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GASEOUS FUEL MIXER FOR INTERNAL COMBUSTION ENGINES

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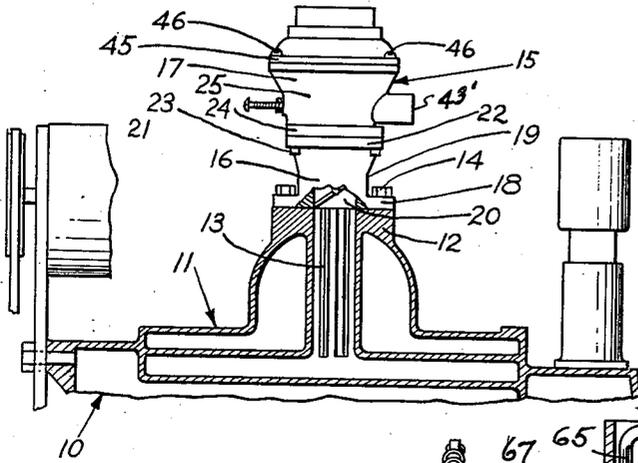


Fig. 1.

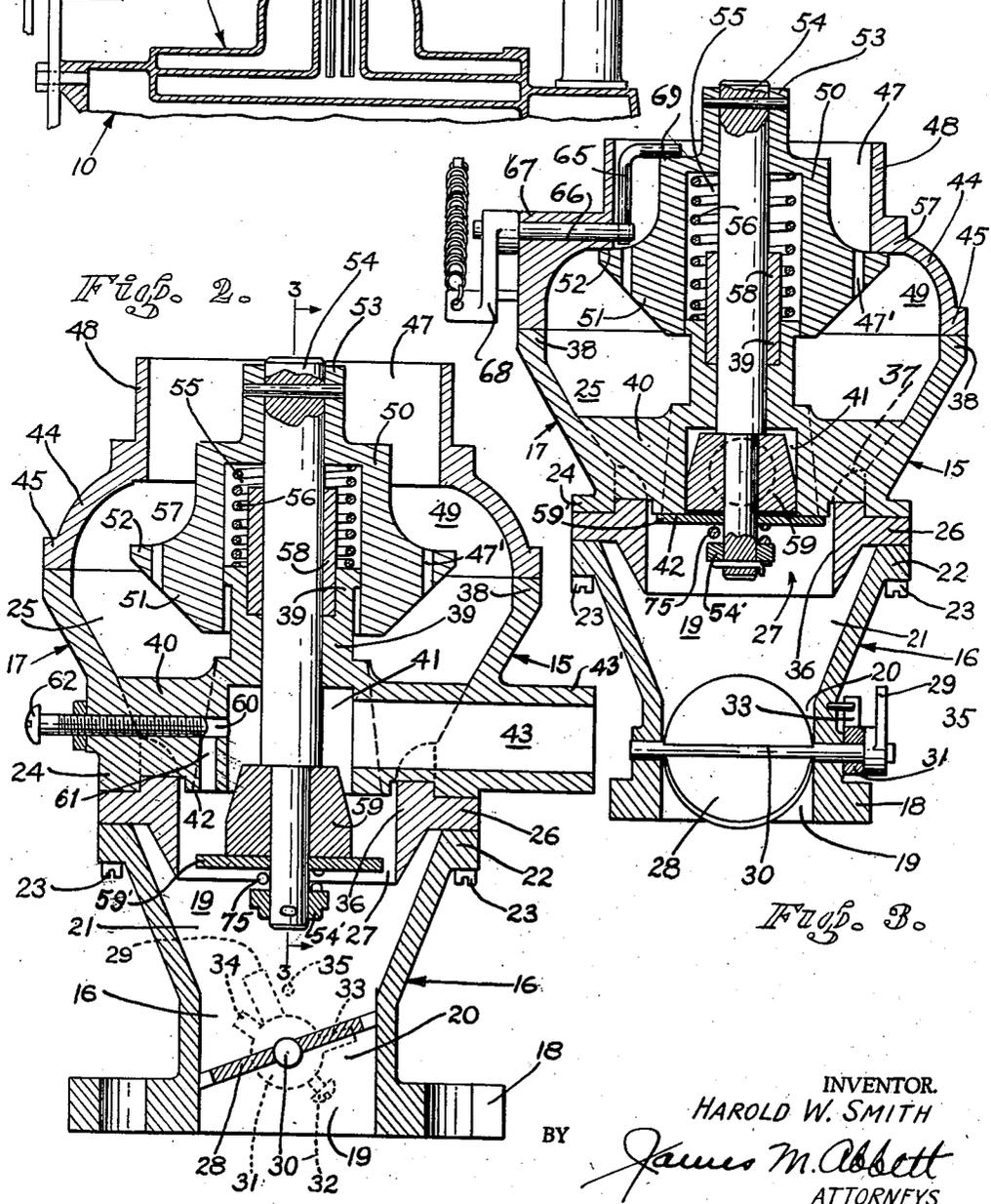


Fig. 3.

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GASEOUS FUEL MIXER FOR INTERNAL COMBUSTION ENGINES

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5 Claims. (Cl. 48—180)

This invention relates to fluid mixing devices and particularly pertains to a gaseous fuel mixer for internal combustion engines, and is a continuation in part of my copending application entitled "Method and means of preparing a combustible fuel," Serial No. 224,718, filed August 13, 1938 now issued as Patent No. 2,279,530 of April 14, 1942.

At the present time gaseous fuel, such as propane and butane, is used in internal combustion engines. When such fuel is used it is necessary to mix it with the proper proportion of air to make a combustible mixture which is then delivered to the engine. In view of the fact that internal combustion engines are built in a wide range of sizes it is difficult to obtain gaseous fuel mixers which are of suitable capacity for a particular engine, with the result that a large number of designs and sizes of carburetor or fuel mixer are required. It is the principal object of the present invention to provide a gaseous fuel mixing structure which is of composite character and makes it possible for a selection of stock parts to be made whereby the mixer may be mounted upon engines varying in fuel requirements with the assurance that the mixer as assembled will supply fuel to the engine properly without making it necessary for each individual engine to require a complete mixing or corporation unit for that particular engine, and therefore making it possible for a few stock parts to be made which when selectively assembled will provide mixers of capacities covering a wide range of requirements. It is a further object of the present invention to provide a fuel mixer of the Venturi type in which it is possible to obtain an overload Venturi safety factor in a variable orifice fuel-air mixer.

The present invention contemplates the provision of a gaseous fuel mixer having a valve structure assembled as a unit, said valve structure being interchangeably connected with a mounting flange and with Venturi throat sections of desired configuration.

The invention is illustrated by way of example in the accompanying drawing in which:

Figure 1 is a view in vertical section and elevation showing the application of the present invention to a manifold of an internal combustion engine.

Fig. 2 is an enlarged view in vertical section showing the fuel mixer.

Fig. 3 is a view in transverse section showing the details of construction of the fuel mixer as seen on the line 3—3 of Fig. 2.

Referring more particularly to the drawing, 10 indicates an engine of the internal combustion type upon which a manifold structure 11 is mounted. This manifold structure is of the type shown in my copending application aforesaid, of which this application is a continuation in part. A bolting flange 12 is formed on the manifold structure and around a gaseous fuel inlet passage 13. Mounted upon the bolting flange and secured by bolts 14 is the gaseous fuel mixer 15 with which the present invention is concerned. This gaseous fuel mixer may be used in conjunction with a conventional gasoline carburetor or may be used separately as shown in the drawing. In view of the fact that engines are of different capacities it is necessary to equip them with mixers of different capacities so far as the throttle valve structure is concerned, while utilizing an automatic main valve unit of a substantially common size for a large variety of engines.

The gaseous fuel mixer comprises a throttle valve portion 16 and an automatic valve portion 17. The throttle valve includes a lower bolting flange 18 and a tubular throat portion 19. The tubular throat 19 has a lower cylindrical section 20 and an upwardly and outwardly flaring frustoconical portion 21. The upper end of the section 19 is fitted with a bolting flange 22 which receives screws 23. This bolting flange may fit directly against a bolting flange 24 of the housing 25 of the automatic valve section 17 or may have interposed between it and the flange 22 the flange 26 of a Venturi throat element 27. Mounted in the cylindrical length 20 of the structure 16 is a butterfly valve 28 which may be moved to closed or opened positions in the throat. This valve is operated by the usual lever 29 carried upon the valve shaft 30. An adjusting element 31 is secured on the shaft by a set screw 32. This element carries arms 33 and 34 which may swing to encounter a stop pin 35 and limit the movement of the valve in either of two directions of rotation. The valve lever 29 is of course connected with the usual throttle control structure. The butterfly valve 28 is disposed at a point between the engine and the Venturi throat, and also between the engine and the air and fuel valve structure. This insures that an undisturbed column of air will be drawn into the mixer and around the valve in uniform flow.

The Venturi throat element 27 may be cast integral with the structure or may be cast separately as shown in the drawing. When cast separately the bolting flange 26 makes it possible

for screws 23 to pass through openings in the bolting flange and engage the flange 24 of the automatic valve housing 25. The Venturi throat structure has a central cylindrical passageway 36 which extends downwardly into the tapered throat 19 of the valve housing and upwardly into the automatic valve housing 25. The upper end of the throat is formed with an outwardly flaring face 37 which is rounded to produce a Venturi restriction effect.

The valve housing 25 is bowl-shaped and terminates at its upper end in a bolting flange 38. Formed centrally of the valve housing 25 is a tubular bearing element 39 which is carried by a transversely extending web 40. The central portion of the web below the member 39 is formed with a passageway 41 which terminates in an annular valve seat 42. The passageway 41 is substantially cylindrical and communicates with a passageway 43 carried within the web and extending laterally thereof. The bowl portion 25 of the automatic valve housing is covered by an inverted bowl-shaped cover 44. This cover is fitted with a bolting flange 45 and receives screws 46 which secure the bolting flanges 38 and 45 together. The upper end of the cover 44 is formed with a central air opening 47 which is surrounded by a cylindrical flange 48. This flange may be used to connect an air conduit with the bowl or to connect an air cleaner or the like. The bowl portion 25 and the bowl cover 44 form a chamber 49 within which an air valve member 50 is vertically reciprocable. The air valve member 50 has an inverted frusto-conical portion 51 and an upper portion of reduced diameter having an outwardly flaring curved face 52 by which incoming air may be directed outwardly and around the large diameter of the frusto-conical portion 51. A hub 53 is formed at the upper end of the air valve element 50 and is pinned onto a valve shaft 54 which extends downwardly through a central cylindrical counterbore 55 within the valve element 50. The counterbore is of a diameter to receive the upwardly projecting tubular bearing element 39. A spring 56 is interposed between the upper end wall of the counterbore 55 and the end of the tubular bearing element 39. This tends to hold the valve element against an annular valve seat 57 which circumscribes the air opening 47, at which time the air valve element 50 will assume the position indicated in Fig. 3. The frusto-conical portion 51 of the air valve element may be formed with ducts 47' which permit a limited flow of air through the valve when the engine is idling. Mounted within the tubular extension 39 is a bearing bushing 58 through which the valve stem 54 extends. At the lower end of the valve stem 54 is a fuel valve 59. This valve is frusto-conical and in its upper position is drawn against the annular valve seat 42. Thus, the air valve 50 and the fuel valve 59 operate in unison as influenced by the spring 56 or engine suction. A valve washer 59' is carried on the lower end of the valve stem 54 and is held yieldably by a spring 75 and a nut 54' on the valve stem 54. Attention is directed to the fact that the fuel valve element 59 has an upper frusto-conical portion and a lower cylindrical portion. The cylindrical portion, as shown in Fig. 2 of the drawing, fits snugly within the passageway 41 when the valve is in its uppermost position, at which time the disc 59' will seat against the under face of the valve seat 42. The outside diameter of the disc 59' is substantially less than the inside diameter

of the bore 27' which extends downwardly as a part of the Venturi throat 27. It will thus be seen that during the initial period of downward movement of the air and fuel valve the valve disc 59' and the valve 59 will cooperate with the walls of the cylindrical bore 27 to provide a mechanical metering action, and that when the air valve and the fuel valve move to their lowermost positions the disc 59' will be beyond the lower edge of the Venturi throat structure 27. At that time a free flow of gas and air will pass downwardly through the Venturi throat to be thereafter regulated by the throttle valve 28. In the initial stages of engine operation the fuel valve will perform the double function of regulating the inflow of fuel and regulating the flow of air. In order to control the feed of fuel during idling times a duct 60 extends into the portion 51 of the bowl and communicates with a duct 61 which conducts the fuel around the fuel valve 59 and into the Venturi throat structure 27. The duct 61 is shown as having its lower end in a position through valve seat 42 to permit the valve washer 59' to close the opening when a positive fuel shut-off is required. It will be evident that a flapper valve might be used if desired. A valve screw 62 adjusts the fuel volume.

It may be desirable to place a special adapter on the base of member 25 to permit a gasoline carburetor to be used with the engine. In this event it is advisable to provide means for locking the automatic air fuel valve open. In Fig. 3 such a device is shown as including a crank lever 65 mounted on a shaft 66. This shaft extends through a boss 69 in the wall of member 44 and may be operated by a lever 68 from a remote point of control. The crank lever rests at its free end upon shoulder 69 of the air valve 50 and when swung to a desired set position will hold the air valve 50 open while permitting the fuel from a gasoline carburetor to pass freely through the structure.

In operation of the present invention the rating and fuel requirements of an engine are ascertained, after which a throttle valve portion 19 is selected to meet the requirements of the engine for use with the automatic valve portion 17. In addition various types of Venturi throat structures may be used. The bolting flange 22 of the throttle valve housing and the bolting flange 24 of the automatic valve structure are maintained at a common size so that these elements will be interchangeable. The bolting flange 18 at the bottom of the throttle valve housing is selected to accommodate the construction and design of a particular engine while the Venturi element is selected to produce a desired restriction in the air stream, or if desired, a structure with an integral venturi may be used. This insures that the mixing valve will function as a Venturi mixer during the full load range of engines sufficiently large to demand more fuel-air mixture than is represented by the normal movement range of the interconnecting air-gas mixing valve. This is for the reason that the Venturi action has little or no effect during light load operations of the engine, at which time the mechanical mixing valve controls the volume of mixture.

It is also to be pointed out that when the structure is assembled the mixer has been designed in a manner to insure that the mixing device will function on a great variety of engine sizes, and due to the interchangeability of parts it is possible to adjust the air flow velocity and volume in definite ratio to the fuel volume. As for ex-

ample, the mixing valve can be arranged and adjusted to provide a lean mixture during light load range of operation of the engine as an economy feature with assurance that during the heavy load range the volume of air required will be sufficiently great to impart a velocity at the Venturi restriction and thereby give a rich mixture during the heavy load range of the engine. It will be appreciated that since lean fuel mixtures are destructive during the heavy load engine ranges the Venturi element will act as an overload safety factor.

When the structure is assembled it may be directly connected with a fuel supply through the extension member 43' within which the fuel passageway 43 occurs, after which suction of the engine as permitted by movement of the butterfly throttle valve 28 will tend to draw downwardly upon the air valve 54 and move the fuel valve 59 downwardly and in unison and automatically provide a desired mixture of air and gaseous fuel which is then drawn by suction into the engine.

It will thus be seen that the fuel mixture structure here disclosed provides a device which may be readily adapted and applied to engines of a great variety of sizes and fuel demands, and that by the use of a relatively few parts maintained in stock it will be possible to meet the requirements of a great many engines without making it necessary to maintain a large and expensive stock of completely assembled mixers.

While I have shown the preferred form of my invention as now known to me, it will be understood that various changes may be made in combination, construction and arrangement of parts by those skilled in the art without departing from the spirit of my invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A gaseous fuel mixer adapted to be applied to an internal combustion engine, comprising a housing, a fluid passageway centrally thereof, an air valve seat at the upper end of said passageway, a fuel valve seat at a point intermediate the ends of said passageway, an air valve adapted to move against the air valve seat, a fuel valve adapted to move upwardly toward a closed position with relation to the fuel valve seat, said valves moving in unison, yieldable means urging said valves to their seated positions, a Venturi throat structure disposed beneath said fluid valve seat and into the restricted area of which the fluid valve may move, means supplying fuel to said fuel valve and whereby the fuel and air will be mixed together and will pass downwardly

through said Venturi throat when the fuel and air valves are opened, and a throttle valve disposed in the air passageway between said Venturi throat and an internal combustion engine upon which the device is adapted to be mounted.

2. The structure of claim 1 including said Venturi throat having a restricted section of uniform diameter and along which the fuel valve moves.

3. The structure of claim 1 including said Venturi throat having a restricted section of uniform diameter and along which the fuel valve moves, the length of said throat portion being less than the length of travel of the fuel valve, whereby the fuel valve will move beyond said length and allow free flow of the gaseous fuel to the throttle.

4. The structure of claim 1 including said Venturi throat having a restricted section of uniform diameter and along which the fuel valve moves, an idling fuel duct leading from a fuel supply conduit, and valve means associated with the main fuel valve to positively close said duct when the main fuel valve is closed.

5. A gas and air fuel mixer, comprising a main housing having an air inlet passageway at its upper end and an air outlet passageway at its lower end, an air valve seat adjacent to the upper end of said passageway, an air valve therefor, a throttle valve at the lower end of said passageway, the walls of said passageway tapering downwardly and inwardly, a fuel valve seat intermediate the air valve and the throttle valve and including a downwardly presented cylindrical bore forming an annular valve seat at its lower end and having a lateral fuel conduit communicating therewith at a point above said seat, a fuel valve adapted to move into said bore, said valve having an upper upwardly and inwardly tapered frustoconical length and a lower cylindrical length substantially fitting said bore when in its full seated position, a Venturi throat section disposed below said seat and extending downwardly into the tapered throat of the main air passageway and having a central cylindrical bore into which the fuel valve may move, a connection between the air valve and throttle valve whereby they will move in unison and yieldable means tending to urge said valves toward their seated positions in opposition to suction action exerted by an engine connected to the lower end of the Venturi throat, said suction acting to draw air downwardly through the air valve and the fuel valve and to mix the air with the fuel admitted through the fuel valve.

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