetors employing relatively small diameter, capillary action fuel tubes of the type disclosed in Applicant's issued Patent where a high degree of fuel atomization is achieved. The flow area of such capillary tubes is so small that the likelihood of malfunction due to the presence of foreign matter is increased substantially.

OBJECTS AND SUMMARY OF THE INVENTION

This invention relates in general to improvements in apparatus for forming a mixture of gas and a vaporized liquid, and in particular relates to improvements in carburetor apparatus for atomizing or vaporizing liquid fuel for mixture with a stream of air to form a combustible charge for induction into an internal combustion engine.

It is a general object of the invention to provide carburetor apparatus which is effective to provide a high degree of liquid fuel atomization in a stream of gas for more complete combustion of the inducted charge, and thereby reduced pollutants in the exhaust.

Another object of the invention is to provide carburetor apparatus which efficiently atomizes and injects fuel into an air stream while at the same time avoids functional failure of carburetor operation which could otherwise occur as a result of any foreign matter contained in the fuel.

Another object of the invention is to provide carburetor apparatus of the character described utilizing fuel jet tubes in which insert members are carried within the tubes to define capillary flow passages therewith, with the inserts adapted to undergo limited vertical and axial

displacement to dislodge any foreign matter which may form or deposit within the tubes.

The invention includes a carburetor apparatus in which an air stream is directed through an inlet conduit into the throat of an annular venturi. A fuel supply reservoir is provided within the carburetor with a plurality of circumferential spaced-apart fuel jet tubes having inlet ends in communication with fuel in the reservoir and having outlet ends disposed in the venturi throat.

Elongate insert members mounted in each of the tubes are radially spaced from the inner surfaces thereof to define relatively small diameter fuel flow passages effective to provide capillary action for withdrawing fuel from the reservoir and to inject fuel into the air stream for relative complete fuel atomization so that more complete combustion is achieved. The elongate inserts are mounted in the tubes for both axial and lateral displacement to dislodge any foreign matter which may form or deposit within the tubes. The ends of the inserts projecting into the reservoir are reversely bent to form enlarged portions for limiting the extent of axial displacement. The gaseous mixture of vaporized fuel and air is directed by the carburetor housing through throttle means for induction into an engine.

Additional objects and features of the invention will appear from the following description in which the preferred embodiments of the invention has been set forth in detail in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view in elevation of carburetor apparatus according to the invention;

FIG. 2 is a cross-sectional view to an enlarged scale of a fuel jet tube and insert of the apparatus of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawing FIG. 1 illustrates generally at 10 carburetor apparatus constructed in accordance with the invention. The preferred form of carburetor apparatus 10 comprises a downdraft type carburetor including a cylindrical housing 11 extending from mounting flange 12 which in turn is secured by suitable fasteners such as bolts to an intake manifold, not shown, incorporated in the associated internal combustion engine. An annular cover 13 is secured to the upwardly open end of housing 11 by means such as a plurality of fasteners 14 extending between brackets 16 secured to the side of the housing and arms 17 secured to the cover. An air inlet conduit 18 is mounted by fasteners 19 within a central opening formed in cover 13, and a suitable air cleaner, not shown, may be provided upstream of the inlet conduit.

Air inlet conduit 18 directs an incoming stream of air vertically downwardly into a chamber 21 formed within an upwardly open cylindrical structure 22 comprising an outer cylindrical wall 23 and flat bottom wall 24. Cylindrical structure 22 is mounted by means of a bracket assembly 26 depending from within conduit 18. The inner surface of cylindrical wall 23 is formed into an annular cusp-shaped configuration radially spaced about the outer periphery of inlet conduit 18 and with an upper portion 27 flaring outwardly from the conduit such that upwardly directed venturi means 28 is formed having an annular throat portion 29 adjacent the cusp of the cylindrical wall. The stream of air flowing from chamber 21 and exiting from the venturi

means is reversed in direction by cover 13 and housing 11 for downward flow through the pair of passageways 31, 32 leading to the intake manifold. Throttle means is provided which includes a pair of butterfly-type valves 33, 34 mounted on a throttle shaft 36 for pivotal movement by means of a suitable throttle linkage, not shown.

A plate 37 having a circular recess 38 is mounted below bottom wall 24 of the cylindrical structure through suitable fasteners 39 to define a fuel supply reservoir 41. A suitable annular gasket 42 is provided to form a fluid-tight seal between the peripheral rim of the plate and the bottom wall. A liquid hydrocarbon fuel is supplied to the reservoir through a passageway 43 formed in the plate and connected through tubing 44 with a float chamber assembly 46. The float chamber assembly comprises a housing 47 defining a fuel chamber 48 having an inlet 49 in communication with fuel supply fitting 51 and an outlet 52 in communication with tubing 44. The float chamber housing is threadably mounted to the downwardly projecting end of the fitting which in turn is mounted through an opening in cover 13 and connected at its upwardly projecting end 53 with a fuel supply line, not shown. A longitudinally grooved needle valve 54 is slidably mounted within housing inlet 49 for movement to and from a valve seat formed within fitting 51. The needle valve directs fuel into the float chamber responsive to movement of a float 56 carried within the chamber for maintaining the fuel supply substantially at the illustrated level 57.

Fuel jet means is provided to meter the fuel with a high degree of atomization into the incoming stream of air. This fuel jet means comprises a plurality of upright, circumferentially spaced-apart hollow capillary tubes 58, 59 mounted within openings 60 formed within bottom wall 24 in vertical alignment below venturi throat 29. Each of the tubes has an inlet end 61 in fluid communication with the fuel supply reservoir and an outlet end 62 disposed in the venturi throat. The level 57 of the fuel within float chamber assembly 46 is established at an elevation which is below the level of the tube outlet ends.

As best illustrated in FIG. 2 an elongate rod-like insert 63 is mounted within each of the tubes. Preferably both the tubes and inserts are circular in cross-section, although the invention contemplates that other cross-sectional configurations may be employed. The insert 63 is radially spaced from the inner cylindrical surface of the tube to define an annular fuel flow passageway 64 of a relatively small cross-sectional area which is effective to create a capillary effect for withdrawing fuel from the reservoir into the tube, and at the same time to create a high degree of liquid subdivision as the fuel is sprayed into the air stream for a relatively greater atomization and vaporization of the fuel.

The inserts are mounted within each tube for both axial and lateral displacement to dislodge any foreign matter which may form or deposit within the small clearance between the insert and tube. Movement of the insert in this manner effects both abrasive and mechanical action against the foreign matter to prevent obstruction of passageway 64 and to ensure proper operation of the carburetor. Engine vibration and movement is carried through to the carburetor to generate lateral displacement of the inserts. Axial displacement of the inserts is generated by changes in the static pres-

sure differential between the tube inlet and outlet ends due to variations in air stream flow rates through the venturi. Thus, an increased flow rate reduces the static pressure at the venturi throat tending to both aspirate added fuel through the tubes and raise the insert to the broken line position of FIG. 2. A decrease in the air flow rate reduces the static pressure differential so that the insert is moved by force of gravity downwardly to the illustrated solid line position. Suitable means is provided to limit the extent of axial displacement of the inserts, and this means preferably comprises an enlarged extension 66 of the insert disposed within the reservoir and which is formed by reversely bending the lower end of the insert. This extension engages at its upper extremity with tube inlet end 61 to limit upward travel of the insert, and engages at its lower extremity with the surface of annular shoulder 67 formed within the recess of plate 37, as best illustrated in FIG. 1. The insert is sized to be of sufficient axial length so that it completely projects through the tube throughout the range of its axial displacement.

In the operation of carburetor 10 when connected with the intake manifold of an internal combustion engine, float chamber assembly 46 feeds sufficient fuel through tubing 44 to completely fill supply reservoir 41, with the fuel moving upwardly by capillary action into each of the fuel jet tubes 58, 59. Operation of the engine with the pumping action of its pistons inducts a stream of air downwardly through inlet conduit 18 where it reverses for upward flow through venturi means 28 and then again reverses for downward flow within housing 11 and is directed into the engine's intake manifold under control of throttle valves 33, 34. The increased flow velocity of the air at venturi throat 29 creates a reduced static pressure which acts to aspirate and meter fuel with a high degree of atomization from the outlet ends of fuel jet tubes 58, 59. At the same time the static pressure differential acts on the tube inserts moving them upwardly which, together with lateral displacement of the inserts as limited by the radial clearance within the tubes, serves to dislodge any foreign matter which may form or deposit within the tubes. Fuel which is withdrawn from reservoir 41 is replenished from float chamber assembly 46 which in turn is replenished by operation of float 56 and needle valve 54.

While the embodiment herein is at present considered to be preferred it is understood that numerous variations and modifications may be made therein by those skilled in the art, and it is intended to cover in the claims all such variations and modifications as fall within the true spirit and scope of the invention.

I claim:

1. In a carburetor for mixing a liquid fuel with a gas, the combination of a conduit positioned to direct said gas into an incoming stream, means defining an annular venturi about said conduit, said venturi having a throat portion for reducing the static pressure of said stream of gas, a reservoir spaced below said throat portion for containing a supply of fuel, a plurality of vertically elongate hollow tubes each having an inlet end in fluid communication with fuel contained in said reservoir and having an outlet end in discharge relationship with said venturi throat portion, a plurality of elongate tube inserts, each insert being mounted in a respective one of said tubes and being radially spaced from the inner surface thereof to define a capillary fuel flow passage-

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way, each insert being mounted for vertical and lateral displacement with respect to the tube inner surface associated therewith, and means to limit the vertical displacement of each insert between an upper position assumed under the influence of reduced static pressure of gas in said venturi throat portion and a lower position assumed under influence of gravity acting on said insert.

2. In a carburetor apparatus, the combination comprising means forming a reservoir containing a liquid fuel, means forming a continuous passageway for directing a stream of gas through said carburetor, said last mentioned means including means forming a venturi having a throat portion, fuel jet means for directing fuel from said reservoir into said stream of gas, said fuel jet means including one or more substantially vertically extending elongate tubes, each tube being formed with an inner cylindrical surface having a length extending between an inlet disposed in said reservoir in communication with said contained fuel and an outlet disposed in said venturi throat portion, an elongate insert carried within each of said tubes and being radially spaced

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from said inner cylindrical surface to define a fuel flow passageway therewith, means forming upper and lower spaced stop surfaces in substantially vertical register and disposed below said tubes, weight means formed on the lowermost ends of each insert and disposed between said stop surfaces, and means mounting each insert for movement axially within its associated tube between extreme positions in which said weight means contacts, respectively, said upper and lower surfaces responsive to the resultant force acting on said insert from the force of gravity and the pressure force differential acting on the insert as a combination of static gas pressure within said venturi and fuel pressure within said reservoir whereby said movement of each insert dislodges any foreign matter disposed in said flow passageway, each insert being sized in length sufficiently greater than said length of the associated tube inner cylindrical surface whereby the cross sectional area of the flow passageway therebetween is independent of the axial position assumed by the inserts with respect to the tubes.

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