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2,128,079

CARBURETOR

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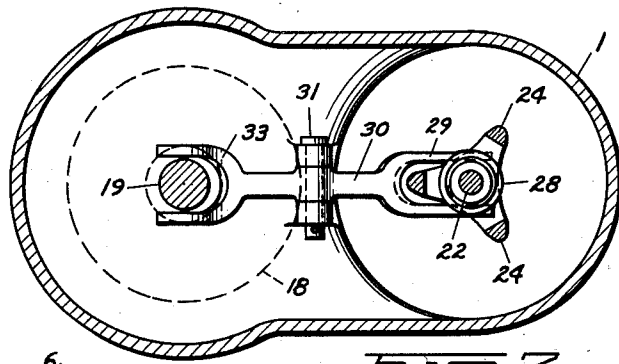


FIG. 2.

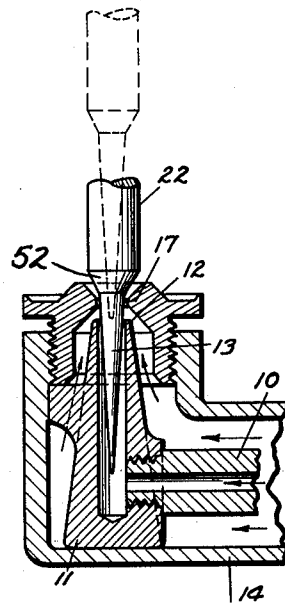


FIG. 3.

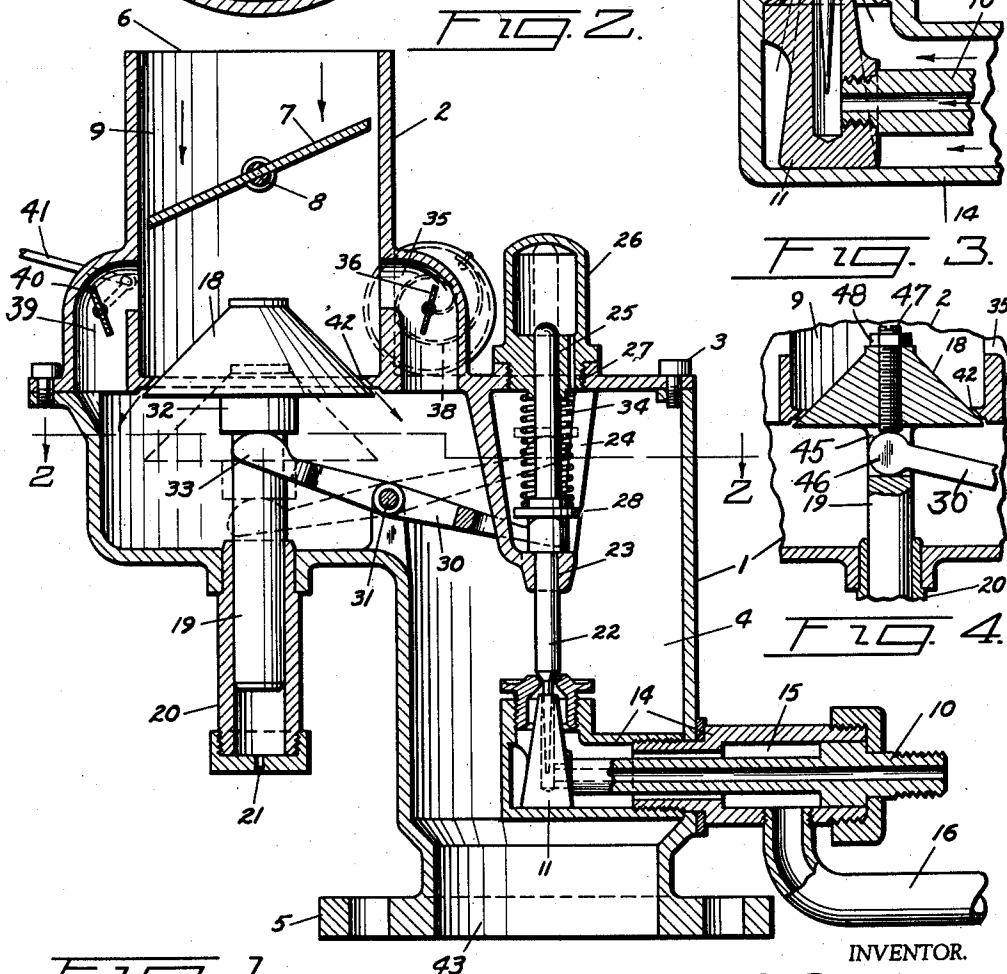


FIG. 1.

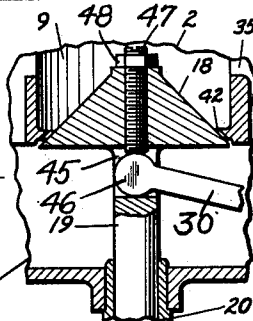


FIG. 4.

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CARBURETOR

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4 Claims. (Cl. 261—50)

This invention relates to a fuel carburetor for an internal combustion engine.

It is an object of this invention to produce a carburetor for an internal combustion engine which will produce a highly atomized mixture of fuel and air regardless of whether the fuel is gasoline or the high boiling distillates such as the numerous fuel oils which are burned both in domestic as well as in industrial heating plants including such fuels as kerosene and fuel oils No. 1, 2 and 3 such as are commonly used in domestic and industrial oil burners.

It is also an object of this invention to produce a fuel carburetor for an internal combustion engine which is highly efficient in producing an atomized mixture of fuel and air thereby effecting economies in the operation of the engine as well as a smoother running of the engine.

Another object of this invention is the production of a carburetor which is simple in structure and which will produce a uniform mixture of fuel and air at all speeds of the engine.

This invention also contemplates a carburetor that will produce a uniform mixture of fuel and air regardless of whether the carburetor is positioned right side up as occurs when the injector is used for an automobile engine and the vehicle is traveling on a level road, or upside down as would often occur when the carburetor is used for an aeroplane engine, or in some intermediate angular position as very often occurs when the automobile is driving along a road with a rounded surface, uphill, or around a curve in a road which is banked.

In the drawing:

Fig. 1 is a vertical section through the carburetor showing the injector in idling position in the full lines and in wide open position in the dotted lines.

Fig. 2 is a section along the line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary detail of the needle valve and fuel inlet.

Fig. 4 is a detail showing of a modified form of the connection between the air valve and counterbalancing lever.

Referring more particularly to the drawing it will be seen that the carburetor comprises the outer shell portions 1 and 2 which are secured together by any suitable means such as the screws 3. The shell portion 1 encompasses the mixing chamber 4 where the fuel is atomized and mixed with air. The shell portion 1 is provided with a suitable flange 5 which may be bolted or otherwise secured to the intake manifold of the internal combustion engine with which this carburetor is used. The shell 2 is open at its upper end as at 6 to provide an opening through which the air passes into the air intake passageway 9 encompassed by the shell 2. The upper end 6

of the shell 2 may be provided with any suitable conventional air cleaner and silencer.

The air inlet is provided with the usual butterfly valve 7 which is pivoted to swing on the pin 8. The butterfly valve 7 may be manually controlled by a hand throttle or by a foot control in the form of a conventional accelerator pedal.

Any suitable fuel pump may be used for supplying the carburetor with fuel. To this end the fuel line 10 is connected directly to the fuel pump so that the fuel is supplied to the carburetor under positive pressure. The end of the fuel line 10 (Fig. 3) is provided with a nipple 11. The nipple 11 has a fuel inlet orifice 12 which is controlled by the needle valve 13.

It is proposed to heat the fuel preparatory to injecting it into the mixing chamber. Therefore the fuel line 10 and nipple 11 are surrounded by a tubular casing 14 which encompasses a heating chamber 15. A pipe line 16 is threaded into the casing 14 for supplying heat to the chamber 15. The heat units which are supplied to the chamber 15 may take the form of hot air or steam but preferably the line 16 is connected with the exhaust manifold so that a small supply of exhaust gases under pressure is conducted by the line 16 into chamber 15, thence past the fuel inlet orifice 12 and through the orifice 17 which is also controlled by the needle valve 13. The exhaust gases are preferably used as a source for preheating the fuel because of their high water content. The exhaust gases in passing by the orifice 12 and nipple 11 have an aspirating effect on the fuel supplied to the nipple 11 by the fuel line 10. However, the positive pressure of the fuel pump is relied upon primarily for injecting the fuel into the mixing chamber 4.

In view of the fact that this invention contemplates a carburetor which will produce a uniform mixture of air and fuel at all motor speeds, to this end the injection of fuel and the admission of air into the mixing chamber 4 are at all times coordinated so that the mixture will remain uniform. The mixture of gasoline and air may be according to any proper ratio such as fifteen pounds of air to one pound of gasoline and this ratio, of course, will be varied depending upon the type of fuel used. To this end the air intake passageway 9 is provided with a control valve which takes the form of a conical valve 18 mounted on the stem 19. The stem 19 is reciprocally mounted in the cylinder 20 provided with a breathing port 21. The needle valve 13 is provided with a stem 22 which is reciprocally mounted in the guideway 23 provided by the spider 24. The upper end of the stem 22 is also guided as at 25 in the closure cap 26 which is threaded into the carburetor shell as at 27. The stem of the needle valve is also provided with a shoulder 28 which is seated upon the bifurcated

end 29 of lever 30 which is pivoted within the carburetor shell upon the pin 31. The stem 19 of the valve 18 is provided with a shoulder 34 which is seated upon the other bifurcated end 33 of the lever 30.

Threaded over the upper end of the stem 22 and positioned between the shoulder 23 and the closure member 26 is a coil spring 34. The tension of this coil spring 34 is gauged so that the valve 18 is held closed when the engine is not running but will open as soon as sufficient vacuum is created in the mixing chamber 4 to draw air through the intake passageway 9. The coil spring 34 is tensioned relative to the weight of the needle valve stem 22 and valve 18 and stem 19 to make the valve 18 highly responsive or sensitive to the kinetic energy or force of the air passing through the intake passageway 9 into the mixing chamber 4. The butterfly valve 7 controls the amount of the air which is permitted to pass through the intake passageway 9 and therefore the amount of the displacement of the valve 18 corresponds to the amount that the butterfly valve 7 has opened. As shown in the full lines the butterfly valve 7 and valve 18 are approximately in idling position. The dotted line showing of the valve 18 shows the position of the valve when the butterfly valve 7 is wide open.

There are times, such as in the summer time or in tropical regions, where due to the heat the density of the air is reduced sufficiently to require the admission of an additional amount of air in the mixing chamber 4. To this end the carburetor is provided with a bypass passageway 35 which permits air to pass around the valve 18 directly from the intake passageway 9 into the mixing chamber 4. The bypass passageway 35 is controlled by a butterfly valve 36. This butterfly valve 36 is controlled by a thermostatic bimetal element 38. Normally the valve 36 will remain closed thus shutting off the bypass passageway 35. However, when the temperature of the air under the hood passes a predetermined point the bimetal element 38 will respond to this predetermining temperature and begin to open the valve 36. The thermostatic bimetal element 38 will be fabricated and regulated so that upon additional increase in temperature the valve 36 will open further corresponding to the increase in temperature. The thermostatic element 38 will start opening the valve 36 at approximately 60° F. under hood temperature and will completely open the valve at about 200° F. under hood temperature. This temperature range in which the thermostatic bimetal element 38 begins to open and completely opens or begins to close and completely closes the valve 36 will vary with the fuel used.

An additional by-passageway 39 is provided around the valve 18. This passageway 39 is provided with a butterfly valve 40 manually controlled by the rod 41 which leads to the instrument board of the automotive vehicle. This manually controlled by-passageway 39 will normally be closed but will be opened whenever the carburetor or engine are operating in high altitudes where the rarification or lower density necessitates the admission of additional quantities of air into the mixing chamber 4 to maintain the desired uniformity of mixture of atomized fuel and air.

As shown in Fig. 4, the valve stem 19 is provided with a slot 45 which receives the disc shaped end 46 of the lever 30. The valve 18 is drilled and tapped to receive the set screw 47 and the

lock nut 48. The lower end of the set screw 47 engages the disc end 46 of the lever 30 to provide an adjustable connection between the lever 30 and the valve stem 19. This connection between the lever 30 and valve stem 19 is positive so that the valve 18 must necessarily move back and forth with the lever arm 30.

In operation the carburetor functions as follows: When the engine is not running the valve 18 closes the air inlet port 42 and the needle valve 13 closes the fuel inlet orifice 12 and orifice 17. As soon as the motor is turned over a vacuum is created in the chamber 4 which causes the valve 18 to open which in turn operating through the lever 30 raises the needle valve 13 to open ports 12 and 17. The valve 13 now acts as a vane and the kinetic energy of the air flowing by valve 18 holds it open. As soon as ports 12 and 17 are opened, fuel is forced through the orifice 12 by the fuel pump and strikes against the conical portion 52 at the lower end of the needle valve stem 22 and at the same time exhaust gases pass upwardly into the chamber 4 about the nipple 11 through the orifice 17. This atomizes the fuel. A downward flow of air through the air passageway 9 and port 42 strikes the fuel thus intimately mixing the fuel with air before it passes through the outlet 43 into the intake manifold of the engine. As soon as the engine starts running this operation of the carburetor continues. However, hot exhaust gases will now be passed through the exhaust line 16 into the chamber 15 where the fuel will be preheated before being ejected through the orifice 12. At the same time the accelerated flow of exhaust gases through the orifice 17 will atomize the fuel and assist in its mixture in this highly atomized state with the air passing through the intake opening 42 into the mixing chamber 4 preparatory to passing through the outlet 43 into the intake manifold of the motor.

It will be noted that the needle valve 13 is tapered thus the higher the needle valve 13 is raised, as viewed in Figs. 1 and 3, the less the fuel inlet orifice 12 and orifice 17 are obstructed thus permitting a greater amount of fuel to be ejected through orifice 12 and a greater amount of exhaust gases and fuel to be ejected through orifice 17. In other words, the valve 13 meters the fuel as it is ejected into mixing chamber 4. The taper of the needle valve 13 and size of the orifices 12 and 17 are fabricated and gauged so that in any position of the valve 18 the corresponding position of the valve 13 will be such that the ratio of air admitted through the intake opening 42 and the fuel ejected through the orifices 12 and 17 into the mixing chamber will remain approximately constant thus insuring a uniform mixture of fuel and air at all operating speeds of the engine.

It is obvious from the above description that the further the butterfly valve 7 is open the further the valve 18 will open and in turn the further the needle valve 13 will be opened. It will be noted that the butterfly valve 7 is positioned above or ahead of the mixing chamber 4 and fuel inlet orifice 12 and 17. This positioning of the butterfly valve ahead of the mixing chamber is important because after the fuel is once atomized and mixed with the air in the mixing chamber 4 it is passed in this highly atomized mixed state directly into the intake manifold of the engine. This free passageway between the mixing chamber 4 and the intake manifold of the engine insures that the mixture will be fed into

the cylinders in its highly atomized state because any obstruction such as a butterfly valve between the mixing chamber and the intake manifold would cause the atomized fuel to condense and thereby would cause a certain amount of raw and unmixed fuel to pass through the manifold into the cylinders. The tubular casing 14 is preferably circular in cross section so that it presents what may be termed a stream line surface to the flow of high atomized mixture of fuel and air and therefore does not cause the fuel to condense on the surface of the tubular casing 14.

When the needle valve 13 completely closes fuel inlet orifice 12 as occurs when the butterfly valve 8 completely closes the air inlet 9, then as long as the motor continues to turn over, the fuel pump will, of course, continue to pump fuel but the fuel will be by-passed from the pressure or output side of the pump back around to the intake side of the pump in the well-known and conventional manner.

I claim:

1. A carburetor for atomizing fuel and mixing the same with air preparatory to being burned in an internal combustion engine comprising in combination a casing encompassing a mixing chamber having an air inlet and an outlet for the mixture of air and fuel, a valve for controlling the air inlet, means responsive to the flow of air passing through the air inlet, a fuel inlet for supplying fuel to the said mixing chamber where the fuel is atomized and mixed with the air, a chamber surrounding the fuel inlet and provided with an outlet spaced from the fuel inlet, means for supplying a gas to the last mentioned chamber surrounding the fuel inlet, the said fuel and gas passing through the opening in the last mentioned chamber into the mixing chamber and a needle valve for controlling both the fuel inlet and the gas outlet, and means interconnecting the fuel inlet valve and the air responsive means whereby the admission of fuel and air into the mixing chamber is coordinated and the mixture ratio of air to fuel is maintained approximately the same at all times during the operation of the carburetor.

2. A carburetor for atomizing fuel by mixing the same with air preparatory to being burned in an internal combustion engine comprising in combination, a casing encompassing a mixing chamber having an air inlet and an outlet for the mixture of air and fuel, a manually operated valve for controlling the flow of air through the air inlet, an upright conical valve reciprocally mounted in and responsive to the flow of air passing through said inlet and arranged to open in a downstream direction to progressively increase the effective unobstructed area of said inlet port, a fuel inlet for supplying fuel to the said mixing chamber, a tapered metering valve for said fuel inlet arranged to open to progressively increase the effective unobstructed area of said fuel inlet, said tapered metering valve having an inverted conical portion exposed directly to the air in the said mixing chamber, a chamber surrounding the fuel inlet in spaced relation therewith and provided with an outlet into the said mixing chamber, means for supplying gas to the last mentioned chamber, said last mentioned chamber directing a flow of gas by the fuel inlet before the fuel and gas passes out of the said outlet into the mixing chamber, the said fuel and gas upon passing through the said outlet impinging against the inverted conical portion of the tapered metering valve as it en-

ters the mixing chamber, means interconnecting said conical and tapered valves for translating the opening movement of the conical valve to the tapered valve to simultaneously and correspondingly open the said tapered valve, the taper of the said metering valve being gauged relative to the taper of said conical valve whereby as the conical valve progressively opens responsive to an increase in volume of air flowing through said air inlet the tapered metering valve correspondingly progressively opens to admit a corresponding increase in the amount of fuel admitted to said mixing chamber to thereby maintain said fuel to air ratio in said mixing chamber approximately constant.

3. A carburetor for atomizing fuel and mixing the same with air preparatory to being burned in an internal combustion engine comprising in combination a casing encompassing a mixing chamber having an air inlet and an outlet for the mixture of air and fuel, a valve for controlling the flow of air through the air inlet, means responsive to the flow of air passing through the air inlet, a fuel inlet for supplying fuel to the said mixing chamber where the fuel is atomized and mixed with the air, a chamber adapted to receive gas surrounding the fuel inlet and provided with a gas outlet spaced from the fuel inlet, means for supplying a gas to the last mentioned chamber surrounding the fuel inlet, a metering valve for controlling both the fuel inlet and the gas outlet and provided with an inverted conical portion positioned within and exposed directly to the air within the mixing chamber against which the said fuel and gas simultaneously impinges upon entering the mixing chamber, and means interconnecting the fuel inlet and the air responsive means whereby the admission of fuel and air into the mixing chamber is coordinated and the mixture ratio of air to fuel is maintained approximately the same at all times during the operation of the carburetor.

4. A carburetor for atomizing fuel and mixing the same with air preparatory to being burned in an internal combustion engine comprising in combination a casing encompassing a mixing chamber having an air inlet and an outlet for the mixture of air and fuel, a valve for controlling the flow of air through the air inlet, means responsive to the flow of air passing through the air inlet, a fuel inlet for supplying fuel to the said mixing chamber where the fuel is atomized and mixed with the air, a chamber adapted to receive gas surrounding the fuel inlet and provided with a gas outlet spaced from the fuel inlet, means for supplying a gas to the last mentioned chamber surrounding the fuel inlet, a tapered metering valve for controlling both the fuel inlet and the gas outlet and provided with an inverted conical portion positioned within and exposed directly to the air within the mixing chamber against which the said fuel and gas simultaneously impinges upon entering the mixing chamber, the said inverted conical portion of the said tapered valve being in axial alignment with the said gas outlet and fuel inlet, and means interconnecting the fuel inlet and the air responsive means whereby the admission of fuel and air into the mixing chamber is coordinated and the mixture ratio of air to fuel is maintained approximately the same at all times during the operation of the carburetor.