

Sept. 18, 1956

F. E. PILLING ET AL
GAS CARBURETOR

2,763,538

Filed May 22, 1951

2 Sheets-Sheet 1

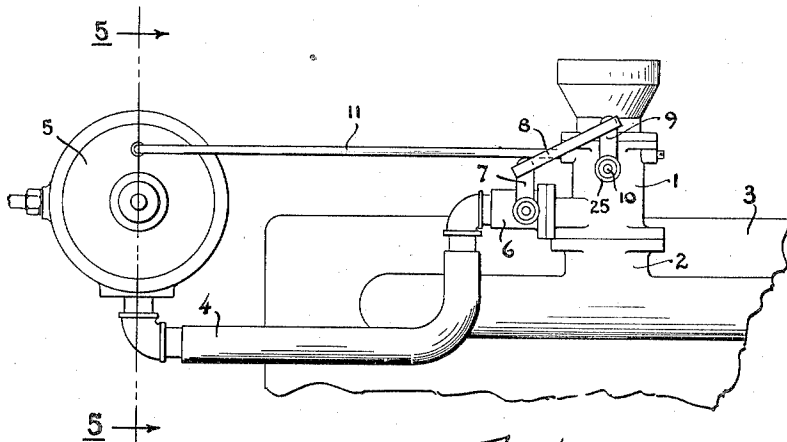


Fig. 1.

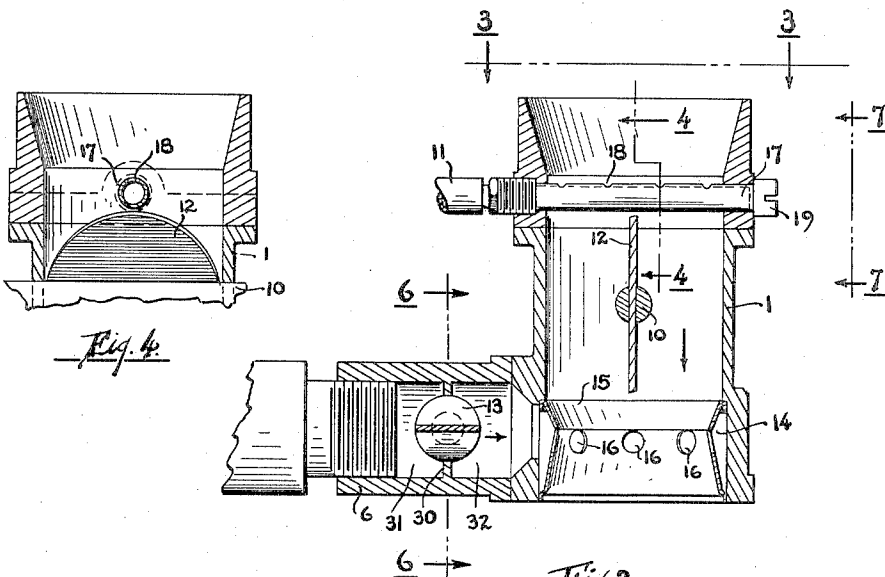


Fig. 2.

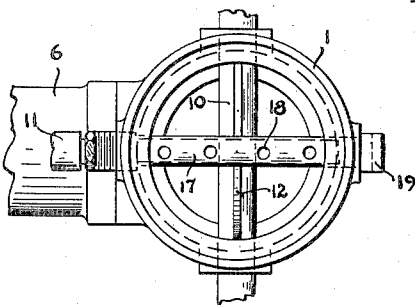


Fig. 3.

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2 Sheets-Sheet 2

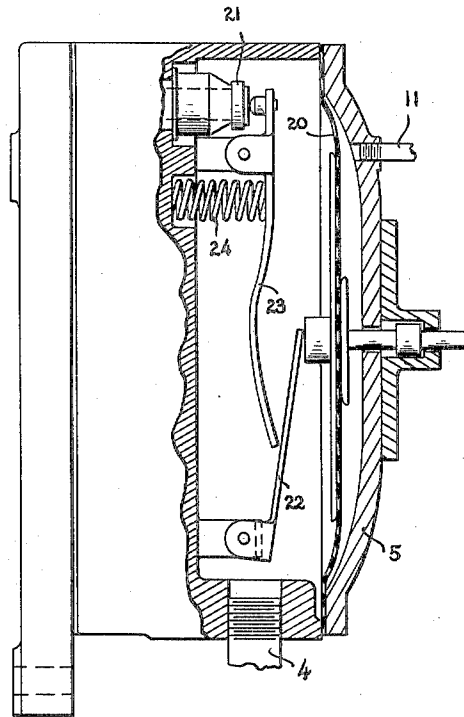


Fig. 5.

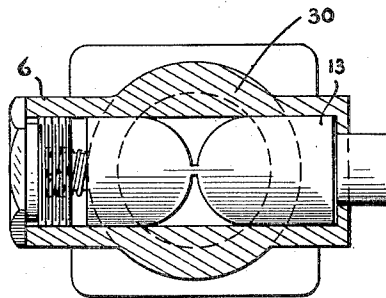


Fig. 6.

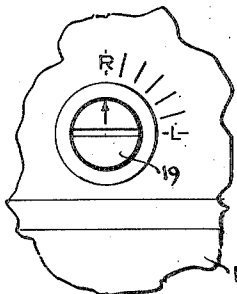


Fig. 7.

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GAS CARBURETOR

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Application May 22, 1951, Serial No. 227,616

4 Claims. (Cl. 48—184)

This invention relates to carburetion for internal combustion engine and particularly to an improved carburetion system for liquified gases such as for butane or liquid propane.

It is an object of this invention to provide a liquified gas carburetor having improved control of the combustion mixture of gas and air.

It is another object of this invention to provide a liquified gas carburetor in which the fuel gas is metered into the combustion air stream downstream from the throttle valve.

It is another object of this invention to provide in a liquified gas carburetor means for controlling accurately the richness of the fuel gas-air mixture for all flow rates of the carburetor.

It is another object of this invention to provide a liquified gas carburetor having predeterminable gas to air mixture ratios for all throttle openings.

It is another object of this invention to provide a liquified gas carburetor in which the richness of the fuel gas-air mixture is controlled in response to the rate of air flow through the carburetor.

It is another object of this invention to provide a liquified gas carburetor in which the richness of the fuel gas-air mixture is optimum when substantial power is required of the engine and somewhat richer or leaner when the engine is idling.

It is another object of this invention to provide an improved metering valve for a vaporized liquified petroleum gas carburetor.

Other objects of the invention will become apparent from the following description taken in connection with the accompanying drawings in which:

Figure 1 is an elevational view of the invention installed on an internal combustion engine,

Figure 2 is a vertical sectional view of the invention,

Figure 3 is a plan view of the device taken at 3—3 in Figure 2,

Figure 4 is a fragmentary section taken at 4—4 in Figure 2,

Figure 5 is a side elevation view partly in section taken at 5—5 in Figure 1,

Figure 6 is a sectional view taken at 6—6 in Figure 2, and

Figure 7 is a fragmentary view of the invention taken at 7—7 in Figure 2.

Referring now to Figure 1, carburetor body 1 is attached to manifold 2 of internal combustion engine 3. Vaporized liquified petroleum gas is introduced into carburetor 1 by means of fuel conduit 4 through pressure regulated valve 5 and metering valve 6. Metering valve 6 is actuated by lever 7 attached by drag link 8 to lever 9 connected to shaft 10 of the carburetor throttle valve. Pressure regulated valve 5 is connected to carburetor body 1 by vacuum line 11.

Referring now to the remaining figures and particularly to Figure 2, butterfly valve element 12 attached to shaft 10 controls flow of air through body section 1 of the car-

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buretor. Shaft 10 is connected by drag link 8 to lever 7 which in turn is connected to valve element 13 of rotary valve 6, so that rotary valve 6 opens when butterfly valve element 12 opens and at the same rate valve 6 is formed by drilling coaxial passages 31 and 32 in body 6, leaving web 30 through the center of which is disposed rotary valve element 13. Vaporized liquified petroleum gas flows through valve 6 and into annular chamber 14 separated from the interior of body 1 by spray ring 15 of venturi form having evenly spaced holes 16 on the downstream side thereof. Upwardly from butterfly valve element 12 and positioned athwart carburetor body 1 is cylindrical tube 17 having a plurality of evenly spaced holes 18 on one side thereof. Cylindrical tube 17 is rotatable in body 1 by means of slot 19 and communicates with vacuum line 11 which is also connected to pressure regulator valve 5 shown in detail in Figure 5.

Referring now to Figure 5, vacuum from line 11 actuates diaphragm 20 which in turn actuates inlet valve 21 through levers 22 and 23 restrained by compression spring 24. The lower side of diaphragm 20 is subject to vacuum from fuel conduit 4 so that movement of the diaphragm and hence flow of fuel gas through the pressure regulator is governed by the difference between the vacuum due to tube 17 and the vacuum communicated through conduit 4.

In operation, the device functions as follows: Body 1 is typically attached to the engine intake manifold so that air is drawn through body 1 in the downward direction in Figure 2. Body 1 could however, be mounted in any other convenient position. Motion of the indrawn air through venturi insert 15 causes fuel gas to be drawn into body 1 in a proportion to the air drawn determined by the opening of valve 6 and butterfly valve 12. As shown in Figure 6, valve element 13 is shaped like the intersection of a right circular cylinder with two nearly tangent half-cylinders. It may readily be appreciated that the shape of valve element 13 may be varied somewhat to suit varied operational conditions. The natural result of this valve configuration is that as valve 6 is opened in unison with butterfly valve 12, the increased flow of air through the valve is matched by a proportionate increase in flow of fuel gas through valve 6. By means of stop 25 shown in Figure 1, both butterfly valve 12 and rotary valve 6 are held slightly open when the engine is idling and drag link 8 is adjustable to the proper length so that the proper proportion of air to fuel gas is supplied to the intake manifold for economical idling.

Although the increase of flow of fuel gas through rotary valve 6 is proportional to the increase of flow of air through butterfly valve 12 as these valves are opened, machining tolerances, atmospheric conditions as affected by altitude, temperature, and humidity and the condition of the engine as determined by wear, age, and type, may cause the mixture ratio of fuel gas to air to be other than optimum at full throttle. To allow very fine and exact adjustment of the fuel gas to air ratio at full throttle, tube 17, line 11, diaphragm 20, and inlet valve 21 are provided. The combination of these elements with the other parts of the carburetor permit a precise adjustment of richness of the fuel gas to air ratio thus allowing predetermined power at full throttle. As will be presently disclosed, this richness adjustment is of no effect when the engine is idling but is highly effective when the engine is operating at or near full throttle.

Referring now to Figures 1, 2, and 5, when air is being drawn through the carburetor at a relatively high rate, as when the throttle is open or nearly open, the flow of air past holes 18 in tube 17 causes a partial vacuum therein, which vacuum may be adjusted in amount by rotation of tube 17. If tube 17 is in the position shown in Figure 2, actually no measurable vacuum is

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created in line 11. As tube 17 is rotated a significant vacuum is created and increases in amount until a maximum vacuum is realized when holes 18 are at right angles to direction of the air stream. Now this vacuum is communicated to the upper side of diaphragm 20 which in turn controls the flow of fuel gas to the carburetor by means of valve 21. The lower side of diaphragm 20 is subject to the vacuum in fuel conduit 4 connected to body 1 through venturi insert 15. The natural effect of vacuum in conduit 4 is to pull diaphragm 20 inward allowing more fuel gas to enter through valve 21. However, to the extent that line 11 furnishes vacuum to the opposite side of diaphragm 20 the opening of valve 21 is retarded or prevented. Therefore at full or nearly full throttle, the angular position of holes 18 in tube 17, and hence the vacuum on the upper side of diaphragm 20, may be accurately adjusted until analysis of the exhaust gases indicates the desired mixture ratio has been attained. In other words, the screw driver adjustments of the angular position of tube 17, as shown in Figure 7, is really a trimming richness adjustment at full or nearly full throttle. The effect of this adjustment is greatest at full throttle but is also present at lesser throttle openings.

Although the invention has been described and illustrated in detail, it is to be clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the invention being limited only by the terms of the appended claims.

We claim:

1. Carburetion apparatus comprising a hollow cylinder reduced in cross-section at one end to form a constriction and adapted to be attached at that end to the intake manifold of an internal combustion engine, manifold means surrounding said constriction for introducing a gas into said cylinder immediately adjacent to said constriction and between said constriction and said intake manifold, a butterfly valve for controlling flow of air through said hollow cylinder, a gas valve for controlling flow of said gas into said cylinder, means for actuating said two valves together, a third valve for controlling flow of said gas before it enters said gas valve, a hollow tube placed diametrically near the non-constricted end of said hollow cylinder having a plurality of drilled holes on one side and rotatable in said hollow cylinder, and pressure regulator means responsive to the difference between the pressure in said hollow tube and the pressure in said manifold means for controlling flow of said gas through said third valve whereby rotation of said hollow tube is effective in achieving fine adjustment of the richness of the mixture of said gas and air.

2. In a gas carburetor having an air metering valve and a substantially cylindrical body section attached at its lower end to the intake manifold of an internal combustion engine flow of air through which is controlled by said air metering valve, means for controlling the richness of the gas-air mixture furnished to said intake manifold comprising a hollow manifold shaped to fit within said body section below said air metering valve and having inner surfaces adapted to form a venturi shape within said body section, the lower divergent section of said venturi shape being perforated to permit entry of gas from said manifold into said body section, a pressure regulator having a diaphragm responsive to differential pressure on the opposite sides thereof, and a valve operable in response to motion of said diaphragm, a hollow cylindrical tube perforated on one side rotatably placed athwart said body section above said air metering valve, a conduit for connecting said tube to the space on one side of said diaphragm and conduit means for connecting said manifold to the other side of said diaphragm whereby said richness may be controlled by rotation of said tube.

3. A liquefied gas carburetor comprising a cylindrical

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throat section adapted to be attached to the intake manifold of an internal combustion engine and defining the flow path of said air entering said intake manifold, a butterfly valve associated with said throat section so as to restrict the passage of air therethrough, a substantially cylindrical extension of said throat section extending downstream therefrom and having a cross-section area less than said throat section, a conduit for supplying a fuel gas to said reduced diameter section, a valve in said conduit for controlling the flow of fuel gas in said conduit, mechanical linkage means for controlling the motion of said butterfly valve in synchronism with the motion of said fuel gas valve, a pressure regulator for controlling flow of fuel gas to said fuel gas valve, an adjustable means, including a hollow tube, placed athwart said throat section and having a plurality of perforations along one side thereof and a conduit connecting said tube and said pressure regulator for controlling said pressure regulator in response to flow of air through said throat section to thereby adjustably control the mixture ratio of fuel gas and air passing through said carburetor throat section.

4. A carburetor comprising a cylindrical case having a venturi throat section of reduced diameter, a butterfly valve in said cylindrical case on the upstream side of said throat section, a manifold surrounding said throat section and communicating by means of a plurality of evenly spaced peripheral holes with said throat sections on the opposite side thereof from said butterfly valve, a hollow tube having a plurality of evenly spaced peripheral holes along one side thereof placed across said cylindrical case upstream from said butterfly valve and rotatable in said casing, a conduit for furnishing combustible gas to said manifold, a valve in said conduit for controlling flow of combustible fuel gas into said manifold, a mechanical linkage for opening and closing said gas valve and said butterfly valve together to provide substantially constant fuel gas to air ratio for all valve openings, a closed chamber, a diaphragm placed across said chamber, a conduit for connecting the space on one side of said diaphragm with said hollow tube, a conduit for connecting the space on the other side of said diaphragm to the inlet of said gas valve, conduit means for furnishing fuel gas to the side of said diaphragm to which said last named conduit is connected and valve means responsive to movement of said diaphragm for allowing flow of gas through said last named conduit whereby rotation of said tube causes sufficient variation in the movement of said diaphragm to provide adjustment of the richness of the fuel gas to air mixture at full open position of said butterfly valve and said gas valve.

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