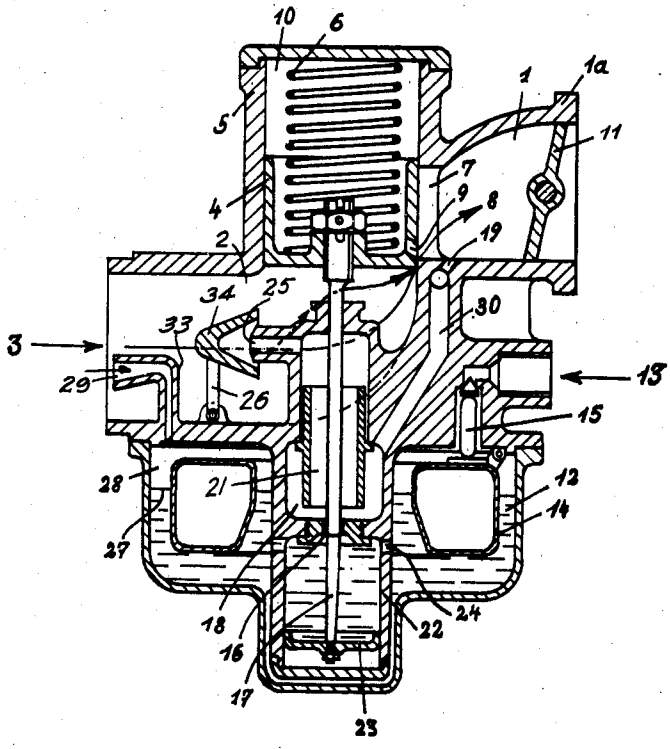
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CARBURETOR

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CARBURETOR

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1 Claim. (Cl. 261—54)

The present invention relates to means for the automatic or at least partially automatic regulating of the mixture of fuel in motors at different altitudes. The invention refers only to carburetors with double carburation and with constant partial vacuum in the second carburation space.

The invention utilizes the back pressure and the suction pressure of the air current in order to alter in carburetors, in which the fuel supply is effected at an always constant pressure-difference, this pressure-difference depending on the specific gravity of the air.

The invention makes use of the fact that for carburetors of the kind having a pre-carburation stage the supply-pressure or feed pressure which sucks in the fuel, can be regulated in the pre-carburation space in which the first mixing of fuel and air takes place independently of the supply-pressure which prevails at the place of the second carburation.

The invention contemplates that the back and suction pressure of the air flowing through the carburetor, which pressure is a function of the specific gravity of the air, is utilized not only mediately by means of being derived from the second mixing place but also immediately for supplying or conveying the fuel into the first mixing place.

As is known, the mixture in the carburetors of aircraft motors becomes richer as the height of the aeroplane increases. In order to establish the correct mixing proportions at all altitudes, various regulating devices have already been proposed which either work automatically or are controlled by the pilot.

This invention utilises the dynamic effect of the air current for the purpose of altering the difference of pressure that conveys the fuel into the carburetor in dependence upon the specific gravity of the air.

As is known, the mixture changes in consequence of the diminution of the specific gravity of the air in such a way that the quantity of air drawn in by the suction of the motor diminishes proportionally to the specific gravity of the air, while the quantity of fuel only decreases with the square root of this specific gravity. Consequently the mixture becomes richer when the specific gravity of the air decreases.

Let γ be the weight of 1 cubic metre of air, v the velocity of the air in metres per second, and g the acceleration due to gravity in meters per second squared (9.81).

As is known, if a surface is exposed to a current of air the pressure upon the side of the surface facing the current is greater by

$$\gamma\frac{v^2}{2g}$$

and the pressure upon its other side is less by

$$\gamma\frac{v^2}{2g}$$

than the pressure in the neighbourhood of this surface.

Now if a tube is so arranged in a current of air that the air current blows into the opening of the tube, then the pressure in the interior of the tube is greater by

$$\gamma\frac{v^2}{2g}$$

than the pressure beside the tube or outside the tube. If on the other hand the tube is so arranged that the current of air exerts a suction effect upon the aperture of the tube, then the pressure in the interior of the tube is less by

$$\gamma\frac{v^2}{2g}$$

than the pressure beside or outside the tube.

In both cases, if the velocity of the current of air does not change, the pressure in the interior of the tube will only vary with the specific gravity of the air. If a motor runs with the same speed at all altitudes without the adjustment of the throttle valve being altered, the motor always fills with the same volume of air. Consequently the pressure in the interior of a tube which is arranged in the current of air, as explained above, will only alter with the specific gravity of the air, since the speed of the air does not change.

This invention utilises the fact that for carburetors of the kind in which the partial vacuum that sucks in the fuel is invariable and remains independent of the specific gravity of the air, such a tube or the like which is exposed to the dynamic action of a current of air is a simple means for the re-establishment and maintenance of the correct mixing proportions at different altitudes. The invention consists in the fact that the dynamic pressure of the air flowing through the carburetor, which is a function of the specific gravity of the air, is utilised for the delivery of the fuel. In this way a complete regulation, or at least a partial regulation of the mixing proportions can be brought about.

For carburetors in which the partial vacuum in the mixing chamber remains invariable, but which have a double gasification, this invention

renders it possible to influence the partial vacuum in the pre-carburation chamber independently of the constant partial vacuum in the main mixing chamber. In such carburetors as these the fuel first enters a chamber in which the partial vacuum is only a portion of that which prevails in the main mixing chamber, the quantity of air that flows into the pre-carburation chamber being only a portion of the total quantity of air. It therefore forms an emulsion with the fuel, which meets the main air in the mixing chamber with an invariable partial vacuum. The device according to the invention may then be such that the air supply to the pre-carburation chamber is so arranged that besides the dynamic effect of the air current the static partial vacuum in the pre-carburation chamber is also influenced. With the decrease in the specific gravity of the air, the partial vacuum in the pre-carburation chamber then also falls, whereby the enrichment of the mixture at a height is compensated for.

One example of construction of the invention is illustrated in the accompanying drawing which shows a regulating means according to the invention on a carburetor with duplicate carburation in which the partial vacuum in the main mixing chamber always remains unchanged.

As shown, air flows through a connecting piece 2 in the direction of the arrow 3 into the carburetor and flows from there in the direction of the arrows into a mixing chamber 1, where a second atomization takes place. Part of this air flows through an aperture 25 and tube 21 into a pre-carburation chamber 18. The fuel passes in the direction of the arrow 13 through a needle valve 15, which is controlled by a float 14, into a chamber 12, out of which it flows, through the cross section of the aperture 16 uncovered by the conical needle 17, into the chamber 18. In the chamber 18 an emulsion is formed, which passes through a passage 30 and an aperture 19 into the mixing chamber 1. In the mixing chamber 1 the emulsion mixes with the main air of this chamber, and the ultimate mixture flows through a connecting piece 1a, provided with a throttle valve 11, to the motor.

The chamber 18 is formed with a cylindrical extension 22 in which moves a disk 23 carried on the bottom of the needle 17 for braking or damping the movement of said needle.

The connection with the mixing chamber 1 is controlled by a piston 4, which is guided in a cylindrical portion 5 of the casing, and assumes different positions according to the quantity of air drawn in by the suction of the motor, as a result of which it opens the aperture 7 leading to the mixing chamber 1 to a greater or less extent.

The difference of pressure between the chamber 1 and the space 2 underneath the piston 4, that is to say, the partial vacuum which draws the air by suction through the aperture 7 in the direction of the arrow 8, is always constant and independent of the specific gravity of the air. The pressure of the chamber 1 is propagated through the aperture 9 into the space above the piston 4, so that the partial vacuum, which sucks the air in the direction of the arrow 8, tends to raise the piston 4. This force or this tendency is counteracted by the weight of the piston 4, which in practice is very small, and the compressing force of the spring 6, which, in order to keep its action as constant as possible, is preferably formed by a spring with numerous turns. The constant vacuum in the chamber 1 determines a constant vacuum in the space 18, the vacuum in the space 18, however, being less than the vacuum in the chamber 1, because the space 18 communicates by the aperture or apertures 25 with the space 2, in which the pressure is greater. In order to ensure complete regulation, it is necessary to regulate the aperture 25 correspondingly, and therefore to vary the vacuum in the chamber 18 to a corresponding extent. Therefor a lever 26 is provided with a conical closure piece 34, by the movement of which towards the aperture 25 the latter is closed to a greater or lesser extent, and therefore the partial vacuum in the space 18 can be accordingly altered. The vacuum in the space 18 diminishes of course with the enlargement of the aperture 25, and becomes greater when the aperture 25 is smaller. If therefore the aperture 25 is completely closed, the pressure in the space 18 would be equal to the pressure in the space 1. The air flowing in the neighbourhood of the aperture 25 exerts, however, upon the mouth of the aperture a suction effect which is proportional to the specific gravity of the air. This suction effect and consequently also the vacuum in the space 18, is greater at the level of the ground than at great altitudes. At greater altitudes the closure piece 34 must be moved further away from the aperture 25. The adjusting of the closure piece 34 may be effected by any suitable controlling means within reach of the pilot's hand.

The air flowing in the direction of the arrow 3 enters the aperture 29 of the tube 33, and consequently the pressure in the space 28 above the surface of the fuel is greater at the ground level than at great altitudes. The fuel is delivered by the difference of pressure between the space 28 and the space 18. At great altitudes the excess pressure in the space 28 diminishes, as also does the partial vacuum in the space 18. The pressure difference that delivers the fuel will therefore fall in consequence of these two effects. The quantity of fuel therefore diminishes in proportion as the altitude increases, and consequently the enrichment of the mixture in consequence of the decrease in the specific gravity of the air is compensated for.

The utilisation of the dynamic effect of the air current is only limited by the air speeds which can be attained without considerable losses in cross sections in which the tubes for the utilization of this dynamic effect are located.

The more important the part played by the dynamic effect of the air current for the pressure difference that delivers the fuel, that is to say, the smaller this difference is without dynamic effect, the more complete will the above-described altitude regulation be. This is illustrated by the following example:

Let it be assumed that the difference of pressure in the spaces 2 and 18 without dynamic effect is equivalent to a column of water 10 centimetres high, and let it be further assumed that in consequence of the dynamic effect at the ground level a raised pressure of 15 centimetres (water column) in the space 28 and a partial vacuum of 15 centimetres (water column) in the space 18 arises. Under these circumstances a pressure difference of 30 centimetres (water column) will arise, which then, with the difference of 10 centimetres, which is without dynamic effect, yields an aggregate difference of 40 centimetres (water column).

At an altitude of 6000 metres the dynamic ef-

fect will produce a difference of 2 × 7.5=15 centimetres (water column). The total difference of pressure which delivers the fuel will therefore amount to 10 + 15=25 centimetres (water column). The pressure difference delivering the fuel will therefore fall, at an altitude of 6000 metres, in the ratio of 25:40. Although this is not a complete regulation it will be sufficient in practice for the satisfactory working of the motor at an altitude of 6000 metres.

For carburetors with invariable spraying nozzles the arrangement of a tube in the air current for regulating the suction vacuum is not applicable, since the vacuum which sucks in the fuel changes with the specific gravity of the air.

What I claim is:

In a carburetor for mixing fuel and air in two stages, a main air inlet, a fuel chamber, a fuel inlet for said fuel chamber, a first stage mixing chamber, a passage leading from said fuel chamber to said first stage mixing chamber, a second stage mixing chamber in communication with the first stage chamber, an automatically operated valve for maintaining constant the partial vacuum in said second stage mixing chamber, a passage leading from said main air inlet to said first stage mixing chamber for supplying air to said first stage mixing chamber, the entrance to said passage being arranged in a direction opposite to the air current in the main air inlet, a conically shaped member in front of said entrance with its apex directed towards said air current so that the dynamic pressure of said air current in the main air inlet causes a suction effect on said entrance and means for adjusting said conical member relatively to said entrance in order to vary the partial vacuum in said first stage mixing chamber caused by said suction effect.

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