CARBURETOR

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.FIG.1.

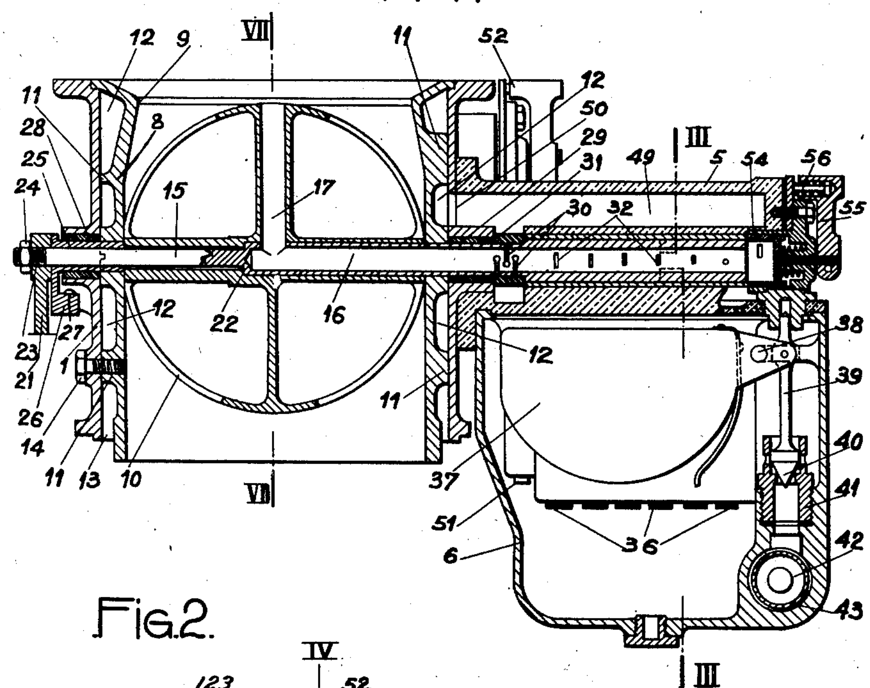


FIG.2.

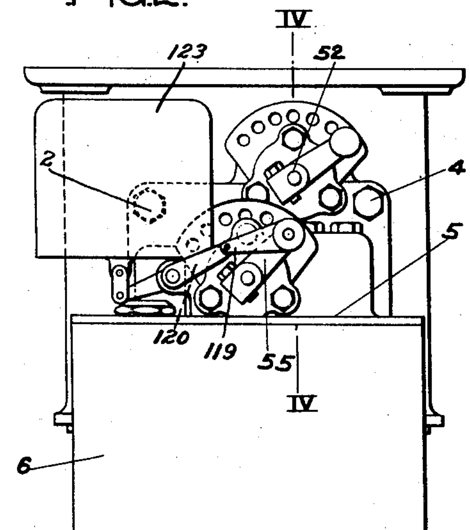
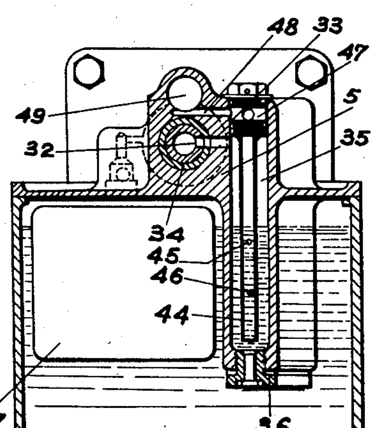


FIG.3.



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CARBURETOR

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Fig.4.

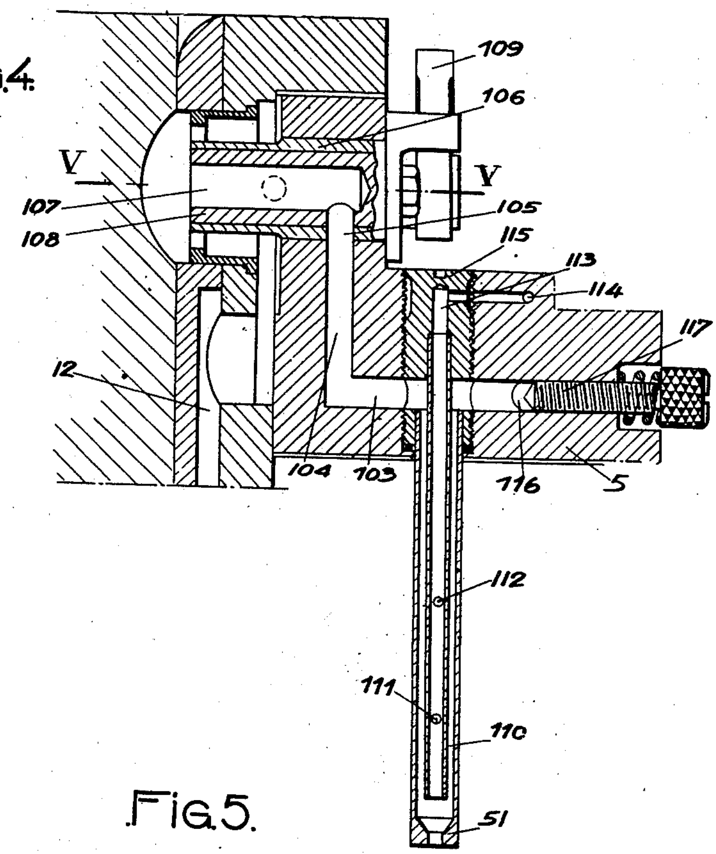

Fig.5.

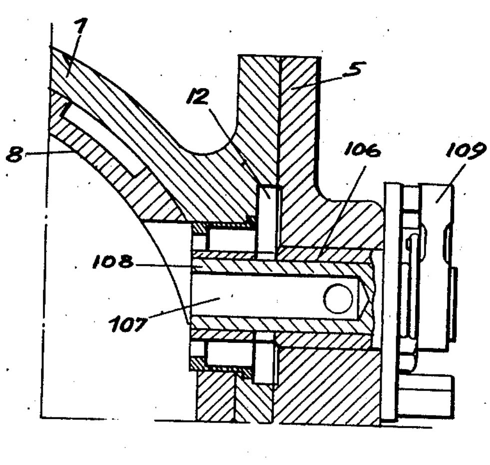

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Fig. 8.

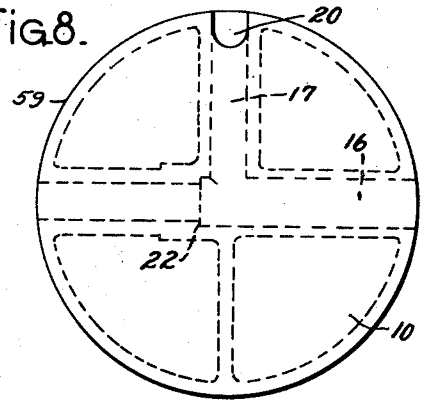


Fig. 7.

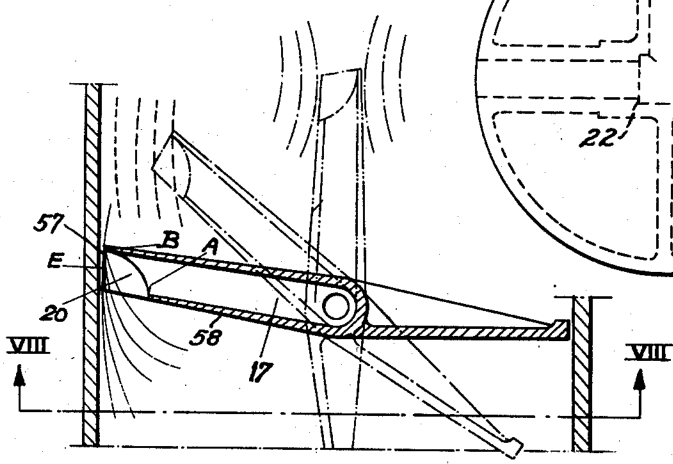
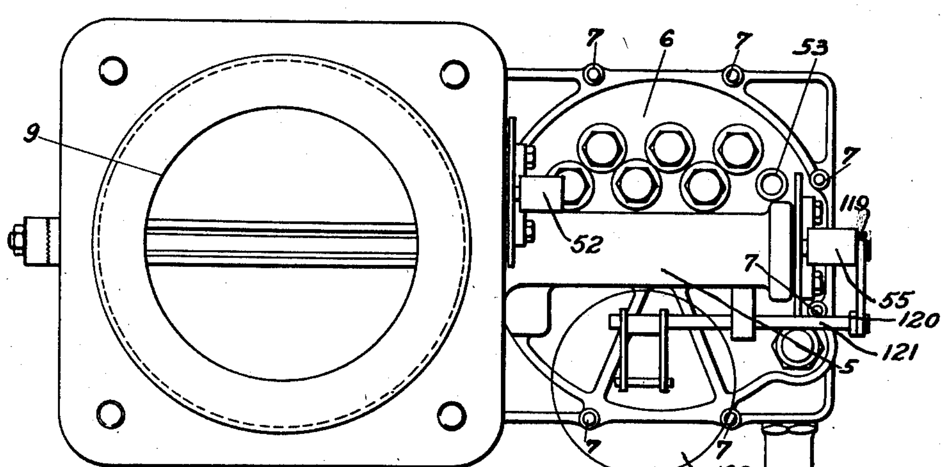


Fig. 6



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CARBURETOR

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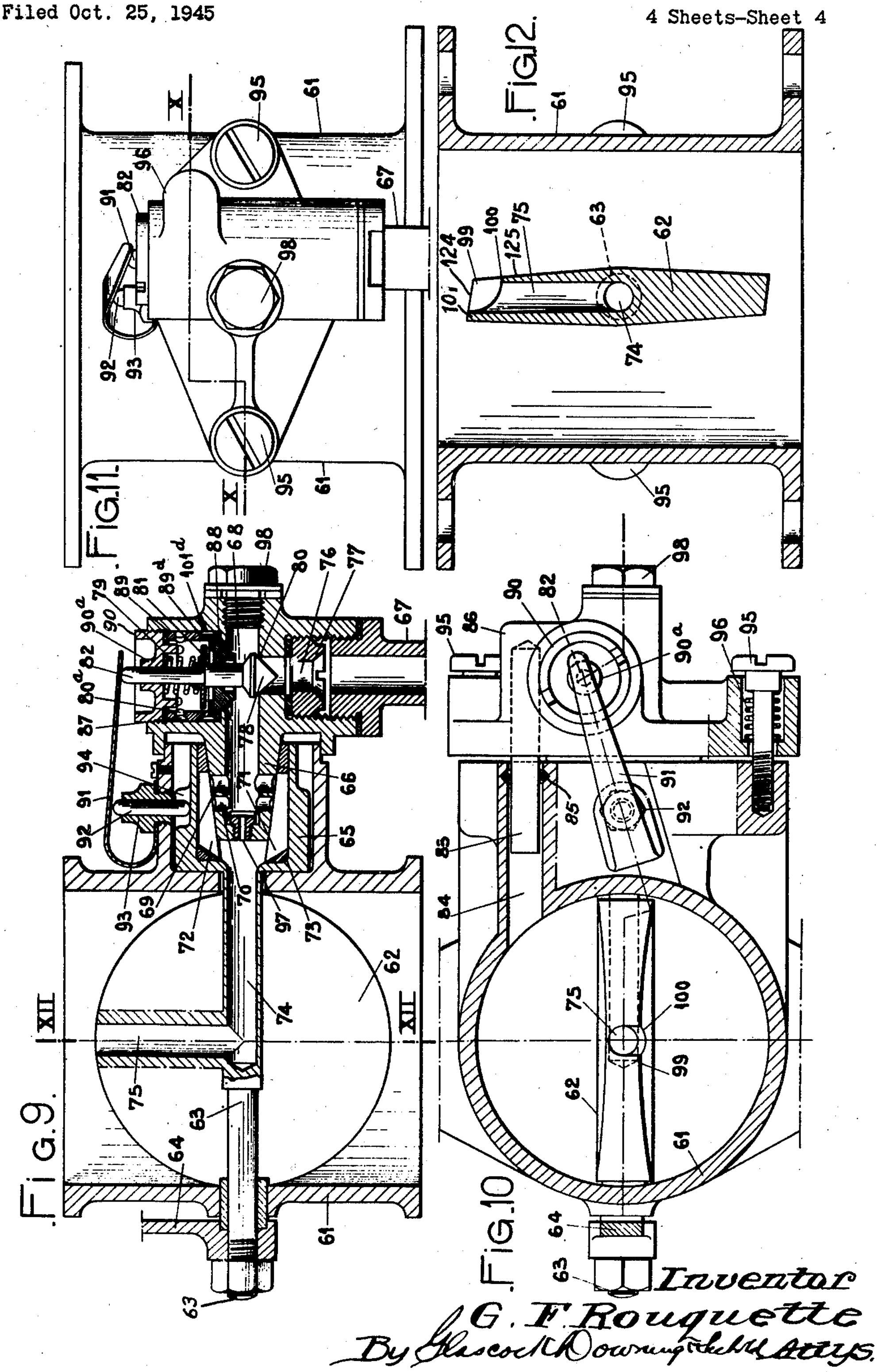

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UNITED STATES PATENT OFFICE

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CARBURETOR

Guillaume François Rouquette, Paris, France

Application October 25, 1945, Serial No. 624,382
In France December 22, 1943

Section 1, Public Law 690, August 8, 1946
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5 Claims. (Cl. 261—39)

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The present invention relates to improvements in carburetors.

The main object of the invention is to provide a carburetor having a perfectly regular feeding of fuel regardless of the speed of rotation of the engine, and one that eliminates the necessity for any movable members in connection with the carburetor, such as pumps or the like.

For this purpose, a carburetor is provided in which the throttle valve for regulating the intake of air is constituted by a disc-like member through which there is formed a passage coaxial with the pivoting axis of said member and communicating on the one hand with the fuel jet or jets of the carburetor and on the other hand with one or more radial ducts, also formed in the said disc-like member.

In order to prevent excessive suction at the delivery nozzle during the lower throttle valve opening range, devices have been proposed in which the edge of the disc-like member is bevelled. Such a structure presents drawbacks and generally the bevelled portion causes turbulence in the air flow. Furthermore, such devices provide a very irregular feeding of fuel, the bevel serving merely to reduce the suction on the delivery nozzle at idling speeds and speeds slightly higher than idling speeds.

The present invention provides means whereby reduction in vacuum or suction at the delivery nozzle is effected over a greater range of throttle valve opening without materially altering the upstream surface of the throttle valve, which surface remains substantially planar. In a carburetor according to the present invention, each of the aforesaid radial ducts comprises a delivery nozzle formed by terminating said duct in an opening respectively on and common to the cylindrical and the upstream sides of said throttle valve, said opening having a width equal to the diameter of the duct and extending respectively from the common peripheral edge of said sides to the wall of the duct opposite thereto on said cylindrical side and toward the center of said throttle disc on said upstream side for a distance substantially equal to said diameter. Thus there is provided an effective means of preventing excessive vacuum at the delivery nozzle during the lower throttle opening range. Such an opening being very narrow does not change the general form of the upstream side of the disc, and causes no perturbation in the air flow.

For gravity fed multiple jet carburetors such a fuel intake arrangement permits efficient control of the suction effect of the air flow on the fuel in relation to the position of the throttle valve. For constant level fed multiple jet carburetors provided with jets brought into operation in succession and wherein the flow of fuel through each jet is dependent on the suction, the fuel intake arrangement of this invention effectively prevents, during the throttle valve closure, an increase in suction in the fuel induction opening or openings, so as to prevent any flow of fuel through the first jet when the throttle is down.

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In addition the present invention relates to the several particular structural features which will become apparent from the following description taken in connection with the accompanying drawings, given by way of example only and wherein:

Fig. 1 is a vertical axial section of a multiple jet constant level carburetor embodying the invention.

Fig. 2 is a side view of the carburetor shown in Fig. 1,

Fig. 3 is a cross sectional view on line III—III of Fig. 1.

Fig. 4 is a cross sectional view on line IV—IV of Fig. 2.

Fig. 5 is a cross sectional view on line V—V of Fig. 4.

Fig. 6 is a top plan view of the carburetor shown in Fig. 1.

Fig. 7 is an enlarged sectional view on line VII—VII of Fig. 1, but on an enlarged scale and intended to explain the operation of the device.

Fig. 8 is a plan view of the throttle valve in the direction of arrows VIII—VIII on Fig. 7.

Fig. 9 is a vertical axial section of a gravity fed multiple jet carburetor embodying the invention.

Fig. 10 is a corresponding top plan view of the carburetor shown in Fig. 9 with a partial sectional view taken on the line X—X of Fig. 11.

Fig. 11 is a side elevational view of the carburetor shown in Fig. 9.

Fig. 12 is also a vertical sectional view taken along the line XII—XII of Fig. 9.

The multiple-jet constant level carburetor provided with jets operated successively, as illustrated in Fig. 1, comprises:

A tubular body 1, on one side of which is secured by means of screws 2, 3 and 4 a supporting member 5 at the lower portion of which a float chamber 6 is secured by screws 7.

Within the tubular body 1 is secured by screws 14 a nozzle or choke tube 8 comprising a contraction 9 located above a regulating disc-like throttle valve 10. The choke tube 8 is mounted by means of screws 14 within the body 1 by means of outer ribs 11 providing therebetween annular recesses 12, adapted to communicate between each other and with the atmosphere. This last communication is effected by means of the annular space or clearance 13 remaining between the body 1 and the choke tube 8 at the base of the latter.

The disc-like throttle valve 10 has a cylindrical side 57 and an upstream side 58 and includes a perimetrical edge 59 common to said cylindrical and upstream sides. Said disc-like throttle valve is diametrically mounted on a pivotal shaft 15 formed with a hollow portion 16 through which flows the fuel. A radial duct 17 formed through said throttle valve 10 communicates with said hollow portion 16 and terminates in an opening 20 (Figs. 7 and 8) respectively on and common to said both sides of the said edge.

As clearly seen in the drawings, said terminal opening 20 has a width equal to the diameter of the duct 17 and extends respectively from said common edge 59 to the wall of said duct opposite thereto on the cylindrical side 57 of the throttle disc and from said edge 59 toward the center of said throttle disc on the upstream side 58 for a distance substantially equal to the diameter of said radial duct.

The shaft 15 carries at its outer end an operating arm 21, operatively connected to the intake regulating device operated by the pilot for regulating the engine intake. The hollow shaft 15 is provided with a thrust collar 22 abutting against the bottom of an axially extending passage through the throttle valve 10, while its outer projecting end is threaded at 23 to receive a clamping nut 24. A sleeve 25 is inserted between the arm 21 and the cylindrical side of the throttle valve, and, as the adjacent faces of arm 21 and sleeve 25 are provided with grooves in mesh with each other, the clamping action of nut 24 ensures an effective fixation between shaft 15, throttle valve 10, sleeve 25 and operating arm 21. Further, sleeve 25 includes a radial extension 26 cooperating with an adjustable set screw stopping device 27 for regulating the position of the throttle valve 10 when down.

The hollow shaft 15 is journaled into bushings 28 and 29 inserted in the body 1, and extends within the supporting member 5. When very large dimensions are required the hollow shaft 15 is provided with a resiliently flexible portion between its parts respectively guided within body 1 and supporting member 5. For this purpose saw notches 30 are effected throughout a considerable depth of the hollow part of shaft 15 so as to present a staggered relationship with respect to each other. A sleeve 31 of a resilient material resistant to or unaffected by gasoline, such as synthetic rubber or the like is used as bearing packing. The extension of the hollow shaft 15 within the supporting member 5 acts as one element of a sleeve valve means the other elements of which comprise the various jets with which the carburetor is supplied and to which said extension is successively connected as indicated hereinafter. Said extension of the hollow shaft 15 is provided with suitably shaped lateral openings 32, cooperating with corresponding openings 33 provided in a stationary bushing 34 fitted within the supporting member 5 and each of said openings 33 communicates with a cylindrical chamber 35. There are accordingly as many such cylindrical chambers, as there are main jets such as 36 which in this example are six in number. These jets are submerged and communicate with the float chamber 6 within which is a float 37. This float 37, pivotally mounted on a pin 38, actuates the rod 39 of a needle valve 40 regulating the supply of fuel to the float chamber 6. The seat of the needle valve 40 is indicated at 41; it communicates with the fuel inlet 42 through a filter 43.

Into each cylindrical chamber 35 is immersed a tube 44 acting to emulsify the fuel and which is provided with radial apertures 45 and 46 at different levels. This tube communicates by holes 47 and 48 with a chamber 49 provided in the supporting member 5. This chamber 49 substantially cylindrical in shape communicates through the opening 50 with the annular recesses 12 provided between the tubular body 1 and the choke tube 8; and thus said chamber is in communication with the atmosphere.

According to the most important feature of the invention, the duct 17 terminates in an opening 20 respectively on and common to the cylindrical and upstream sides of the throttle valve. This arrangement operates as follows:

When the throttle valve is at its position of minimum opening (slow running position) as indicated in continuous line in Fig. 7, the suction in the space E provided between the throttle valve and the choke tube 8 is high. If the duct 17 opened directly into this space, as effected hitherto, the first jet would be subjected to a strong suction and therefore would discharge fuel irregularly. If, on the contrary, the improved opening 22 is used, it is clear that the suction existing at the port inner ridge A is of much smaller degree than the suction existing at the port outer ridge B, said suction may be sufficiently moderated so that said first jet provides a fuel flow corresponding to a normal slow running. But, so soon as the throttle valve is open, the angle formed by the line A—B with the streamlines contracted by the throttle edge decreases, so that the distance between the port inner ridge A and the streamlines contracted by the throttle edge on the level of the port outer ridge B decreases in proportion as said throttle valve is open. Consequently, the average value of the vacuum or suction acting on the surface limited by the port outline progressively increases, during the throttle valve opening, in relation to the maximum vacuum exerted on the outer ridge B for each throttle valve position, as indicated in dotted lines in Fig. 7.

The operation at full opening of the throttle valve is therefore the same as in known carburetors, and is prefectly satisfactory, but, at lower R. P. M. and in particular for slow running, that operation is considerably improved by the new application according to the invention, whereby the throttle valve acts as a distributing device regulating the fuel flow according to its angular position in the choke tube.

On the other hand, it is to be noted that in carburetors of the above disclosed type, the point of impact of the fuel emulsion on the walls of the device is situated after the throttle and very far from the same, which is thus protected from the effects of icing; this does not of course apply to carburetors wherein the fuel intake is located beyond the throttle, as is generally the case.

However, when a choking device is required to interrupt the slow running, as it is the case for aircraft engines, the carburetor according to the invention is provided with a pilot jet 51 secured to the supporting member 5 and communicating through ducts 103 and 104, drilled through said member, simultaneously with the opening 105 of a stationary bushing 106 and the blind bore 107 formed in a pivotally mounted plug 108 actuated by means of a control arm 109. Within the pilot jet 51 projects an emulsifying tube 110, provided with radial openings 111 and 112 and which communicate with the atmosphere through the chamber 49 by means of ducts 113 and 114 respectively drilled through the pilot jet clamping screw 115 and the supporting member 2. The duct 103 communicates with said chamber 49 through a duct 116 regulated by means of a screw 117. The fuel flowing through the plug 108 discharges into the choke tube 8 after the throttle valve 10, in a portion of said choke tube connected with the recess 12. The control arm 109 provides for an instantaneous stopping of the engine by choking the fuel flow.

Further, and particularly for aircraft engine, an altimetric control device may be provided, which comprises a jet 53 regulated by a rotating plug 54 actuated by a barometric capsule 123. The connection between said plug and said capsule comprises an actuating arm 55 secured on the plug, a rod 119, a lever 120 secured on a shaft 121 carrying a lever 122 actuated by the capsule. Thus said capsule changes the vacuum exerted on each jet in operation.

The actuating arm 55 may be disposed to be operated directly by hand; thus the jet 53 acts as a mixture enriching device.

In the embodiment of a gravity fed carburetor, as illustrated in Figs. 9 to 12, the body of the carburetor is shown at 61.

The intake regulating disc-like throttle valve 62 is journaled on a pivotal shaft 63 the outer end of said shaft carrying an operating arm 64. Its other end is shaped as the movable box 65 of a cock comprising a stationary plug 66 adapted to ocntrol the admission of fuel so as to regulate its flow when the engine is running, according to the position of the throttle valve 62. To this end, the fuel flows through the pipe 67, the central bore 68 of the plug 66 and openings 69 and 70 of said plug towards suitable shaped grooves 71 and 72 formed in an inner metallic packing 73 located within the movable box 65. The fuel is supplied by gravity from a tank and its flow will depend in particular on the relative position of the valve box 65 and the plug 66. Said plug controls the fuel flow from the openings 70 and 71 to the axial duct 74 drilled through the pivotal shaft 63 of the throttle valve and which communicates with a radial duct 75 extending to the edge of said throttle. The maximum fuel flow is controlled by a gauged port 76 of an auxiliary jet 77.

According to the main features of the invention, the disc-like throttle valve 62 diametrically mounted on the pivotal shaft 63 is provided with a radial duct 75 terminating as already indicated for the multiple-jet constant level carburetor in an opening 99 (Fig. 12) respectively on and common to the cylindrical side 124 and the upstream side 125 of said throttle valve. Such an arrangement offers a very great advantage in that it very effectively permits an adjustment, according to the throttle valve position, of the attractive effect of the air flow on the fuel. This result is easily explained by considering that the distance between the inner ridge 100 of said opening 99 and the streamlines contracted by the throttle valve on the level of the outer ridge 101 decreases in proportion as said throttle valve is open and will be on the contrary the greater when the throttle valve is down. Now, the attractive effect of the air flow on the fuel is the greatest for the throttle valve position to which said distance is smallest. The device according to the invention thus effects a perfect control of said effect.

The purpose of the above arrangements is not only to control the flow of fuel during engine running according to the setting of the throttle valve 62, but also to stop the flow of fuel when the throttle valve 62 is down and consequently the engine stopped. In such a position, the cock 65—66 completely obstructs the flow of liquid. But it will be understood that, in the event where the engine is in stopped condition, without the throttle valve 62 being closed the fuel can freely escape outside. The arrangements described hereinafter avoid such drawback.

Such dispositions consist of an automatic stopping device acting on the fuel intake to the bore 68 of the stationary plug 66, such device comprising needle valve 78 urged at all times against its seat 80 by the action of a spring 79, said spring acting in opposition to the vacuum caused by the suction of the motor exerting its action on a piston 81 mounted on the stem 82 of the needle valve 78. Said vacuum is transferred to said piston 81 by a tube 83 fitted in a bore 84 of the carburetor body, air-tightness being achieved by a suitable means, such as, for example, a rubber washer 85 engaged in an annular groove. The tube 83 is mounted in the bossing 86 secured on the stationary plug 66, so that the boring of the hole 87 laterally opens at the same time the tube 83 which thus communicates with the bore 87. Now, this bore is, at its lower end, closed by a seat 88 held in place by a ring 89 maintained by a screw plug 90, having a centrally disposed apertured bearing 90^a for guiding the stem 82. The ring 89 acts as a cylinder for the piston 81, it has a smaller diameter at the central outer portion thereof to constitute a chamber wherein is exerted the vacuum, and this chamber communicates with the inner space of the cylinder through apertures 80^a provided on the upper cylinder portion. Accordingly when the vacuum is active, it may be operative to raise the piston 81 and consequently the needle valve 78 against the opposite action exerted by the spring 79. Preferably, said needle member will, in that position, be applied against the upper seat 88 and ensure tightness.

In order that atmospheric pressure will be exerted below the piston 81, the ring 89 has a smaller outer diameter at the base thereof, to constitute an annular chamber communicating, on one hand, with the inner bore of the ring 89 through one or more small apertures 89^a and, on the other hand, with the outer atmosphere through the aperture 101^d.

The spring 79, as will be explained below, is comparatively weak; however, as soon as the engine is stopped the action of a second spring 91 is added to that of spring 79. Said spring 91 is a strong spring plate bearing against the head of the rod 82; but another rod 92, guided in 93 operates to raise the spring 91 by means of an appropriate cam surface 94 pertaining to the valve box 65. The cam 94 is suitably inclined and, if desired, may operate through a suitable amplifying means such as a lever. When said cam raises the spring 92, the action of the latter on the rod 93 of the needle valve is suspended.

It will be observed that the plug 66 is resiliently applied against the movable box 65 by screws 95 acting on springs 96. A resilient engagement of the stationary plug 66 against the movable box 65 is allowed by the fact that, on one hand, the tube 83 may move within the bore 84 and that, on the other hand, the pipe 67 comprises a flexible portion. Lastly, a pilot jet may be mounted at 97, preferably by screwing. In order to allow for readily introducing and withdrawing said pilot jet 97, the axis of the bore 87 and consequently the axis of the needle valve 78 and of the stem 82 thereof do not intersect the axis of the bore 68, as illustrated in the drawings and particularly in Figs. 10 and 11; in this way, said bore 68 remains free throughout the whole length thereof to allow for ready access to the pilot jet 97, by unscrewing of the threaded plug member 98.

The device operates as follows:

In the stopped condition of the engine, which is that in which the throttle valve is down, the relative position between the movable box 65 and the stationary plug 66 is preferably such that the ducts 70 and 71 are completely closed. Besides, the position of the movable box 65 is such that the cam 94 actuating the rod 92 is in the position shown in Fig. 9, whereby the rod 92 entirely disengages the spring 91. Consequently the action of said spring 91 is added to that of spring 79 and operates to firmly press the needle member 78 against its seat 80. In this way, a perfect seal is provided and no leakage may occur.

When the engine is started, the throttle valve 62 is set to the so called slow running position; during this movement, the cam 94 raises the rod 92 which in turn raises the spring 91, which no longer actuates the rod 82. On the other hand, the suction produced causes above the throttle valve 62 a vacuum which is transmitted through the dutc 84 and the tube 83 to the bore 87 and thence through the upper aperture of the ring 89 to the inner space of the cylinder constituted by the inner bore of said ring. Said vacuum is sufficient to overcome the resistance of the spring 79 so that the piston is upwardly displaced together with the needle valve 78 and fuel is thereby allowed to pass. The fuel then fills the bore 68 of the plug 66 and passes through the pilot jet 97 to reach the bores 74 and 75 wherefrom it is discharged by the effect of the suction, through the edge of the throttle 62, which is incompletely closed, in the well known way.

What I claim as my invention and desire to secure by Letters Patent is:

1. In a carburetor for an internal combustion engine, a choke tube, a pivotal shaft transversely crossing said tube with at least a portion thereof hollow and adapted to act as a fuel distributing device, and a disc-like throttle valve having a cylindrical and an upstream side and including a perimetrical edge common to said cylindrical and upstream sides, said valve being diametrically mounted on said shaft within said choke tube and having a radial duct communicating with said hollow portion of said shaft at one end and terminating in an opening respectively on and common to said both sides of the said edge.

2. A carburetor as defined in and by claim 1 and the terminal opening of the radial duct having a width equal to the diameter thereof and extending respectively from said common edge to the wall of said duct opposite thereto on the said cylindrical side of said throttle disc and from said edge toward the center of said throttle disc on the upstream side thereof for a distance substantially equal to the diameter of said radial duct.

3. A carburetor as defined in and by claim 1 and including a fuel conduit communicating with said hollow shaft, sleeve valve means for regulating the flow of fuel through said conduit in accordance with the position of said throttle disc, said shaft including an extension constituting one element of said sleeve valve means, and valve means in said conduit independent of said sleeve valve means for interrupting the flow of fuel when the engine is stopped.

4. A carburetor as defined in and by claim 3, wherein said second mentioned valve means comprises cock means including a fixed plug, a seat for said plug, and resilient means for urging said plug on said seat.

5. A carburetor, according to claim 1, further comprising an altitude jet, a barometric capsule and a lever and rod system connected to said jet and to said capsule, whereby the control of the jet is automatically effected in accordance with the pressure of the circumambient atmosphere air.

GUILLAUME FRANÇOIS ROUQUETTE.

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