CARBURETTOR

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

In my earlier patents, an intimate contact between 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 vaporised liquid passes into a vapour chamber which preferably is heated, and any liquid droplets are returned to the body of the 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 the liquid fuel is forced into and through the fuel under pressure and the fuel vapour 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 ensures a sufficient pressure being maintained in the vapour heating and expanding chamber, to cause at least a portion of it to be expelled from it into the intake manifold as soon as the valve controlling the passage to it is opened.

In accordance with the present invention, improved means are provided for maintaining the vaporous mixture in the vapour-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 vapour into and through the chamber. The pump is provided with a suitable pressure-regulating valve so that when the pressure in the vapour-heating chamber exceeds the predetermined amount, a portion of the vapour mixture will be by-passed from the outlet side to the inlet side of the pump, and so be 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 invention is not limited to that embodiment of the invention.

DESCRIPTION OF THE DRAWINGS
Fig. 1 is a side elevation of a carburettor embodying the invention.

Fig. 2 is a plan view of the carburettor.

Fig. 3 is an enlarged vertical section view.
Fig. 4 is a transverse sectional view on 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, 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
Fig. 8 is a longitudinal sectional view through a part of the pump cylinder, showing the piston in elevation.

In the drawings, a vaporising and atomising chamber 1 is located at the bottom of the carburettor and has an outlet at its top for the passage of fuel vapour and air into a primary vapour-heating chamber 2.

The vaporising chamber 1 is provided with a perforated false bottom 3 and is normally filled with liquid fuel to the level indicated in Fig. 1. Air is introduced via conduit 4 into the space below the false bottom 3, and then through the perforations 5 in the false bottom which breaks it into a myriad of fine bubbles, which pass upwards through the liquid fuel above the false bottom.

Liquid fuel for maintaining the level indicated in chamber 1 passes from the usual fuel tank (not shown) through pipe 6, and is forced by pump 7 through pipe 8 through a pair of nozzles 9 having their outlets located in chamber 1, just above the level of the liquid fuel in it. 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 cars.

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

The upper ends of 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 Patent No. 1,997,497. The liquid fuel being forced from the ends of nozzles 9 into the restricted portions of the venturi tubes, causes a rapid circulation of the air and vapour in the chamber through tubes 10 and brings the air and vapour into intimate contact with the liquid fuel, with the result that a portion of the liquid fuel is vaporised. Unvaporised portions of the liquid fuel strike the baffles 11 and are thereby further broken up and deflected downwards into the upward-flowing current of air and vapour.
Pump 7 is regulated to supply a greater amount of liquid fuel to nozzles 9 than will be vaporised. The excess liquid fuel drops into chamber 1 which causes the liquid there to be maintained at the indicated level. When the liquid fuel rises above that level, float valve 12 opens and the excess fuel flows through overflow pipe 13 into pipe 14 which leads back to pipe 6 on the intake side of pump 7. Such an arrangement permits a large amount of liquid fuel to be circulated by pump 7 without more fuel being withdrawn from the fuel tank than is actually vaporised and consumed by the engine. As 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 vapour passing into pipe 14 and thence into pump 7 to interfere with its normal operation.

The amount of liquid fuel vaporised by nozzles 9 and by the passage of air through the body of liquid, 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 air passes.

Vapour formed by air bubbling through the liquid fuel in the bottom of chamber 1 and that formed by the atomisation at the nozzles 9, pass from the top of that chamber into the primary heating chamber 2. As is clearly shown in Fig.1, chamber 2 comprises a relatively long spiral passage 15 through which the vaporous mixture gradually passes inwards 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 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 outwards 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 vapour chamber 2, the ends of passage 19 are covered with a fine mesh screen 25, which, operating on the principle of a miner’s lamp, will prevent the vapour in chamber 2 from exploding in case of a backfire, but will not interfere substantially with the passage of the vapour from chamber 21 into air tube 22 when valve 24 is open.

The air tube 22 is preferably in the form of a venturi with the greatest constriction being at that point where outlet 23 is located, so that when 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 outlet 23, as well as an expelling force on it due to the pressure maintained in chamber 21 by pump 18.

Both the primary and secondary spiral heating chambers 15 and 21, and the central portion of 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 gasses coming from the exhaust manifold.

Pump 18, used to force the vaporous mixture from primary heating chamber 2 into and through the secondary chamber 21, includes a working chamber 29 for hollow piston 30, provided with an inlet 31 controlled by valve 32, and an outlet 33 controlled by a valve 34. The end of the working chamber 29 to which is connected conduit 17, which conducts the vaporous mixture from primary heating chamber 2, has an inlet valve 35, and the opposite end of the working chamber has an outlet 36 controlled by valve 37 positioned in an auxiliary chamber 38, to which is connected 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-loaded or other types of one-way valves may be used if desired.

One side of 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 shaft 41 and operating in a housing 42 formed on the pump cylinder. The other end of 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 windscreen wipers on cars, 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 pipe 17, and causes valve 35 to be forced tightly against the inlet opening. In a like manner, valves 32 and 34 are forced open and the 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 to the left. During such movement of the piston, valve 37 is maintained closed and prevents any sucking back of the vaporous mixture from the secondary heating chamber 21.
When motor 47 reverses, piston 30 moves to the right and the vaporous mixture in the right-hand end of the working chamber is forced past valve 37 through pipe 19 into the secondary heating chamber 21. At the same time, a vacuum is created behind piston 30 which results in the left-hand end of the working chamber being filled again with the vaporous mixture from the primary heating chamber 2.

As the operation of pump 47 varies in accordance with the suction created in the intake manifold, it should be regulated so that the vaporous mixture is pumped into the secondary heating chamber at a rate sufficient to maintain a greater pressure there than is needed. 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 between the inlet and outlet pipes 17 and 19. Valve 51 will permit a portion of the vaporous mixture discharged from the pump to be bypassed to inlet 17 so that a pressure predetermined by the seating of valve 51 will at all times be maintained in the second heating chamber 21.

Air tube 22 is provided with a butterfly throttle valve 52 and a choke valve 53, as is usual with carburettors adapted for use with internal combustion engines. Operating stems 54, 55 and 56 for valves 52, 53 and 24 respectively, extend through casing 26. An operating arm 57 is rigidly secured to the outer end of stem 55 and is connected to a rod 58 which extends to the dashboard of the car, or some other place convenient to the driver. The outer end of stem 56 of valve 24 which controls outlet 23 from the secondary heating chamber 21 has one end of an operating arm 59 fixed securely to it. The other end is pivotally connected to link 60 which extends downwards and pivotally connects to one end of a bell crank lever 61, rigidly attached to the end of stem 54 of throttle valve 52. The other end of the bell crank lever is connected to an operating rod 62 which, like rod 58, extends to a place convenient to the driver. 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, valve 24 will also be opened to admit a larger amount of the heated vaporous mixture from the secondary heating chamber 21.

While the suction created by pump 18 ordinarily will create a sufficient vacuum in the primary heating chamber 2 to cause air to be drawn into and upwards through the body of liquid fuel in the bottom of vapourising chamber 1, in some instances it may be desirable to provide supplemental means for forcing the air into and up through the 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 engine fan 63 which is customarily placed behind the engine radiator.

The foregoing description has been given in connection with a downdraft type of carburettor, but it is to be understood that the invention is not limited to use with such type of carburettors and that the manner in which the mixture of air and vapour is introduced into the engine cylinders is immaterial as far as the advantages of the carburettor are concerned.

Before the carburettor is put into use, the pressure-regulating valve 51 in the bypass pipe 50 will be adjusted so that the pressure best suited to the conditions under which the engine is to be operated, will be maintained in the secondary heating chamber 21. When valve 51 has thus been set and the engine started, pump 18 will create a partial vacuum in the primary heating chamber 2 and cause air to be drawn through conduit 4 to bubble upwards through the liquid fuel in the bottom of the vapourising and atomising chamber 1 with the resulting vapourisation of a part of the liquid fuel. At the same time, pump 7 will be set into operation and liquid fuel will be pumped from the fuel tank through the nozzles 9 which results in an additional amount of the fuel being vapourised. The vapour resulting from such atomisation of the liquid fuel and the passage of air through the body of the liquid, will pass into and through spiral chamber 1 where they will be heated by the products of combustion in the surrounding chamber formed by casing 26. The fuel vapour and air will gradually pass inwards through outlet 16 and through conduit 17 to 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 chamber 21 and passes spirally outward to the valve-controlled outlet 23 which opens into air tube 22 which conducts the main volume of 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 chamber 21 is prevented due to the pressure regulating valve 51. However, as soon as the heated vaporous mixture passes valve 24 and is introduced into the air flowing through 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 heating chamber 21 is forced into the air passing through air tube 22 by a positive force, but it is also heated to such an extent that after it leaves chamber 21 it will expand to such an extent as to have a density less than it would if introduced directly from the vapourising and atomising chamber 1 into the air tube 22.

The majority of the liquid particles entrained by the vaporous mixture leaving 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 fuel in
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 vaporised before the vaporous mixture is introduced into the air tube 22 from the secondary heating chamber 21. Thus only “dry” vapour is introduced into the engine cylinders and any burning in the engine cylinders of liquid particles of the fuel, which would tend to raise the engine temperature above its most efficient level, is avoided.

While the fullest benefits of the invention are obtained by using both a primary and secondary heating chamber, the primary heating chamber may, if desired, be eliminated and the vaporous mixture pumped directly from the vaporising and atomising 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 carburettor disclosed in my Patent No. 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 vapour molecules with the air.