Sept. 23, 1952 C. E. STREED 2,611,595

CARBURETOR

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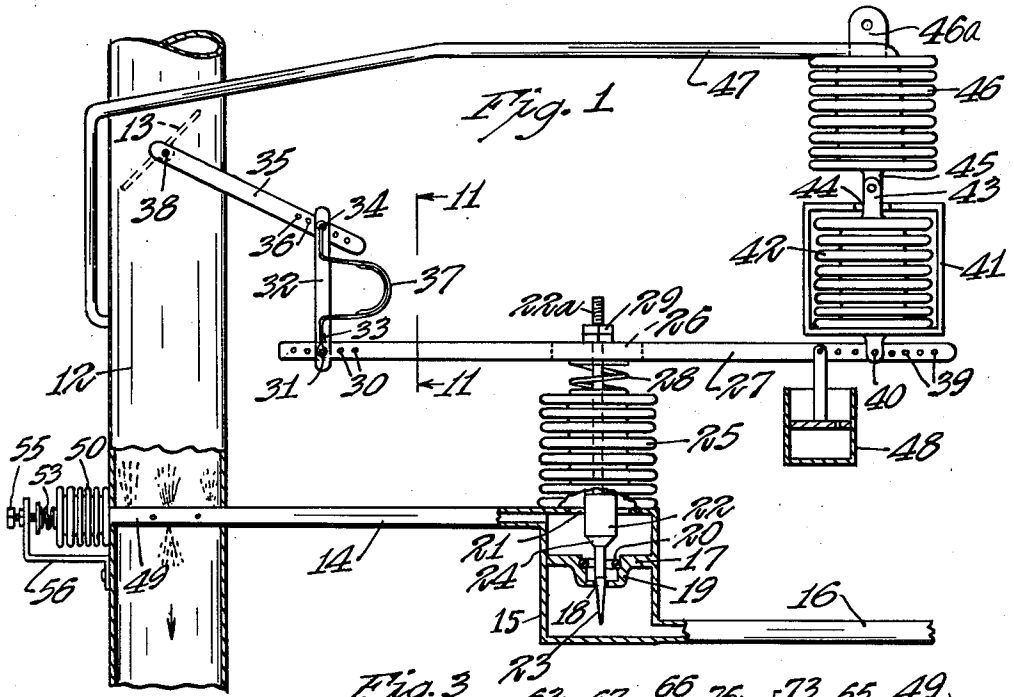


Fig. 1

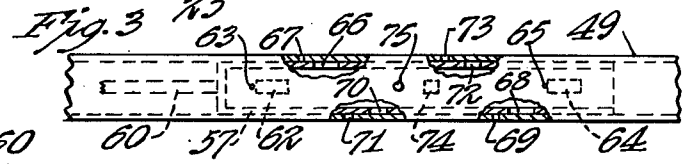


Fig. 3

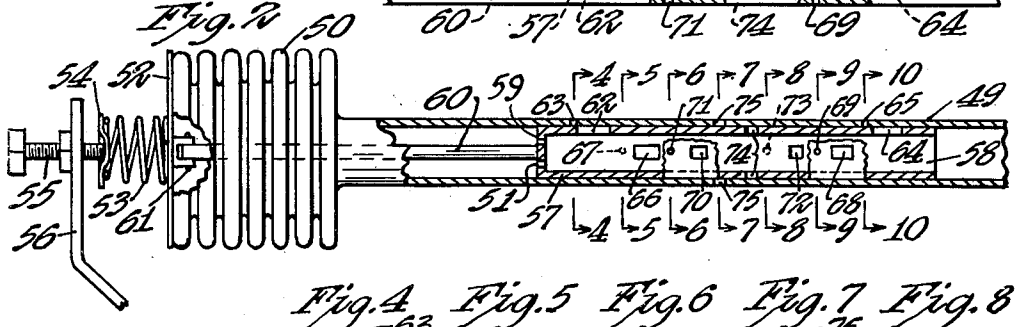


Fig. 2



Fig. 4 Fig. 5 Fig. 6 Fig. 7 Fig. 8

Fig. 11 Fig. 9 Fig. 10

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CARBURETOR

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3 Claims. (Cl. 261—50)

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This invention relates to carburetors or devices for mixing fuels with air in internal combustion engines.

It is a general object of the invention to provide a carburetor for internal combustion engines wherein the amount of fuel supplied is determined by the degree of throttle opening, the air pressure in the intake manifold, atmospheric pressure and the amount of pressure exerted upon the fuel supply itself and can be adapted for liquid or gaseous fuels. It is a fuel mixing or carbureting device which can be used in connection with an ordinary Venturi type carburetor with open jet or a pressure supply type, either inverted or upright, and is not affected by its position or angle.

One object of the invention is to provide a carburetor of such construction as to maintain such a ratio between the air and the fuel supplied to the internal combustion engine as will operate the engine at the highest efficiency under all conditions of speed and load.

Another object is to provide a novel method of supplying and mixing the air and fuel charged to an internal combustion engine which consists in varying the fuel supplied in proportion to balanced forces determining the air supplied and created by the throttling of the air supply and the suction pressure exerted on the charge by the engine.

Another object of the invention is to provide greater accuracy through metering of fuel under a controlled pressure.

A further object of the invention is to provide a fuel supply and control under pressure which is sealed so that fuels of high volatility or gaseous fuels can be efficiently handled.

It is a further object of the invention to provide means for metering fuel under pressure which will also allow the use of fuels of high viscosity.

A further object of the invention is to provide means for producing a lean-rich mixture adjustment responsive to changes in weather and engine temperatures.

Still a further object of the invention is to provide a fuel supply nozzle structure of extreme accuracy and efficiency.

The above and other objects and advantages of the invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to the same parts throughout the views, and, in which:

Figure 1 is a side elevational view of portions broken away and in section of an embodiment of the invention combined with an engine air intake and throttle;

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Figure 2 is an enlarged side elevational view partially in longitudinal section of the spray nozzle;

Figure 3 is a plan view of the nozzle element with portions in section;

Figures 4 through 10 are enlarged transverse sections taken approximately on the lines 4—4 through 10—10 in Figure 2; and

Figure 11 is an enlarged section taken on the line 11—11 of Figure 1.

In Figure 1 there is shown a fuel intake or supply conduit 12 through which fuel flows to the engine. In the illustrated embodiment air enters the conduit through an air intake at the upper end of the same, it being assumed that the fuel intake conduit communicates with an internal combustion engine at its lower end, flow through the conduit being as indicated by the arrow. A conventional butterfly throttle valve 13 controls the flow of air from the air intake through the fuel intake conduit 12.

Communicating with the interior of the fuel intake or supply conduit 12 is a liquid fuel conduit 14 leading from a valve chamber 15. The valve chamber 15 is supplied by liquid fuel from a suitable source under pressure such as a pump, not shown, through a conduit 16. The valve chamber 15 is provided with a partition 17 having a valve port 18 therethrough which is formed at the bottom of a central cup-like portion 19 in the partition 17. A synthetic rubber sealing ring 20 is disposed in the upper portion of the cup 19. An opening 21 is formed in the upper end of the valve chamber 15 and through which extends a valve rod 22 having a tapered lowered end 23 extending through the port 18 and also having a frusto-conical shoulder portion 24 adapted to seat against the synthetic rubber ring 20. The valve rod 22 has a reduced upper portion 22a which extends through the closed upper end of an expansible bellows 25 and through a slot 26 in a valve operating member in the form of a lever 27. A compression spring 28 is interposed between the upper end of the bellows 25 and the under side of the valve operating member 27. A pair of locking nuts 29 are threaded on the upper end of the valve rod extension 22a and bear against the upper side of the valve operating member 27.

The left hand end of the valve operating member 27 is provided with a series of apertures 30 to selectively receive a pivot pin 31 which con-

nects said member 27 to a link 32. The link 32 is provided with a lower slotted portion 33 through which the pivot pin 31 extends so that the link 32 is longitudinally movable relative to the valve operating member 27. The upper end of the link 32 is pivotally connected at 34 to a lever 35 having a series of longitudinally spaced apertures 36 to selectively receive said pivot pin 34. Connected between the pivot pins 31 and 34 is a bent thermoleaf 37 which, upon expansion and contraction, will shift the pivot pin 31 in the slotted portion 33 of the link 32 to vary the distance between the pivot pins 31 and 34, thereby varying the relative movements of said valve operating member 27 and said lever 35. The left hand end of the lever 35 is connected to a pivot 38 of the butterfly throttle valve 13.

At the right hand end of the valve operating member 27 is a series of apertures 39 which selectively receive the connector pin 40 and secures the operating member 27 to the lower end of a cage 41. Lying in the cage 41 is a bellows 42 which is sealed and expansible or collapsible in response to changes in atmospheric pressure. A tongue 43 extends upwardly through an opening 44 in the top of the cage 41 and is connected to a cooperating tongue 45 on the lower end of another bellows 46. The bellows 46 is connected at its upper end to a bracket 46a which is adapted to be anchored to any suitable adjacent stationary structure. The interior of the bellows 46 is connected by a tube 47 to the interior of the fuel intake conduit 12 at the engine side of and below the throttle valve 13, as shown in the drawing. Also connected to the right hand end of the valve operating member 27 is a dashpot unit generally indicated at 48 for retarding movement of the right hand end of said valve operating member 27.

The liquid fuel conduit 14 extends into the fuel intake or supply conduit 12 and is provided with a nozzle or outlet end 49. Mounted on the left hand end of the nozzle portion 49 of the conduit 14 is a bellows 50 which has its interior connected to the interior of the conduit 14. The left hand end of the bellows 50 is provided with an end plate 52 against which bears a spring 53 having a spring cap 54 engaged by a bolt 55 which is threaded through a bracket 56 mounted on the side of the fuel intake or supply conduit 12.

Slidably mounted in the nozzle portion 49 of the liquid fuel conduit 14 is a hollow piston 57 having an open right hand end 58 and a left hand end member 59 with openings 51 therethrough. A piston rod 60 is connected to the left hand end 59 of the piston 57 and it extends through the left hand end of the tubular nozzle portion 49, through the wall of the fuel intake or supply conduit 12 and through the bellows 50 to connect with the bellows end plate 52, as shown at 61.

The cylindrical side wall of the hollow piston 57 is provided with a plurality of apertures 62, 64, 66, 68, 70, 72 and a pair of upwardly oppositely disposed apertures 74. The jet section 49 of the liquid fuel conduit 14 is provided with a plurality of apertures 63, 65, 67, 69, 71, 73 and an oppositely upper and lower pair of apertures 75.

The piston aperture 62 is so positioned relative to the jet aperture 63 that when the piston is moved to the left, said apertures will coincide permitting fuel to pass therethrough, the remaining apertures being closed. Continued movement of the pistons to the left will successively bring the remaining piston apertures 64, 66, 68, 70, 72 and 74 into registration with the jet apertures 65, 67, 69, 71, 73 and 75 respectively and in that order. The increasing lengths of the piston apertures 62 through 74 in reverse order permit the final opening of all of the jet apertures at the same time. It should be noted that the first two jet apertures with which communication is established are the most widely spaced ones, the next two are the next widely spaced, and so on until the upper and lower central jet apertures 75 are opened. Obviously as the piston 57 is moved back to the right the apertures will be closed in reverse order.

With the apparatus installed, as shown, a mechanical actuation of the throttle valve 13 in the customary manner will increase or decrease the flow capacity of the air downwardly from the air inlet through the fuel supply conduit 12. Movement of the throttle valve 13 is transmitted through the lever 35 and link 32 to the valve operating member 27 which will depress or raise the valve 22 in the liquid fuel supply line. When the internal combustion engine is cut off and the throttle is closed, suction in the line 47 and bellows 46 will return to zero. The bellows 46 will expand, lowering the valve operating member 27, permitting the frusto-conical valve 24 to seat against the sealing ring 20, thereby completely closing the liquid fuel supply line so that there is no leakage or drippage of fuel in the fuel jet unit 49. When the engine is in operation with normal intake manifold suction in bellows 46, causing said bellows to be shortened in direct proportion to the amount of suction in said bellows 46, and the throttle is in one of its degrees of open position the frusto-conical valve portion 24 is unseated and the flow of liquid fuel is metered by the tapered valve end 23 which extends through the valve port 18. Changes in the throttle position 13 will also result in changes in position of the tapered valve end 23 relative to said port 18. Furthermore, changes in temperature of the internal combustion engine upon which the carburetor is mounted will cause the thermal element 37 to expand and contract, thereby varying the relative movement of the throttle 13 and valve 22. As the motor becomes warmer the thermal element 37 will expand and tend to close the valve 22 to some extent, thereby reducing the amount of fuel flow which previously was required with the cooler engine temperature.

When the engine begins to operate the cylinders thereof will demand air setting up a suction in the fuel intake conduit 12 which is reflected in the bellows 46. A greater degree of suction or negative pressure will contract the bellows 46, lifting the right hand end of the valve operating member 27 and increasing the liquid fuel flow through the valve port 18. With any fixed opening an increase in suction on the engine side of the air flow control valve 13 will result in an increased flow or volume of air past said valve 13. This increased suction will act on the bellows 46 raising the operating arm 27 and increasing the flow of fuel through the valve port 18, thereby maintaining a uniform ratio of fuel to air under varying load conditions. When the throttle 13 is closed to an idling position, the lever 35, link 32 and valve operating member 27 will move the metering pin 22 toward a closed position, thereby over-

coming the tendency of the increased negative intake pressure to influence the bellows **46** and open the metering pin. There is also means provided for compensating for fluctuations in atmospheric pressures. At lower elevations the higher atmospheric pressure will compress the bellows **42**, thereby pulling upwardly on the right hand end of the valve operating lever **27** and increasing the fuel supply. Naturally, with lower atmospheric pressures at higher altitudes the bellows **42** will expand pushing the operating lever **27** down and decreasing the fuel supply in proportion to the decreased or more rarified air supply entering the conduit **12**. The dashpot **48** serves to make the action of the right hand end of the lever **27** more smooth and gradual, particularly in connection with operation of the engine intake pressure responsive bellows **46**.

Referring to Figure 2 it will be seen that the fuel under pressure in the conduit **14** passes through the piston **47** so that there is an equal pressure on both sides thereof. However, at the left hand side of the piston **57** is the expansible bellows **50** which will pull the piston **57** to the left when the jet apertures are closed. This will progressively open the jet apertures **63, 65, 67, 69, 71** and **73**, and finally the upper and lower pair of jet apertures **75**. The jet tube **49** provides a multidirectional jet spray as indicated by the positions of the jets in Figures 2 through 10. Furthermore, the most widely spaced jets are opened first, the next widely spaced jets are next opened, and so on until the upper and lower central jets **75** are opened at which time, as stated above, they are all open. It is preferred that the total capacity of jets **63, 65, 67, 69, 71** and **73** be sufficient for normal fuel demands and flow, the jets **75**, however, being provided to take care of anything above normal demand and flow and sufficient to take care of the greatest demand and flow.

It must also be noted that the location of the jet assembly **49, 50, 57** is not restricted to any position or location relative to the other parts of the carburetor, but may be near or distant, high or low as may be desired.

I have provided a carburetor construction wherein fuel may be supplied under pressure past a valve which operates in the liquid or gaseous fuel under pressure to supply fuel jet apertures arranged in such a manner as to produce the most advantageous mixture of fuel and intake air. The fuel control valve is operated in response to movement of the air throttle valve, engine temperature, air intake pressure and atmospheric pressure so that the correct proportions of fuel and air are provided regardless of any change in conditions with the exception of changes in humidity in the air. Such an apparatus not only utilizes fuel to the greatest economical advantage but it also produces more efficient and smoother motor operation.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What I claim is:

1. A fuel and air mixing and supply mechanism for internal combustion engines comprising a fuel mixture intake conduit defining an unrestricted passage leading to the engine and having an air intake opening, a throttle valve controlling the flow of air from said air intake opening through said intake conduit, means for introducing liquid fuel into said intake conduit under pressure, a liquid fuel valve controlling the flow through said liquid fuel introducing means, an operating lever for said liquid fuel valve, means connecting one arm of said operating lever to said throttle valve and exerting force on that arm of the lever to tend to open and close said liquid fuel valve as said throttle valve is respectively opened and closed, and a pressure responsive unit responsive to pressure changes in said intake conduit at the engine side of said throttle valve and acting on the other arm of said lever and tending to open and close said liquid fuel valve as the suction in said intake conduit respectively increases and decreases, and means connecting said operating lever to said liquid fuel valve between said two arms to transmit the resultant of the forces exerted by said throttle valve connecting means and said pressure responsive unit on said lever to the liquid fuel valve.

2. A fuel and air mixing and supply mechanism for internal combustion engines comprising a fuel mixture intake conduit defining an unrestricted passage leading to the engine and having an air intake opening, a throttle valve controlling the flow of air from said air intake opening through said intake conduit, means for introducing liquid fuel into said intake conduit under pressure, a liquid fuel valve controlling the flow through said fuel introducing means, a floating operating lever having an intermediate point connected to said fuel valve for swinging movement relative thereto and acting to open said valve as said intermediate point of said lever is moved in a first direction and acting to close said valve as the intermediate point of the lever is moved in a second direction, a linkage connecting said lever at one side of said intermediate point to said throttle valve and tending to move the intermediate portion of said lever in the first direction as the throttle valve is more widely opened and tending to move the intermediate portion of said lever in the second direction as the throttle valve moves toward a closed position, a pressure responsive unit connected to said intake conduit at the discharge side of the same relative to said throttle valve, said pressure responsive unit including a movable part connected to said operating lever at the opposite side of said intermediate point from the point of connection of said linkage thereto and tending to move the intermediate portion of said lever in the first direction as the suction in said intake conduit beyond said throttle valve increases and tending to move the intermediate portion of said lever in the second direction as the suction in said fuel intake conduit beyond said throttle valve decreases.

3. A fuel and air mixing and supply mechanism for internal combustion engines comprising a fuel mixture intake conduit defining an unrestricted passage leading to the engine and having an air intake opening, a throttle valve controlling the flow of air from said air intake opening through said intake conduit, means for introducing liquid fuel into said intake conduit under pressure, a liquid fuel valve controlling the flow through said fuel introducing means and having a valve stem projecting thereabove for opening the fuel valve on up movement and closing the fuel valve on down movement, a lever above said fuel valve pivotally connected at an intermediate portion thereof to said fuel valve stem, a linkage connecting one end portion of said lever to said throttle valve and swinging the end of the lever to which it is connected upwardly as the throttle

valve opens and swinging the end of the lever to which it is connected downwardly as the throttle valve closes, a pressure actuated member connected to the other end portion of said lever and mounted above the lever, and means controlling the actuation of said suction actuated member from the pressure within said intake conduit at the engine side of said throttle valve and causing said pressure actuated member to raise as the suction within said intake conduit beyond the throttle valve increases and causing said pressure actuated member to lower as the suction in said intake conduit beyond said throttle valve decreases.

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