April 9, 1935. C. N. POGUE 1,997,497

CARBURETOR

Filed Nov. 3, 1934 2 Sheets-Sheet 1

Fig. 1.

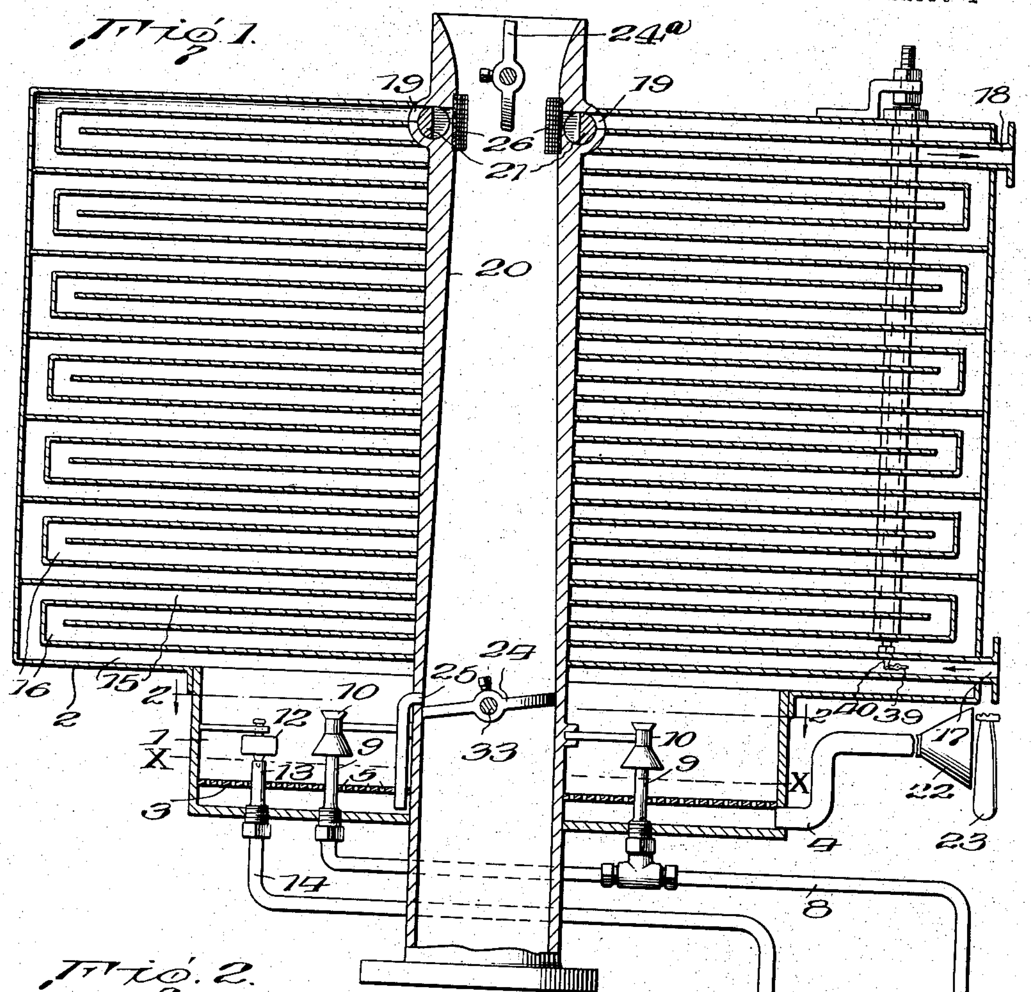

Fig. 2.

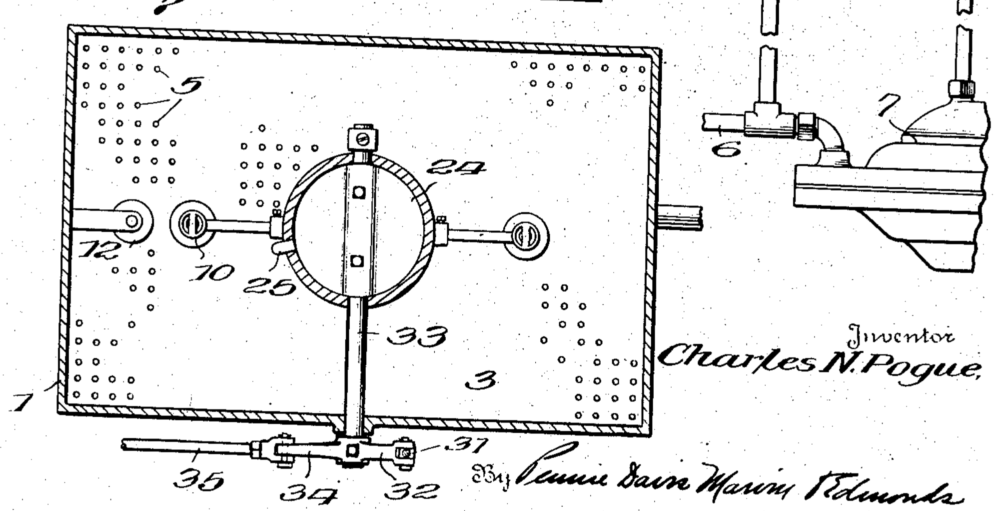

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Fig. 3.

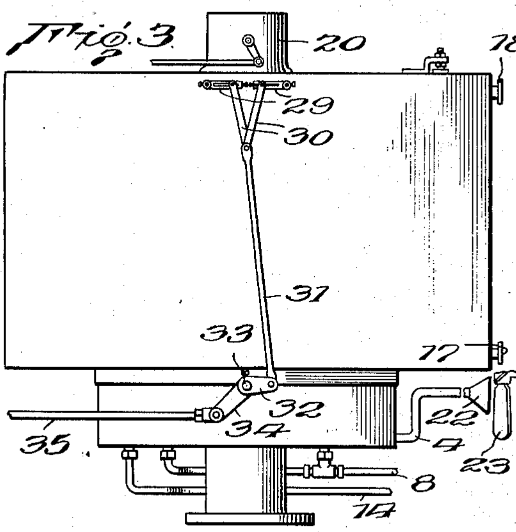


Fig. 5.

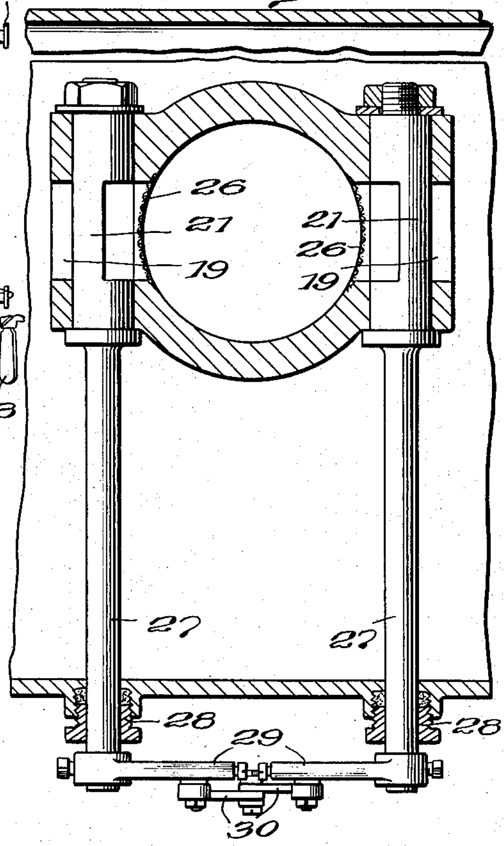


Fig. 4.

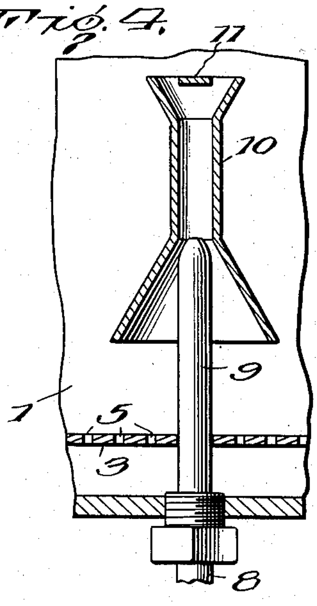


Fig. 7.

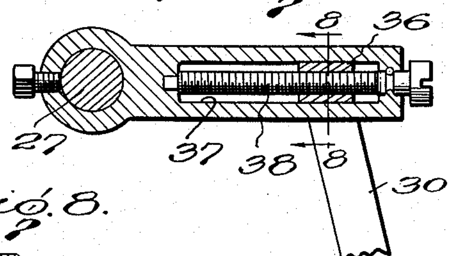
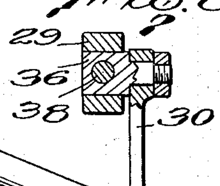


Fig. 8.



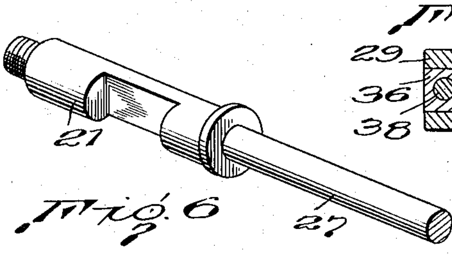


Fig. 6

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CARBURETOR

Charles Nelson Pogue, Norwood, Manitoba, Canada

Application November 3, 1934, Serial No. 751,394

8 Claims. (Cl. 261—15)

This invention relates to a device for obtaining intimate contact between a liquid in a truly vaporous state and a gas, and particularly to such a device which may serve as a carburetor for internal combustion engines, and is an improvement on the form of device shown in my Patent No. 1,938,497, granted December 5, 1933.

In carburetors as commonly used for supplying a combustible mixture of air and liquid fuel to internal combustion engines a relatively large amount of the atomized liquid fuel is not vaporized and enters the engine cylinder more or less in the form of microscopic droplets. When such a charge is "fired" in the engine cylinder only that portion of the liquid fuel which has been converted into the vaporous and consequently the molecular state, combines with the air to give an explosive mixture. The remaining portion of the liquid fuel which is drawn into the engine cylinders and remains in the form of small droplets does not explode and thereby impart power to the engine, but burns with a flame and raises the temperature of the engine above that at which the engine operates most efficiently, i. e., from 160° to 180° F.

In my aforesaid patent there is shown and described a form of carburetor in which the liquid fuel is substantially completely vaporized prior to its introduction into the engine cylinders, and in which means are provided for maintaining a reverse supply of "dry" vapors available for introduction into the engine cylinder. Such a carburetor has been found superior to the standard type of carburetor referred to above and to give better engine performance with far less consumption of fuel.

It is an object of the present invention to provide a carburetor in which the liquid fuel is broken up and prepared in advance of and independent of the suction of the engine and in which a reserve supply of dry vapors will be maintained under pressure ready for introduction into the engine cylinder at all times. It is also an object of the invention to provide a carburetor in which the dry vapors are heated to a sufficient extent prior to being mixed with the main supply of air which carries them into the engine cylinder to cause them to expand so that they will be relatively lighter and will become more intimately mixed with the air prior to their explosion in the engine cylinders.

I have found that when the reserve supply of dry vapors is heated and expanded prior to being admixed with the atmospheric air a greater proportion of the potential energy of the fuel is obtained and the mixture of air and fuel vapors will explode in the engine cylinders without any apparent burning of the fuel which would result in unduly raising the operating temperature of the engine.

More particularly, the present invention comprises a carburetor in which liquid fuel vapors are passed from a main vaporizing chamber under at least a slight pressure into and through a heated chamber where they are caused to expand and in which droplets of liquid fuel are either vaporized or separated from the vapors, so that the fuel finally introduced into the engine cylinders is in true vapor phase. The chamber in which the liquid fuel vapors are heated and caused to expand preferably comprises a series of passages through which the vapors and the exhaust gases from the engine pass in tortuous paths and in such manner that the exhaust gases are brought into heat interchange relation with the vapors and give up a part of their heat to the vapors to cause their heating and expansion.

The invention will be further described in connection with the accompanying drawings, but this further disclosure and description is to be taken merely as an exemplification of the invention, and the same is not limited thereby, except as is pointed out in the appended claims.

In the drawings, Fig. 1 is a vertical cross-sectional view through a carburetor embodying my invention, Fig. 2 is a horizontal sectional view through the main vaporizing or atomizing chamber, the same being taken on line 2—2 of Fig. 1, Fig. 3 is a side elevation of the carburetor, Fig. 4 is a detail sectional view of one of the atomizing nozzles and its associated parts, Fig. 5 is a detail cross-sectional view showing the means for controlling the passage of gases from the vapor-expanding chamber into the intake manifold of the engine, Fig. 6 is a perspective view of one of the valves shown in Fig. 5, Fig. 7 is a cross-sectional view showing means for adjusting the valves shown in Fig. 5 and Fig. 8 is a cross-sectional view on line 8—8 of Fig. 7.

Referring now to the drawings, the numeral 1 indicates a main vaporizing and atomizing chamber for the liquid fuel located at the bottom of and communicating with a vapor heating and expanding chamber 2.

The vaporizing chamber is provided with a perforated false bottom 3 and is normally filled with liquid fuel to the level x. Atmospheric air from a conduit 4 enters the space below the false bottom 3 and passes upwardly through perforations 5 in said bottom and then bubbles up through the liquid fuel vaporizing a portion of it.

Liquid fuel for maintaining the level x in the chamber 1 passes from the usual fuel tank (not shown) through a pipe 6, and is forced by a pump 7 through a pipe 8 into and through a pair of nozzles 9 having their outlets located in the chamber 1, just above the level of the liquid fuel therein. The pump 7 may be of any approved form but is preferably of the diaphragm type, as such fuel pumps are now standard equipment on most automobiles.

The nozzles 9 are externally threaded at their lower ends to facilitate their assembly in the chamber 1 and to permit them to be removed readily, should cleaning be necessary.

The upper ends of the nozzles 9 are surrounded by Venturi tubes 10 having a baffle 11 located at their upper ends opposite the outlets of the nozzles. The liquid fuel being forced from the ends of the nozzles 9 into the restricted portions of the Venturi tubes causes a rapid circulation of the air and vapors in the chamber through the tubes 10 and brings the air and vapors into intimate contact with the liquid fuel, with the result that a portion thereof is vaporized. Unvaporized portions of the liquid fuel strike the baffles 11 and are thereby further broken up and deflected downwardly into the upwardly flowing current of air and vapors.

The pump 7 is regulated to supply a greater amount of liquid fuel to the nozzles 9 than will be vaporized. The excess over that vaporized will drop into the chamber 1 and cause the liquid to be maintained at the indicated level. When the liquid fuel rises above that level, a float valve 12 will be lifted and the excess will flow through an overflow pipe 13 into a pipe 14 leading back to the pipe 6 on the intake side of the pump 7. Such an arrangement permits a large amount of liquid fuel to be circulated by the pump 7 without more fuel being withdrawn from the fuel tank than is actually vaporized and consumed in the engine. As the float valve 12 will set upon the end of the outlet pipe 13 as soon as the liquid level drops below the indicated level, there is no danger of vapors passing into the pipe 14 and hence into the pump 7 to interfere with its normal operation.

The upper end of the vaporizing and atomizing chamber 1 is open and vapors formed by the atmospheric air bubbling through the liquid fuel in the bottom of the chamber and those formed as the result of the atomization at the nozzles 9 will pass into the heating and expanding chamber 2. As is clearly shown in Fig. 1, the chamber 2 comprises a series of tortuous passages 15 and 16 leading from the bottom to the top. The vapors pass through the passages 15 and the hot exhaust gases of the engine pass through the passages 16, a suitable entrance 17 and exit 18 being provided for that purpose.

The vapors passing upwardly in a zigzag path through the passages 15 will be brought into heat interchange relation with the hot walls of the passages 16 for the exhaust gases. The total length of the passages 15 and 16 is such that a relatively large reserve supply of the liquid fuel is always maintained in the chamber 2, and by maintaining the vapors in heat interchange relation with the hot exhaust gases for a substantial period, the vapors will absorb sufficient heat from those gases to cause the vapors to expand, with the result that when they are withdrawn from the top of the chamber 2, they will be in the true vapor phase and, due to their expansion, relatively light.

Any minute droplets of liquid fuel entrained by the vapors in the chamber 1 will precipitate out in the lower passages 15 and flow back into the chamber 1, or else be vaporized by heat which the vapors absorb from the hot exhaust gases in their passage through the chamber 2.

The upper end of the vapor passage 15 communicates with openings 19 adjacent the upper end of a down-draft air tube 20 leading to the intake manifold of the engine. Valves 21 are interposed in the openings 19, so that the passage of the vapors therethrough into the air tube may be controlled. The valves 21 preferably are of the rotary plug type and are controlled as hereinafter described.

Suitable means are provided for causing the vapors to be maintained in the chamber 2 under a pressure greater than atmospheric so that when the valves 21 are opened, the vapors will be forced into the air tube 20 independently of the suction of the engine. Such means may comprise an air pump (not shown) for forcing the atmospheric air through the pipe 4 into the chamber 1, beneath the false bottom 3, but I prefer merely to provide the pipe 4 with a funnel-shaped inlet end 22 and located just back of the usual fan 23 of the engine. That will cause the air to pass through the pipe 4 with sufficient force to maintain the desired pressure in the chamber 2, and the air being drawn through the radiator by the fan will be preheated prior to its introduction into the chamber 1 and hence will vaporize greater amounts of the liquid fuel. If desired, the pipe 4 may be surrounded by an electric or other heater, or exhaust gases from the engine may be passed around it to further preheat the air passing therethrough prior to its introduction into the liquid fuel in the bottom of the chamber 1. The air tube 20 is provided with a butterfly throttle valve 24 and a choke valve 24a, as is customary with carburetors, used for internal combustion engines. The upper end of the air tube 20 extends above the chamber 2 a distance sufficient to receive an air filter and/or silencer, if desired.

A low speed or idling jet 25 has its upper end communicating with the passage through the air tube 20 adjacent the throttling valve 24 and its lower end extending into the liquid fuel in the bottom of the chamber 1 for supplying fuel to the engine when the valves are in a position such as to close the passages 19. However, the passage through the idling jet 25 is so small that under normal operations the suction thereon is not sufficient to lift liquid fuel from the bottom of the chamber 1.

To prevent the engine from backfiring into the vapor chamber 2, the ends of the passages 19 are covered with a fine mesh screen 26 which, operating on the principle of a miner's lamp, will prevent the vapors in the chamber 2 from exploding in case of a backfire, but will not interfere substantially with the passage of the vapors from the chamber 2 into the air tube 20 when the valves 21 are in open position. The air tube 20 preferably is in the form of a venturi with the greatest restriction being at that point where the openings 19 are located, so that when the valves 21 are opened there will be a pulling force on the vapors because of the increased velocity of the air at the restricted portion of the air tube 20 opposite the openings 19, as well as an expelling force on them due to the pressure in the chamber 2.

As shown in Fig. 3, the operating mechanism for the valves 21 is so connected to the operating mechanism for the throttle valve 24 that they are opened and closed simultaneously with the opening and closing of the throttle valve, so that the amount of vapor supplied to the engine will at all times be in proportion to the demands placed upon the engine. To that end, each valve 21 has an extension or operating stem 27 protruding through one of the side walls of the vapor-heating and expanding chamber 2. Packing glands 28 of the ordinary construction surround the stems 27 where they pass through the chamber wall to prevent leakage of vapors at those points.

Operating arms 29 are rigidly secured to the outer ends of the stems 27 and extend towards each other. The arms are pivotally and adjustably connected to a pair of links 30 which at their lower ends are pivotally connected to an operating link 31, which in turn is pivotally connected to an arm 32 rigidly secured on an outer extension 33 of the stem of the throttle valve 24. The extension 33 also has rigidly secured thereto an arm 34, to which is connected an operating link 35 leading from the means for accelerating the engine.

The means for adjustably connecting the upper ends of the links 30 to the valve stems 27 of the valves 21, so that the amount of vapors delivered from the chamber 2 may be regulated to cause the most efficient operation of the particular engine to which the carburetor is attached, comprises angular slides 36 to which the upper ends of the links 30 are fastened, and which are slidably, but non-rotatably mounted in guideways 37 in the arms 29. The slides 36 have threaded bores through which screws 38 pass. The screws 38 are rotatably mounted in the arms 29, but are held against longitudinal movement so that when they are rotated the slides 36 will be caused to move along the guideways 37 and change the relative position of the links 30 to the valve stems 27, so that a greater or less movement, and consequently a greater or less opening of the ports 19 will take place when the throttle valve 24 is operated.

For safety, and for most efficient operation of the engine, the vapors in the chamber 2 should not be heated or expanded beyond a predetermined amount, and in order to control the extent to which the vapors are heated, and consequently the extent to which they are expanded, a valve 39 is located in the exhaust passage 16 adjacent the inlet 17. The valve 39 is preferably thermostatically controlled, as, for example, by an expanding rod thermostat 40 which extends through the chamber 2. However, any other means may be provided, for reducing the amount of hot exhaust gases entering the passages 16 when the temperature of the vapors in the chamber reaches or exceeds the optimum.

The carburetor has been described in detail in connection with a down-draft type of carburetor, but it is to be understood that its usefulness is not restricted to that particular type of carburetor, and that the manner in which the mixture of atmospheric air and vapors is introduced into the engine cylinders is immaterial as far as the advantages of the carburetor are concerned.

The term "dry vapor" is used herein to define the physical condition of the liquid fuel vapor after removal of liquid droplets, or the mist which is frequently entrained in what is ordinarily termed a vapor.

From the foregoing description it will be seen that the present invention provides a carburetor in which the breaking up of the liquid fuel for subsequent use is independent of the suction created by the engine, and that after the liquid fuel is broken up it is maintained under pressure in a heated space for a length of time sufficient to permit all entrained liquid particles to be separated or vaporized and to permit the dry vapors to expand prior to their introduction into, and admixture with the main volume of atmospheric air passing into the engine cylinders.

I claim:

1. A carburetor for internal combustion engines comprising a vaporizing chamber, means for vaporizing liquid fuel therein, a vapor-heating and expanding chamber communicating with the vaporizing chamber, a passage for atmospheric air extending entirely through said heating and vaporizing chamber and adapted to communicate with the intake manifold of the engine, and means for conducting vapors from the heating and expanding chamber into said air passage.

2. A carburetor for internal combustion engines comprising means for vaporizing liquid fuel, a vapor-heating and expanding chamber into which the vaporized liquid fuel passes, means for creating a pressure in said heating and expanding chamber greater than atmospheric during normal operation of the carburetor, and means for conducting heated and expanded gases from the heating and expanding chamber to the intake manifold of the engine upon a suction being created in said manifold.

3. A carburetor for internal combustion engines comprising means for vaporizing liquid fuel, a vapor-heating and expanding chamber into which the vaporized liquid fuel passes, a passage for atmospheric air adapted to be connected with the intake manifold of the engine, a connecting passage between the heating and expanding chamber and said atmospheric air passage, a valve controlling the passage of vapors through said connecting passage, and means for creating a pressure in said heating and vaporizing chamber greater than atmospheric, so that when said valve is opened the pressure under which the vapors are maintained in the heating and expanding chamber will cause at least a part of them to be expelled from said chamber and into the atmospheric air passage.

4. A carburetor for internal combustion engines comprising a vaporizing chamber, means for vaporizing liquid fuel therein, a vapor-heating and expanding chamber communicating with the vaporizing chamber and adapted to receive vapors therefrom; said heating and vaporizing chamber having tortuous passages therethrough for said vapors and for a heating fluid which is maintained in heat interchange relation with said vapor passages, a passage for atmospheric air adapted to be connected with the intake manifold of the engine and extending through said heating and vaporizing chamber, a pair of connecting passages extending through the walls of said atmospheric air passage through which vapors from the vapor passage in the heating and expanding chamber may pass into said air passage, a valve in each of said connecting passages, a valve in said atmospheric air passage controlling the flow of air and vapors to the engine, and means for operating the valves in said connecting passages in unison with said air and vapor control valve.

5. A carburetor for internal combustion engines comprising a vaporizing chamber, a liquid

fuel nozzle in said vaporizing chamber, a pump for forcing liquid fuel through said nozzle, an overflow passage for liquid fuel located above the bottom of said vaporizing chamber, whereby the liquid fuel which is projected from said nozzles and remains unvaporized forms a body in the bottom of the vaporizing chamber, means for introducing atmospheric air into said body of liquid fuel whereby the air bubbles upwardly through said body and vaporizes a portion thereof, means for conducting liquid fuel from said overflow to the intake of said pump, so that said pump may be regulated to circulate an amount of liquid fuel in excess of that vaporized by the nozzles, a vapor heating and expanding chamber communicating with the vaporizing chamber and receiving vapors therefrom, and means for conducting heated and expanded vapors from the heating and expanding chamber into the intake manifold of the engine.

6. A carburetor for internal combustion engines comprising a vaporizing chamber, means for maintaining a body of liquid fuel in the bottom of said chamber, a heating and expanding chamber communicating with the vaporizing chamber, means for introducing atmospheric air into the body of liquid in the vaporizing chamber under a pressure greater than atmospheric, whereby said air will bubble upwardly through the liquid fuel, vaporize a portion thereof and build up a pressure greater than atmospheric in the heating and expanding chamber, and means for conducting heated and expanded vapors from the heating and expanding chamber into the intake manifold of the engine.

7. A carburetor for internal combustion engines comprising a vaporizing chamber, a liquid fuel atomizing nozzle in said chamber, a pump for forcing liquid fuel through said nozzle, a Venturi tube surrounding said nozzle and having a baffle opposite the outlet of said nozzle for further breaking up liquid fuel projected from said nozzle, a heating and expanding chamber communicating with the vaporizing chamber and receiving liquid fuel vapors therefrom, and means for conducting heated and expanded vapors from the heating and expanding chamber into the intake manifold of the engine.

8. A carburetor for internal combustion engines comprising a vaporizing chamber, means for vaporizing liquid fuel therein, a vapor heating and expanding chamber communicating with the vaporizing chamber and adapted to receive vapors therefrom, said heating and vaporizing chamber comprising a relatively long zig-zag passage for the vapors, a relatively long chamber for a heating fluid interleaved with the zig-zag passages for the vapors and in heat interchange relation with said vapor passage, and means for conducting heated and expanded vapors from the heating and expanding chamber into the intake manifold of the engine.

CHARLES NELSON POGUE.