Jan. 7, 1936. C. N. POGUE 2,026,798

CARBURETOR

Filed Sept. 27, 1935 2 Sheets-Sheet 1

Fig. 1

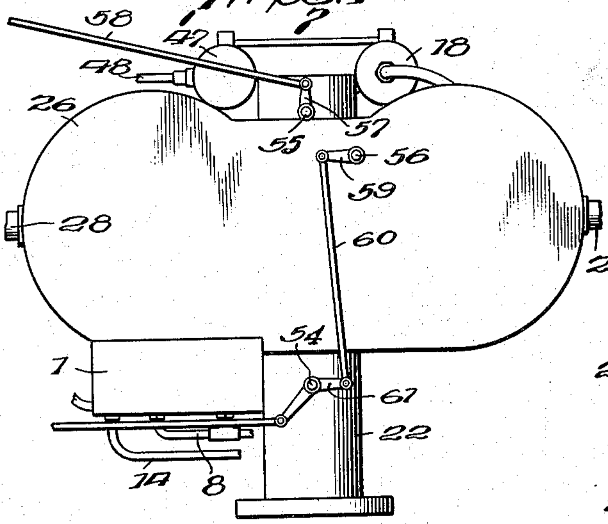


Fig. 5.

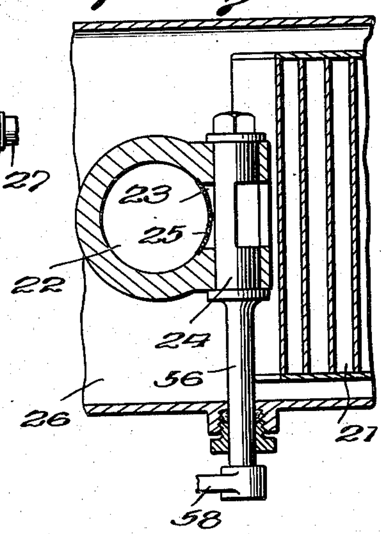


Fig. 2.

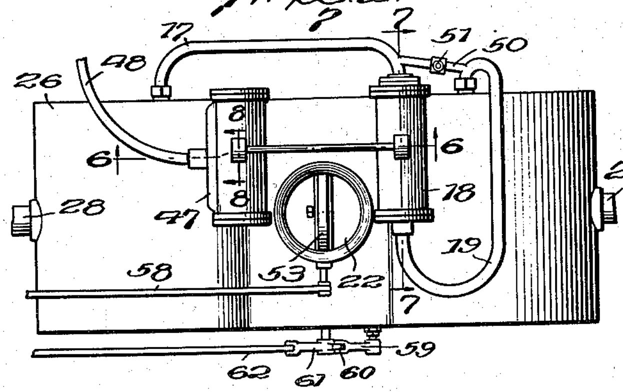


Fig. 8.

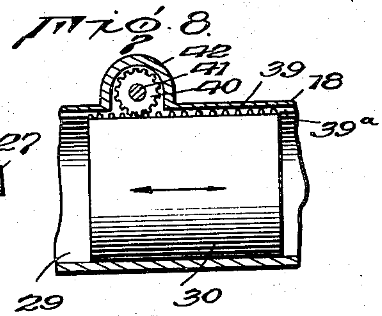
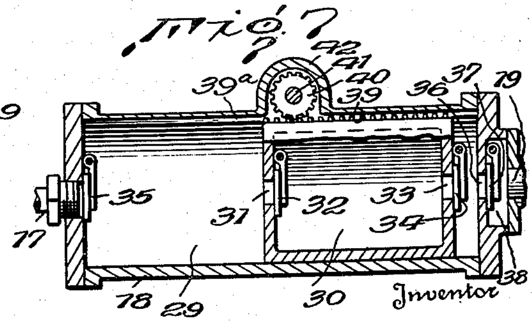


Fig. 7



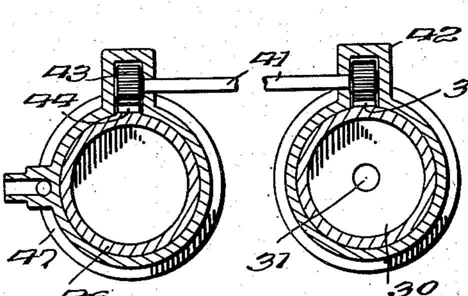


Fig. 6.

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Fig. 3.

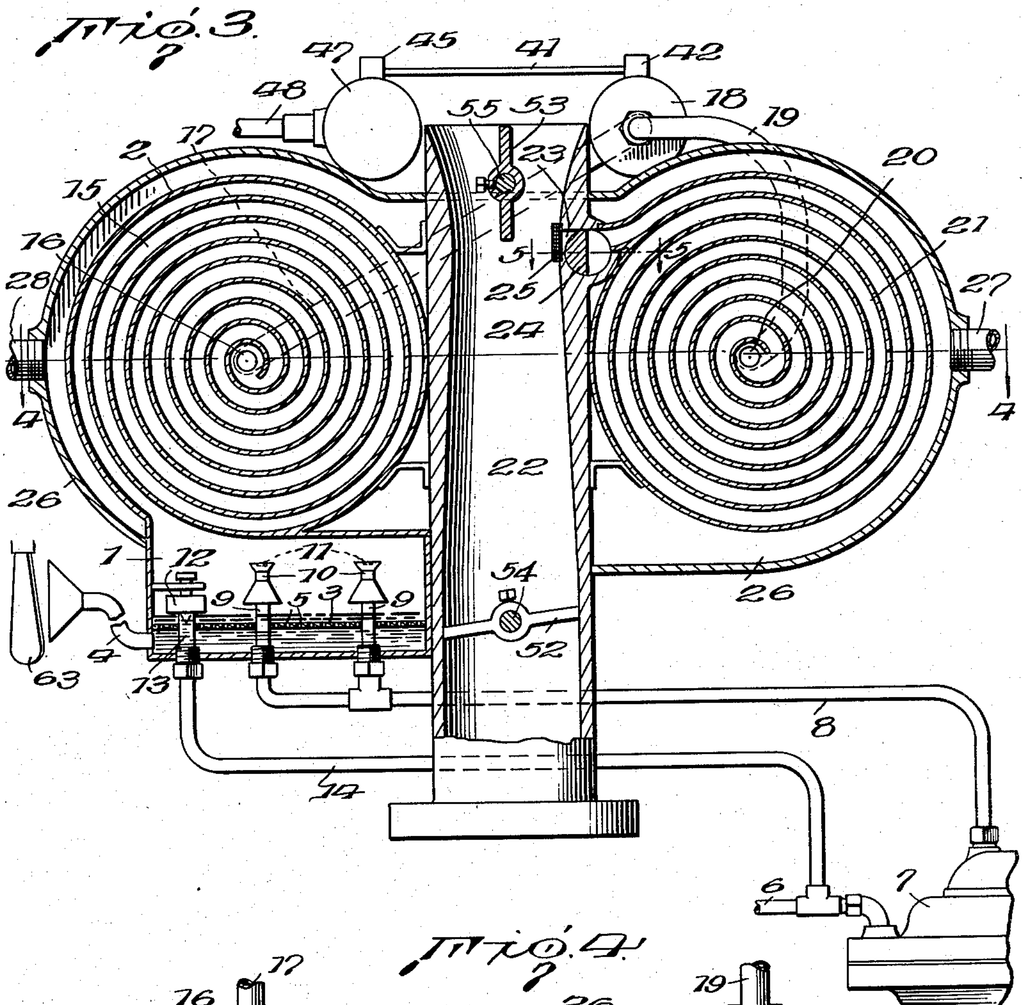
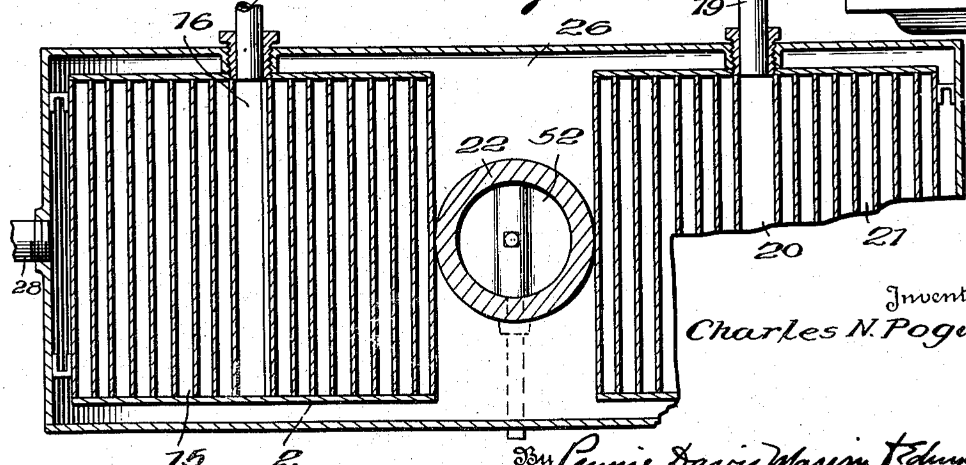


Fig. 4.



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2,026,798

CARBURETOR

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Application September 27, 1935, Serial No. 42,540

8 Claims. (Cl. 261—13)

This invention relates to carburetors suitable for use with internal combustion engines and is an improvement on the carburetors shown in my Patents Nos. 1,938,497, granted December 5, 1933, and 1,997,497, granted April 9, 1935.

In my aforesaid patents an intimate contact between a liquid such as the fuel used for internal combustion engines, and a gas, such as air, is obtained by causing the gas to bubble up through a body of the liquid. The vaporized liquid passes into a vapor chamber which preferably is heated, and any liquid droplets are returned to the body of liquid, with the result that the fuel introduced into the combustion chambers is free of liquid particles, and in the molecular state so that an intimate mixture with the air is obtained to give an explosive mixture from which nearer the maximum energy contained in the liquid fuel is obtained. Moreover, as there are no liquid particles introduced into the combustion chambers there will be no burning of the fuel and consequently the temperature of the engine will not be increased above that at which it operates most efficiently.

In my Patent No. 1,997,497, the air which is to bubble up through the body of liquid fuel is forced into and through the fuel under pressure and the fuel vapors and air pass into a chamber where they are heated and caused to expand. The introduction of the air under pressure and the expansion of the vaporous mixture insures a sufficient pressure being maintained in the vapor heating and expanding chamber to cause at least a portion of it to be expelled therefrom into the intake manifold as soon as the valve controlling the passage thereto is opened.

In accordance with the present invention, improved means are provided for maintaining the vaporous mixture in the vapor heating chamber under a predetermined pressure, and for regulating such pressure so that it will be at the optimum for the particular conditions under which the engine is to operate. Such means preferably comprises a reciprocating pump operated by a vacuum-actuated motor for forcing the vapors into and through said chamber. The pump is provided with a suitable pressure-regulating valve so that when the pressure in the vapor-heating chamber exceeds the predetermined amount a portion of the vaporous mixture will be by-passed from the outlet side to the inlet side of the pump and recirculated.

The invention will be described further in connection with the accompanying drawings, but such 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 subjoined claims.

In the drawings:

Fig. 1 is a side elevation of a carburetor embodying the invention.

Fig. 2 is a plan view thereof.

Fig. 3 is an enlarged vertical sectional view.

Fig. 4 is a transverse sectional view on the line 4—4 of Fig. 3.

Fig. 5 is a detail sectional view on line 5—5 of Fig. 3.

Fig. 6 is a transverse sectional view through the pump and actuating motor therefor, taken on line 6—6 of Fig. 2.

Fig. 7 is a longitudinal sectional view through the pump, taken on line 7—7 of Fig. 2, and

Fig. 8 is a longitudinal sectional view through a part of the pump cylinder, showing the piston in elevation.

In the accompanying drawings, a vaporizing and atomizing chamber 1 is located at the bottom of the carburetor and has an outlet at its top for the passage of fuel vapors and air into a primary vapor heating chamber 2.

The vaporizing chamber 1 is provided with a perforated false bottom 3 and is normally filled with liquid fuel to the level indicated in Fig. 1. Atmospheric air from a conduit 4 is introduced into the space below the false bottom 3 and passes upwardly through the body of liquid fuel below the false bottom 3, and then through the perforations 5 in said false bottom, which breaks it up into a myriad of fine bubbles, which pass upwardly through the liquid fuel above the false bottom.

Liquid fuel for maintaining the level indicated 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 baffles 11 located at their upper ends opposite the outlets of the nozzles, as is shown and described in detail in my aforesaid Patent No. 1,997,497. 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 amount of liquid fuel vaporized by the nozzles 9 and by the passage of air through the liquid body thereof is sufficient to provide a suitably enriched vaporous mixture for introducing into the passage leading to the intake manifold of the engine through which the main volume of atmospheric air passes.

Vapors formed by the atmospheric air bubbling through the liquid fuel in the bottom of the chamber 1 and those formed as the result of the atomization at the nozzles 9 pass from the top of that chamber into the primary heating chamber 2. As is clearly shown in Fig. 1, the chamber 2 comprises a relatively long spiral passage 15 through which the vaporous mixture gradually passes inwardly to a central outlet 16 to which is connected a conduit 17 leading to a reciprocating pump 18 which forces the vaporous mixture under pressure into a conduit 19 leading to a central inlet 20 of a secondary heating chamber 21 which like the primary heating chamber comprises a relatively long spiral. The vaporous mixture gradually passes outwardly through the spiral chamber 21 and enters a downdraft air tube 22, leading to the intake manifold of the engine, through an outlet 23 controlled by a rotary plug valve 24.

To prevent the engine from backfiring into the vapor chamber 2, the ends of the passages 19 are covered with a fine mesh screen 25, 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 21 into the air tube 23 when the valve 24 is in open position. The air tube 22 preferably is in the form of a venturi with the greatest restriction being at that point where the outlet 23 is located, so that when the valve 24 is opened there will be a pulling force on the vaporous mixture due to the increased velocity of the air at the restricted portion of the air tube opposite the outlet 23, as well as an expelling force on them due to the pressure maintained in the chamber 21 by the pump 18.

Both the primary and secondary spiral heating chambers 15 and 21 and the central portion of the air tube 22 are enclosed by a casing 26 having an inlet 27 and an outlet 28 for a suitable heating medium such as the gaseous products of combustion from the exhaust manifold.

The pump 18 for forcing the vaporous mixture from the primary heating chamber 2 into and through the secondary chamber 21 includes a working chamber 29 for a hollow piston 30 provided with an inlet 31 controlled by a valve 32, and an outlet 33 controlled by a valve 34. The end of the working chamber 29 to which is connected the conduit 17, which conducts the vaporous mixture from the primary heating chamber 2, has an inlet valve 35, and the opposite end of the working chamber has an outlet 36 controlled by a valve 37 positioned in an auxiliary chamber 38, to which is connected the outlet pipe 19 which conducts the vaporous mixture under pressure to the secondary heating chamber 21. Each of the valves 32, 34, 35 and 37 is of the one-way type. They are shown as being gravity-actuated flap valves, but it will be understood that spring-pressed or other types of one-way valves may be used if desired.

One side of the piston 30 is formed with a gear rack 39 which is received in a groove 39a of the wall forming the cylinder of the pump. The gear rack 39 engages with an actuating spur gear 40 carried on one end of the shaft 41 and operating in a housing 42 formed on the pump cylinder. The other end of the shaft 41 carries a spur gear 43, which engages and is operated by a gear rack 44 carried on a piston 46 of a double-acting motor 47. The particular construction of the double-acting motor 47 is not material, and it may be of a vacuum type commonly used for operating windshield wipers on automobiles, in which case a flexible hose 48 would be connected with the intake manifold of the engine to provide the necessary vacuum for operating the piston 45.

Under the influence of the double-acting motor 47, the piston 30 of the pump has a reciprocatory movement in the working chamber 29. Movement of the piston towards the left in Fig. 7 tends to compress the vaporous mixture in the working chamber between the end of the piston and the inlet from the pipe 17, and causes the valve 35 to be forced tightly against the inlet opening. In a like manner, the valves 32 and 34 are forced open and vaporous mixture in that portion of the working chamber is forced through the inlet 31 in the end of the piston 30, into the interior of the piston, where it displaces the vaporous mixture there and forces it into the space between the right-hand end of the piston and the right-hand end of the working chamber. The passage of the vaporous mixture into the right-hand end of the working chamber is supplemented by the partial vacuum created there when the piston moves towards the left. During such movement of the piston, the valve 37 is maintained closed and prevents any sucking back of the vaporous mixture from the secondary heating chamber 21.

When the motor 47 reverses, the piston 30 moves to the right and the vaporous mixture in the right-hand end of the working chamber is forced past the valve 37 and through the pipe 19 into the secondary heating chamber 21. At the same time, a vacuum is created behind the piston 30 and results in the left-hand end of the working chamber again being filled with the vaporous mixture from the primary heating chamber 2.

As the operation of the pump 47 will vary in accordance with the suction created in the intake manifold, it preferably is regulated to actuate the pump at such a speed that the vaporous mixture will always be pumped into the secondary heating chamber at a rate sufficient to maintain a greater pressure there than is desired. In order that the pressure in the working chamber may at all times be maintained at the optimum, a pipe

50 having an adjustable pressure-regulating valve 51 is connected across the inlet and outlet pipes 17 and 19. The valve 51 will permit a portion of the vaporous mixture discharged from the pump to be bypassed to the inlet 17 so that a pressure, predetermined by the seating of the valve 51, will at all times be maintained in the second heating chamber 21.

The air tube 22 is provided with a butterfly throttle valve 52 and a choke valve 53, as is usual with carburetors adapted for use with internal combustion engines. Operating stems 54, 55, 56 for the valves 52, 53 and 24 respectively, extend through the casing 26. An operating arm 57 is fixedly secured to the outer end of the stem 55 and is connected to a rod 58 which extends to the dashboard of the automobile or some other place conveniently located to the driver of the automobile. The outer end of the stem 56 of the valve 24 which controls the outlet 23 from the secondary heating chamber 21 has one end of an operating arm 59 fixedly secured thereto. The other end of the arm 59 is pivotally connected to a link 60 which extends downwardly and pivotally connects to one end of a bell crank lever 61, fixedly secured to the end of the stem 54 of the throttle valve 52. The other end of the bell crank lever 61 is connected to an operating rod 62 which, like the rod 58, extends to a place conveniently located to the driver. The valves 24 and 52 are connected for simultaneous operation so that when the throttle valve 52 is opened to increase the speed of the engine the valve 24 will be opened to admit a larger amount of the heated vaporous mixture from the secondary heating chamber 21.

While the suction created by the pump 18 ordinarily will create a sufficient vacuum in the primary heating chamber 2, to cause atmospheric air to be drawn into and upwardly through the body of liquid fuel in the bottom of the vaporizing chamber 1, in some instances it may be desirable to provide supplemental means for forcing the atmospheric air into and through said body of liquid and in such cases an auxiliary pump may be provided for that purpose, or the air conduit 4 may be provided with a funnel-shaped intake which is positioned behind the fan 63 which is customarily placed behind the radiator of the engine.

The foregoing description has been given in connection with a downdraft type of carburetor, but it is to be understood that the invention is not limited to use with such type carburetors 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.

Before the carburetor is put into use the pressure-regulating valve 51 in the bypass pipe 50 will be adjusted so that the pressure best suited for conditions under which the engine is to operate will be maintained in the secondary heating chamber 21. When the valve 51 has thus been set and the engine started, the pump 18 will create a partial vacuum in the primary heating chamber 2 and cause atmospheric air to be drawn through the conduit 4 and to bubble upwardly through the liquid in the bottom of the vaporizing and atomizing chamber 1 with resultant vaporization of a part of the liquid fuel therein. At the same time, the pump 7 will be set into operation and liquid fuel will be pumped from the fuel tank through the nozzles 9 which will result in an additional amount of the fuel being vaporized. The vapors resulting from such atomization of the liquid fuel and the passage of the air through the body of the liquid will pass into and through the spiral chamber 1 where they will be heated by the products of combustion in the surrounding chamber formed by the casing 26. The fuel vapors and air will gradually pass inwardly to the outlet 16 and thence through the conduit 17 to the pump 18 which will force them into the secondary heating chamber 21 in which they will be maintained at the predetermined pressure by the pressure-regulating valve 51. The vaporous mixture is further heated in the chamber 21 and passes spirally outwardly to the valve-controlled outlet 23 which opens into the air tube 22 which conducts the main volume of atmospheric air to the intake manifold of the engine.

The heating of the vaporous mixture in the heating chambers 2 and 21 tends to cause them to expand, but expansion in the chamber 21 is prevented due to the pressure maintained in that chamber by the regulating valve 51. However, as soon as the heated vaporous mixture passes the valve 24 and is introduced into the air flowing through the intake tube 22, it is free to expand and thereby become relatively light so that a more intimate mixture with the air is obtained prior to the mixture being exploded in the engine cylinders. Thus it will be seen that the present invention not only provides means wherein the vaporous mixture from the heating chamber 21 is forced into the air passing through the air tube 22 by a positive force, but it is also heated to such an extent that after it leaves the chamber 21 it will expand to such an extent as to have a density less than it would if introduced directly from the vaporizing and atomizing chamber 1 into the air tube 22.

The majority of the liquid particles entrained by the vaporous mixture leaving the chamber 1 will be separated in the first half of the outermost spiral of the primary heating chamber 2 and drained back into the body of liquid in the tank 1. Any liquid particles which are not thus separated will be carried on with the vaporous mixture and due to the circulation of that mixture and the application of heat, will be vaporized before the vaporous mixture is introduced into the air tube 22 from the secondary heating chamber 21. Thus "dry" vapors only are introduced into the engine cylinders and any burning of liquid particles of the fuel in the engine cylinder, which would tend to raise the temperature of the engine above that at which it operates most efficiently is avoided.

While the fullest benefits of the invention are obtained by using both a primary and a secondary heating chamber, the primary heating chamber may, if desired, be eliminated, and the vaporous mixture pumped directly from the vaporizing and atomizing chamber 1 into the spiral heating chamber 21.

From the foregoing description it will be seen that the present invention provides an improvement over the carburetor disclosed in my aforesaid Patent 1,997,497, in that it is possible to maintain the vaporous mixture in the heating chamber 21 under a predetermined pressure, and that as soon as the vaporous mixture is introduced into the main supply of air passing to the intake manifold of the engine, it will expand and reach a density at which it will form a more intimate mixture with the air. Furthermore, the introduction of the vaporous mixture into the air stream in the tube 22 causes a certain amount of turbulence which also tends to give a more intimate mixture of the vapor molecules with the air.

I claim:

1. A carburetor for internal combustion engines comprising a vaporizing chamber, means for vaporizing fuel therein, a vapor-heating chamber, a pump for pumping vapors from the vaporizing chamber into the vapor-heating chamber, a bypass for fuel vapors from the outlet side of said pump to the inlet side thereof, means for maintaining vapors in said vapor-heating chamber during normal operation of the carburetor under a predetermined pressure, a passage for atmospheric air adapted to communicate with the intake manifold of the engine and means for introducing vapors from said vapor-heating chamber into said atmospheric air passage.

2. A carburetor for internal combustion engines comprising a vaporizing chamber, means for vaporizing fuel therein, a vapor-heating chamber, a pump for pumping vapors from the vaporizing chamber into the vapor-heating chamber, a bypass for fuel vapors from the outlet side of the pump to the inlet side thereof, a pressure-regulating valve in said bypass for maintaining vapors in said vapor-heating chamber during normal operation of the carburetor under predetermined pressure, a passage for atmospheric air adapted to communicate with the intake manifold of the engine, and means for introducing vapors from said vapor-heating chamber into said atmospheric air passage.

3. A carburetor for internal combustion engines comprising a vaporizing chamber, means for vaporizing fuel therein, a primary vapor-heating chamber, a secondary vapor-heating chamber, means for conducting vapors from the vaporizing chamber to the primary vapor-heating chamber, means for conducting vapors from the primary vapor-heating chamber to the secondary vapor-heating chamber, means for maintaining vapors in said secondary vapor-heating chamber during normal operation of the carburetor under a predetermined superatmospheric pressure, means for varying the pressure at which vapors are maintained in said secondary vapor-heating chamber independently of the speed of the engine, a passage for atmospheric air adapted to communicate with the intake manifold of the engine, and means for introducing vapors from said secondary vapor-heating chamber into said atmospheric air passage.

4. A carburetor for internal combustion engines comprising a vaporizing chamber, means for vaporizing fuel therein, a vapor-heating chamber, means for conducting vapors from the vaporizing chamber into the vapor-heating chamber, means for maintaining vapors in said vapor-heating chamber during normal operation of the carburetor under superatmospheric pressure, means for varying the pressure at which vapors are maintained in said vapor-heating chamber independently of the speed of the engine, and means for introducing vapors from said vapor-heating chamber into the intake manifold of the engine.

5. A carburetor for internal combustion engines comprising a vaporizing chamber, means for maintaining a body of liquid fuel in the bottom of said chamber, means for introducing atmospheric air into the body of liquid in the vaporizing chamber whereby said air will bubble upwardly through the liquid fuel and vaporize a portion thereof, a vapor-heating chamber, means for conducting vapors from the vaporizing chamber into the vapor-heating chamber, means for maintaining vapors in said vapor-heating chamber during normal operation of the carburetor under a predetermined superatmospheric pressure, means for varying the pressure at which vapors are maintained in said vapor-heating chamber independently of the speed of the engine, and means for introducing vapors from said vapor-heating 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, means for introducing atmospheric air into the body of liquid in the vaporizing chamber whereby said air will bubble upwardly through the liquid fuel and vaporize a portion thereof, a primary vapor-heating chamber, a secondary vapor-heating chamber, means for passing vapors from the vaporizing chamber to the primary vapor-heating chamber, means for conducting vapors from the primary vapor-heating chamber to the secondary vapor-heating chamber, means for maintaining vapors in said secondary vapor-heating chamber under pressure, and means for introducing vapors from said secondary vapor-heating chamber into the intake manifold of the engine.

7. A carburetor for internal combustion engines comprising a vaporizing chamber, means for maintaining a body of liquid fuel in the bottom of said chamber, means for introducing atmospheric air into the body of liquid in the vaporizing chamber whereby said air will bubble upwardly through the liquid fuel and vaporize a portion thereof, a spiral primary vapor-heating chamber, a spiral secondary-vapor-heating chamber, means for passing vapors from the vaporizing chamber into an outer spiral of the primary vapor-heating chamber, means for passing vapors from the center of the primary vapor-heating chamber to the center of the secondary vapor-heating chamber, and means for passing vapors from an outer spiral of the secondary vapor-heating chamber to the intake manifold of the engine.

8. A carburetor for internal combustion engines comprising a vaporizing chamber, means for maintaining a body of liquid fuel in the bottom of said chamber, means for introducing atmospheric air into the body of liquid in the vaporizing chamber whereby said air will bubble upwardly through the liquid fuel and vaporize a portion thereof, atomizing nozzles positioned in said atomizing chamber, means for forcing liquid fuel through said atomizing nozzles whereby an additional amount of liquid fuel is vaporized, a primary vapor-heating chamber, a secondary vapor-heating chamber, means for passing vapors from the vaporizing chamber to the primary vapor-heating chamber, means for passing vapors from the primary vapor-heating chamber to the secondary vapor-heating chamber, means for maintaining vapors in said secondary vapor-heating chamber under a predetermined pressure, and means for passing vapors from said secondary vapor-heating chamber to the intake manifold of the engine.

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