

July 23, 1935.

J. T. JENNINGS

2,009,233

SPRAY CARBURETOR FOR INTERNAL COMBUSTION ENGINES

Filed June 27, 1933

2 Sheets-Sheet 1

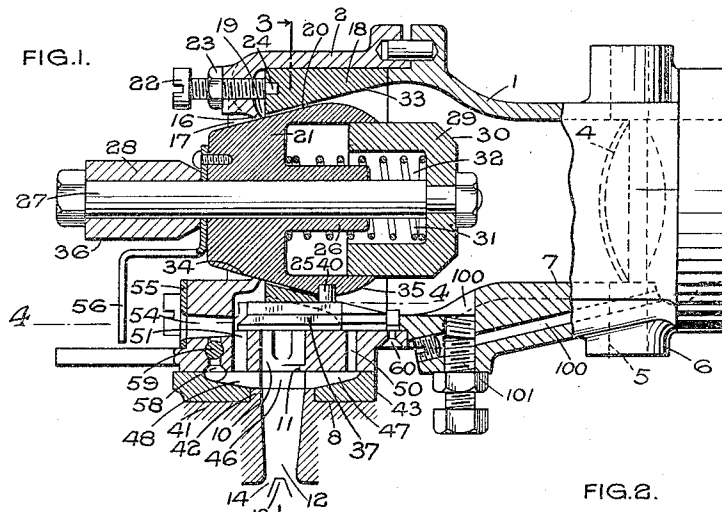


FIG. 3.

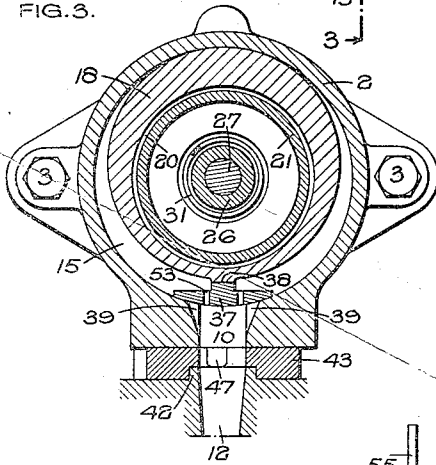


FIG. 2.

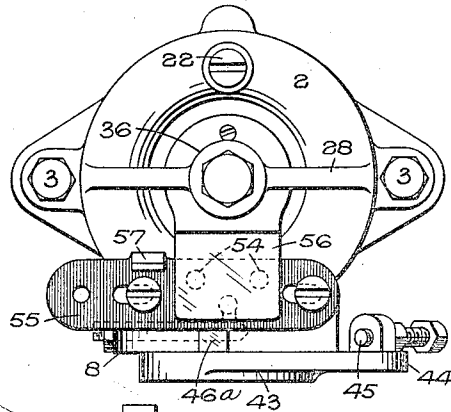
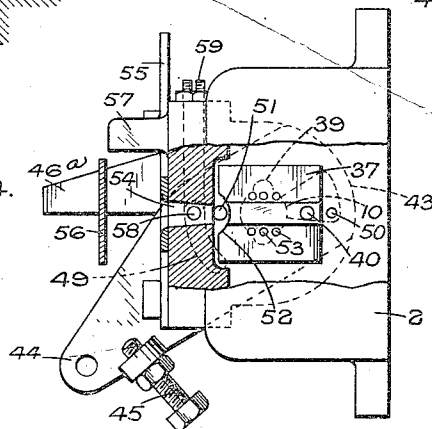


FIG. 4.



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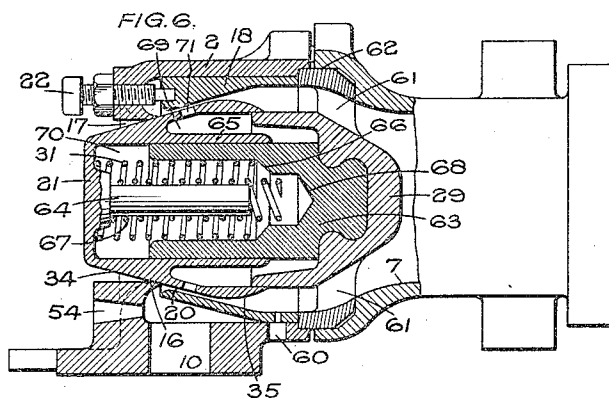
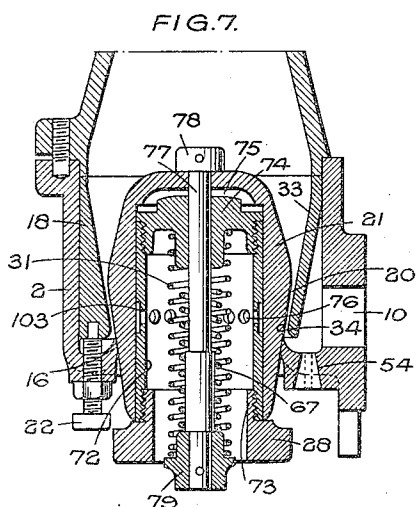
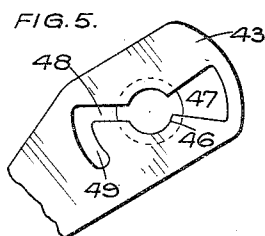
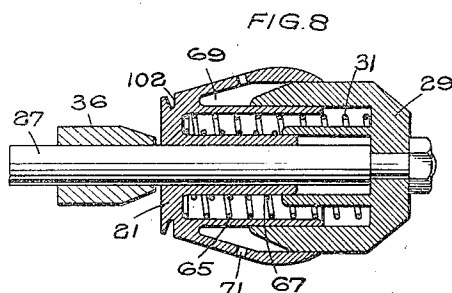
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SPRAY CARBURETOR FOR INTERNAL COMBUSTION ENGINES

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2 Sheets-Sheet 2



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SPRAY CARBURETOR FOR INTERNAL COMBUSTION ENGINES

John Thomas Jennings, King's Norton,
Birmingham, EnglandApplication June 27, 1933, Serial No. 677,781
In Great Britain June 30, 1932

17 Claims. (Cl. 261-64)

This invention relates to improvements in spray carburetors for internal combustion engines, such carburetors being of the type having a loaded air control valve for controlling the passage of secondary air into the interior of the carburetor, and in which the said valve also controls the admission of primary mixture to the mixing chamber of the carburetor.

One object of this invention is to provide improved means for mixing both the primary mixture of fuel and air, and the secondary air and primary mixture, and for regulating the proportions of the same.

A further object of the invention is to provide a carburetor of generally improved form.

In order that my invention may be clearly understood and more readily carried into practice, I have appended hereunto two sheets of drawings illustrating the same, wherein:—

Figure 1 is a part vertical sectional elevation of one form of carburetor constructed according to this invention.

Figure 2 is an end elevation of a part of the carburetor shown in Figure 1.

Figure 3 is a cross section on line 3—3 Figure 1.

Figure 4 is a part sectional plan of a portion of the carburetor shown in Figure 1 taken on line 4—4.

Figure 5 is a plan of a part of a detail of the same.

Figure 6 is a similar view to Figure 1, but illustrates a modified construction of carburetor.

Figure 7 is also a similar view to Figure 1, but illustrates a still further modified construction of the carburetor.

Figure 8 illustrates a modified form of valve.

In the embodiment of the invention illustrated in Figures 1 to 3, there is provided a carburetor comprising a tubular casing having its axis horizontal and comprising in the main two parts 1 and 2, secured together by bolts 3.

The main throttle valve 4 of the carburetor is mounted upon a spindle 5 carried in bearings 6 in the part 1, and the throttle valve is located in the induction or engine supply passage 7 of the part 1 of the carburetor.

The lower portion of the part 2 of the carburetor is provided with a horizontal facing 8 and a primary mixture inlet port 10 the axis of which is perpendicular to said facing 8 and is disposed in the same vertical plane as the longitudinal centre line of the carburetor. This inlet 10 is restricted by a part 11 of crescent shape in

plan. The restriction may, however, be of annular or any other suitable shape in plan.

The port 10 communicates with a primary choke 12 in which is disposed the jet 13 of the carburetor, which jet may be fed from a suitable float chamber, and an annular passage 14 is provided for the ingress of primary air into the primary choke adjacent the jet. The float chamber, and parts connected therewith, are not illustrated in the drawings, but a preferred arrangement is one in which the float and nozzle are concentric, but this arrangement is not essential.

The port 10 leads into a crescent shaped chamber 15 decreasing in cross sectional area in opposite directions from the port 10 and formed between the inner wall, which is cylindrical, of the part 2 of the casing of the carburetor and a liner member 18 disposed within the carburetor part 2 and surrounding a secondary air inlet 17 provided at the outer end of the latter, said air inlet being coaxial with the said casing and being surrounded by a lip 16 provided at the outer end of the said part 2.

The liner 18 has its outer surface cut away eccentrically so as to give the chamber 15 a crescent formation such that it has its greatest cross sectional area adjacent the inner end of the port 10, whilst it has its least cross sectional area substantially diametrically opposite to the said port.

The respective shapes and the arrangement of the liner 18 and the lip 16 on the carburetor part 2 are such as to leave a comparatively small annular port 19 between these parts and co-axial with the secondary air inlet. This annular port communicates with a variable choke or inlet passage 20 having its outer wall formed by the inner surface of the liner 18 and its inner wall formed by the exterior surface of a slidable secondary air control and suction actuated valve 21 mounted within the induction passage of the carburetor.

A set screw 22 having a reduced part 24 engaging in the liner 18 is provided for retaining the latter in its proper position, and a lock nut 23 is provided on this set screw for locking it in an adjusted position.

The suction-actuated secondary air control valve 21 has at its inner end an annular recess 25 and a tubular boss 26 within this recess, and the valve 21 is mounted for axial sliding movement on a bolt 27 passing axially through the valve and carried at its outer end by a stationary bridge 28 on the part 2 of the carburetor. The sliding fit between the valve 21 and the bolt 27 is as close as possible, consistent with easy operation of the valve, so as to reduce the leakage of gas at this

point to negligible proportions. In order to eliminate wear and tear at the adjacent sliding surfaces of these parts the bolt 27 is preferably formed of a hard rustless steel, for example, 5 nitralloy steel and the valve is formed of, or lined with, an aluminium alloy.

The inner end of the bolt 27 rigidly carries a cylindrical hollow cap or guide member 29 having a chamfer 30 and over which the valve 21 is adapted to slide, the cap or guide 29 projecting into the annular recess 25 in the valve 21.

A helical spring 31 is mounted in the chamber 32 formed between the valve 21 and the cap 29, and this spring provides loading for the valve 21, which loading tends to resist the inward movement of the valve. More than one spring may be desired, if desired, for example as shown in Figures 6 and 7.

If two springs were fitted, one spring would be shorter than the other so as not to come into action until the valve 21 had made a certain percentage of its movement.

The interior of the cap 29 and the recess 25 in the valve 21 together constitute a dashpot and depression chamber, herein referred to by the reference numeral 32, and the sliding fit between the cap 29 and the valve 21 is such as to enable air to enter or leave the chamber 32, according to the direction of movement of the parts, at a rate suitable for slightly damping the movement of the valve 21 in order to restrict oscillations of the latter. Providing for a slight leakage between the valve 21 and the cap 29 also enables the depression in the chamber 32 to follow that in the mixing chamber.

The valve 21 is of substantially truncated cone form and the inner surface 33 of the liner 18 of the carburetor is correspondingly shaped adjacent the valve.

The conical portion 34 of the outer surface of the valve 21 is adapted to seat closely to the correspondingly shaped lip 16 of the portion 2 of the carburetor.

The inner end 35 of the valve 21 is of rounded form somewhat as shown.

The annular choke or inlet passage 20 provided between the liner 18 and the valve 21 is long in proportion to its width for all positions of the valve 21.

The valve 21 regulates the depression in the induction passage of the carburetor and allows a greater or less quantity of air to enter the carburetor according to the varying loads and speeds, and the primary mixture is admitted to the choke 20 through the annular port 19 which is disposed as near as possible to the air inlet port 17.

The boss 36 on the bridge 28 serves as a stop for limiting the movement of the air valve 21 for preventing the valve coming closer than into easy engagement with the lip 16 of the portion 2 of the carburetor casing.

The flow of primary mixture from the primary mixture inlet 10 to the chamber 15 is regulated by means of a slidable primary mixture throttling valve 37 connected to, and made movable in unison with, the suction actuated valve 21 by a vertical pin 40. This valve 37 is, in the examples shown, of inverted T shaped cross section and is longitudinally slidable in the casing part 2 over the primary mixture inlet 10 and between the lower part of the casing part 2 and the liner 18, the latter being provided with a longitudinal facing 38 to guide and position the valve.

Vertical transverse side grooves 39 are provided in the walls of the primary mixture inlet 10

and these grooves increase in width from their lower to their upper ends, and the sliding valve 37 is somewhat wider than the combined diametrical width of the inlet 10 and the grooves 39.

Between the carburetor part 2 and a further part 41 of the carburetor, and rotatably mounted on an annular boss 42 provided on the latter, and co-axial with the primary mixture inlet 10, is provided a primary mixture regulator or regulating valve 43 having an operating arm 44 provided with an adjustable stop screw 45 adapted to engage a projection 46a on the carburetor part 2 for limiting the closing movement of the regulator 43.

The primary mixture regulator 43 is of plate like form, and is provided with a circular hole 46 (see particularly Figure 5), into the enlarged lower part of which fits the annular boss 42 on the carburetor part 41. Also the primary mixture regulator 43 is provided with oppositely extending grooves or recesses 47 and 48 leading from the hole 46. The recess 47 is of sector like shape, while the recess 48 is parallel sided as is shown, and is provided with an arcuate lateral extension 49.

In the lower portion of the carburetor part 2 are formed two vertical by-pass holes marked respectively 50 and 51, and both these holes are situated on the longitudinal centre line of the carburetor part 2. The recesses 47 and 48 in the regulator 43 are adapted in certain positions of the mixture regulator to register respectively with the vertical holes 50 and 51.

The primary mixture throttling valve 37 is provided at one end with a part circular recess 52 (Figure 4), which is in alignment with the wall of the primary mixture inlet 10 when the valves 21 and 37 are fully open.

The primary mixture throttling valve 37 is also provided with a series of holes or passages 53 which successively move out of, or move into, register with the primary mixture inlet 10 as the valve opens or closes. Obviously as the valve opens it gradually closes the by-pass hole 50 and vice-versa.

The casing part 2 of the carburetor is provided below the secondary air inlet 17 with three staggered inwardly tapering holes 54 forming subsidiary air inlets leading directly into the annular chamber 15 adjacent the inlet port 10 and so directly into the mixture stream.

A sliding shutter plate 55 is provided on the casing part 2, and has three staggered holes capable of being moved into or out of register with the subsidiary air inlet holes 54, whereby the latter may be manually opened or closed to the desired extent by sliding endwise the shutter 55.

For automatically cutting off the subsidiary air supply through the holes 54 as the air valve 21 more or less reaches its maximum opening, a cover plate 56 is provided which is secured to the valve 21 so that as the valve opens the cover plate moves towards the subsidiary air inlets 54 and eventually closes them entirely, or to a predetermined degree.

The shutter plate 55 is provided with a laterally extending projection 57 which may, by sliding the shutter plate endwise, be interposed between the cover plate 56 and the casing part 2, whereby the loaded valve 21 is prevented from opening. The operation of the shutter may be effected by suitable remote or other control means.

A further vertical by-pass passage 58 is provided in the lower part 2 of the carburetor, and communicates at all times at its upper end with

one of the subsidiary air inlet holes 54, and at its lower end with the arcuate part 49 of the groove or recess 48 in the regulator 43.

The by-pass 58 may be regulated or restricted by a screw 59 that can pass diametrically through it and which is operable from the exterior of the carburetor.

It should be understood that the by-passes 50 and 58, and the extension 49 of the recess 48 in the regulator 43 are not absolutely essential but they are desirable in some cases.

In order to facilitate slow and even running, a small passage 100 runs from the lowest part of the interior of the carburetor to a convenient point on the engine side of the main throttle valve 4, and an adjustable stop screw 101 is provided in the passage for restricting the flow to the right amount for the desired slow running speed. This passage serves to ensure that any deposited fuel lying in the bottom of the induction passage will be picked up and carried into the main mixture stream, and the passage is of particular value when running slowly under light loads, the velocity of the mixture flow being then at its minimum.

Operating the primary throttle valve by the suction actuated valve 21 provides for a suitable mixture of fuel and air being supplied at all positions of the air valve, and the holes 53 in the valve ensure that the supply of mixture is maintained at the correct proportion as the valve 21 (and incidentally the throttling valve) opens. The orifice of the inlet passage 10 may be of any shape to suit the requirements of the engine.

In the modified construction illustrated at Figure 6, the cap 29 is carried by a plurality of arms 61, the cap and the arms forming a spider which may be a die casting. The spider is suitably mounted in the casing of the carburetor and conveniently in a recess 62 between the parts 1 and 2 of the said casing. The cap 29 carries a hard metal valve guide 63 which may be cast in place in the cap 29. The valve 21 is slightly modified in its internal construction, and the bolt 27 and bridge 28 of the previously described construction, and parts connected therewith are dispensed with.

The valve 21 is provided with a central inwardly extending pin or projection 64 which takes the place of the hereinbefore named tubular boss 26 and forms a guide for the spring 31.

The valve 21 works over the cap 29 as previously described, but it is also provided with an inner concentric wall 65 which slides on the guide 63. The spring 31 is mounted between the closed end of the valve 21 and an annular shoulder 66 formed interiorly of the guide 63, whilst a second spring 67 is mounted around the pin 64 on the valve 21 and is adapted to bear on the closed inner end 68 of the guide 63, but is adapted not to come into operation until the valve has made a part of its stroke.

With the valve 21, cap 29, and valve guide 63, constructed as just described, there is provided an outer chamber 69 between these parts, and an inner chamber 70 between the valve guide 63 and the valve 21, and radial holes 71 are provided in the valve 21, which holes communicate with the chamber 69. The chamber 70 serves as a dashpot cylinder, whilst the valve guide 63 serves as a stationary dashpot piston working in the said dashpot cylinder. In this way dashpot means are provided for steadying the movement of the valve.

In the construction illustrated in Figure 7, the

valve 21 is adapted to work in a vertical direction, but it can quite easily be disposed so as to work in a horizontal direction. In this case the casing of the carburetor is provided with a bridge 28 as described with reference to Figures 1 to 5, but in this instance the bridge carries a hard metal tubular valve guide 72 which screws at one end on to a tubular boss 73, and the valve guide is at its opposite and inner end provided with a closure member 74 screwing into it.

The valve 21 slides on the exterior of the valve guide 72, and the valve has a substantially plain cylindrical bore of such a size that the said guide is a sliding fit in this bore. A chamber 75 is formed between the closed end 74 of the valve guide 72 and the interior of the valve 21, and this chamber serves as a dash-pot chamber. Holes 76 are provided in the valve guide 72 and communicate between the interior of the valve guide 72 and the exterior thereof.

A bolt or pin 77 provided with a head or collar 78 passes through the valve 21 from the inner end thereof, and the guide 72, the outer end of the pin being provided with a flanged collar 79.

As in the arrangement described with reference to Figure 6, the valve 21 is loaded by two helical springs 31 and 67, and these springs are arranged around the bolt 77 and the opposite ends of the spring 31 respectively engage with the flanged collar 79 and the inner surface of the closure member 74, whilst the inner spring 67 abuts at one end the flanged head 79, and is adapted to abut at the other end the closure member 74 after the valve 21 has made a part of its stroke.

The holes 76, closely pitched as shown, ensure that by leakage through these holes into the surrounding clearance space between the valve and the guide, any tendency of a depression at the open end of the valve to affect the pressure under the head is nullified by air at atmospheric pressure entering at these holes. (If desired a shallow recess 103 may be cut around the face of the guide in the path of the ring of holes to ensure this.)

In the modified valve 21 shown in Figure 7, the included angle of the conical face 34 of this valve is smaller than the included angle of the corresponding face of the valve shown in the other figures of the drawings and hereinbefore referred to. This valve with the conical face of a smaller included angle than the other valves 21 described, is designed to reduce the effect of the high depression acting on the conical face referred to.

The pressure in the cavity between the valve and its guide is atmospheric, and has a dashpot action on the movement of the valve, as air can only enter and escape from this space by leaking between the valve and the guide which are of suitable fit to produce the required restraint.

In all the constructions heretofore described, the valve moves inwardly, that is, in the direction of flow of the fuel or mixture in order to allow of an increased flow.

In Figure 8 is illustrated a still further slightly modified form of valve, this valve being adapted to work horizontally or vertically and being in most respects very similar to the valve shown in Figure 6 except that in this case the cap is carried by the bolt 27 as in the arrangement described with reference to Figures 1 to 5 instead of being carried by arms 61 as described with reference to Figure 6.

The flow through the variable passage or choke must be turbulent properly to mix the fuel and air. If a choke of considerable width is required, it will be necessary to introduce some

irregularity of the surface of the loaded valve or of the surrounding structure or of both in order to ensure this turbulence. This may take the form of small grooves around the valve, which

- 5 may be cut, rolled or cast therein, or any other roughened surface can be used. However, where a narrow choke only is required, the flow will be sufficiently turbulent even with mechanically smooth surfaces.
- 10 Figure 8 also shows a valve having a single peripheral groove 102, and this valve is particularly suitable for carburetors adapted for a wide maximum opening of the variable choke, and this form of valve ensures sufficient turbulence with a
- 15 widely opened choke. Preferably such a valve has also a slightly roughened surface, and indeed any of the valves or the choke walls herein described may be slightly roughened in any desired manner to increase the turbulence. The rough-
- 20 ening is so slight as not to be capable of being clearly shown in the drawings and has accordingly been omitted completely.

In the arrangements shown in Figures 6 and 8 the internal depressions causing the air valves

25 to open are communicated from the annular choke 20 to the actuating chambers by the holes or passages 71 formed in the walls of the valve. In the arrangement shown in Figure 7 the valve 21 is actuated by a depression acting on its outer

30 end face. The inner surface of the valve is open to atmospheric pressure as previously described.

The operation of a carburetor constructed as illustrated in Figures 1 to 6 is somewhat as follows:—

- 35 Assuming the carburetor to have its loaded suction-actuated air valve in the closed position on starting from cold the engine with which the carburetor is used, fuel is drawn by induction from the jet 13 into the primary choke 12. Pri-
- 40 mary air is similarly drawn into the choke 12, and here it mixes with the fuel so forming the primary mixture which passes through the hole 46 in the regulator 43 into the primary mixture inlet passage 10. The mixture then passes
- 45 through the holes 53 in the sliding primary throttling valve 37 to the chamber 15, and passes from there to the annular mixture port 19 into the choke 20. Forming the chamber 15 between the
- 50 liner 18 and the casing part 2 of crescent like shape ensures that the velocity of the mixture is well maintained as it flows from the widest to-
- 55 port 19. wards the narrowest parts of the chamber 15 and at the same time supplies an inward flow of primary mixture through the whole of the annular

When starting the engine from cold a mixture considerably richer than usual is necessary, and this is obtained by by-passing primary mixture past the slide valve by means of the by-passes 51 and 50, these by-passes being opened by suitably manipulating the primary mixture regulator 43.

- An engine of ordinary design runs satisfactorily at moderate to high speeds when comparatively cold with the carburetor adjusted to give a nor-
- 65 mal mixture, but a richer mixture is required for running at low speeds, and it is for this purpose that the by-pass 50 in the casing part 2 of the carburetor, and the recess 47 in the primary mixture regulator 43 are provided, as by this means
- 70 an additional primary mixture supply is available for starting and low speed purposes, but is automatically cut off as it becomes unnecessary, the cutting off being effected by the primary mixture throttling valve 37, as this valve opens together
- 75 with the loaded air valve.

It is arranged that for a given position of the primary mixture regulator 43 both of the by-passes 50 and 51 are open and supply additional primary mixture, but that, on manipulating the primary mixture regulator 43 to close the by-

5 passes 50 and 51, the by-pass 50 remains open longer than the by-pass 51 due to the difference in the shapes of the recesses 47 and 48 respectively in the regulator 43. The stop screw 45 on the primary mixture regulator 43 may be ad-

10 justed to prevent either or both of the by-passes 50, 51 being entirely closed by the regulator.

On starting it may be necessary to close the subsidiary air holes 54, and this may be done by the shutter 55.

When the engine has got up a sufficiently high speed, or temperature, the primary mixture regulator may be moved into its closed position so that the stop 45 abuts the projection 46a whereby the by-passes 50 and 51 are closed or adjusted.

Providing that the shutter plate 55 does not cover the subsidiary air holes 54, rapid streams of subsidiary air are drawn into the carburetor, and this subsidiary air mixes with the primary mixture entering the chamber 15 and these

25 conditions are suitable for ordinary running and moderately cold starting, but when the subsidiary air holes are closed the whole of the mixture supplied is induced from the primary choke, and if the fuel level is temporarily raised, a mixture sufficiently rich for very low temperatures is supplied. When the shutter 55 closes, the valve 21 is retained closed also by means of the lateral projection 57 on the shutter.

The subsidiary air holes are, when open, of particular value in maintaining sufficient gas velocity at the smallest throttle openings when the minimum flow of primary mixture is passing through the annular port 19 and in ensuring proper atomization of the primary mixture.

As the depression or suction in the mixing chamber increases, the valve 21 opens to a corresponding extent. Consequently the sliding valve 37 is operated, and while some of the holes 53 therein are moved out of register with the inlet

45 16, the latter is eventually uncovered to a greater or lesser extent, depending upon the said depression or suction, by the sliding valve. As the valve 21 reaches its fully open position, the subsidiary air holes 54 are automatically closed by the cover

50 plate 56.

By inducing the primary mixture to enter the mixing chamber annularly at or near the position where the loaded valve comes to rest, or closely adjacent this position, the primary mixture and

55 secondary air are brought together with a large area of contact at the junction of the two annular streams, and at the point where approximately maximum velocity is first attained and before much energy has been dissipated.

When the valve 21 is fully open, the primary throttling valve 37 is also at its maximum opening, and it is found that under these circumstances, a restriction of the primary mixture inlet passage 10, the hole 46 through the regulator 43, or the primary choke 12, results in increased efficiency. The said restriction may take the form of a crescent shaped projection 11 in the primary mixture inlet passage 10. The effect of this restriction will be negligible or only small when the

70 suction-actuated and primary mixture valves are only slightly open, but will restrict increasingly the flow of primary mixture as the primary throttle and suction-actuated valves continue to open. Thus when the valves are in the maximum open

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position the primary mixture supply is less than would be the case were the restriction not there.

It is primarily for this reason that the subsidiary air holes are closed by the cover member 56 at the maximum opening of the suction-actuated valve so that the required proportions of fuel and air are maintained.

The purpose of the by-pass passage 58 and the arcuate extension 49 of the groove or recess 48 in the regulator 43 is for supplying, when required, extra primary mixture throughout the whole range of output.

What I claim is:—

1. A carburetor of the type specified and comprising a casing, a loaded air control valve within said casing and adapted to be moved in one direction by suction, the air control valve being so disposed with relation to said casing as to provide an annular choke of variable cross sectional area, the said casing having an inlet for secondary air controlled by said loaded air valve, and the casing also having a primary mixture inlet, a primary mixture throttle valve associated with said loaded air control valve and operated thereby and adapted to control the flow of primary mixture through the said primary mixture inlet, an annular chamber being also provided within said casing and communicating with said primary mixture inlet, the cross section of said annular chamber decreasing on opposite sides of its communication with the primary mixture inlet in a direction away from said communication, such chamber also having communication with said choke and such communication being annularly and co-axially arranged with respect to said loaded air control valve.

2. A carburetor of the type specified and comprising a casing, a loaded air control valve within said casing and movable in one direction by suction against opposing means, a wall in said casing and arranged around and co-axial with said valve so as to leave between them an annular choke of variable cross sectional area, a stationary valve guide co-axial with said wall, and the air control valve being slidable axially supported by said guide, said air control valve being interiorly hollow and having an open end into which projects a part of said guide member, the interior of said air valve being adapted to form a dashpot chamber, the said casing having an inlet for secondary air, a primary mixture inlet, a movable primary mixture throttle valve adapted to control said inlet and associated with and operated by the loaded valve, an annular chamber within said casing and communicating with said primary mixture inlet, and having annular co-axial communication with said choke.

3. A carburetor of the type specified and comprising a casing, a loaded air control valve within said casing and movable in one direction by suction against loading means, such valve being a geometrical figure of rotation and a liner in said casing and arranged around and coaxial with said valve so as to leave between them an annular relatively long and narrow choke of variable cross sectional area, the cross sectional area of said choke at any instant depending upon the positions of the liner and said valve with respect to one another, a stationary valve guide coaxial with said liner and the loaded valve being slidable axially on said guide, said air control valve being interiorly hollow and open at one end, the valve being divided into a plurality of internal annular chambers each of which is substantially closed at the open end of the valve by a port of said

valve guide, one of said chambers with a portion of said guide being adapted to act as a dashpot device and the other of said chambers being in immediate communication with the said variable choke, the said casing having an inlet for secondary air controlled by said loaded air valve and the casing also having a primary mixture inlet, means for controlling the flow of primary mixture through the primary mixture inlet, and the latter inlet having a communication with said choke, and such communication being annularly arranged with respect to said loaded air control valve.

4. A carburetor of the type specified and comprising a casing, a loaded air control valve within said casing and movable in one direction by suction against opposing means, such valve being a geometrical figure of rotation, a wall within said casing and arranged around and coaxial with said valve so as to leave between them an annular choke of variable cross sectional area, a stationary valve guide and the air control valve being slidably and axially supported by said guide, the said casing having an inlet for secondary air coaxial with the said loaded valve, a primary mixture inlet, a slidable primary mixture throttle valve controlling the latter and adapted to move in unison with the loaded valve, an annular chamber communicating with said primary mixture inlet, and having annular coaxial communication with said choke and an inlet for subsidiary air.

5. A carburetor of the type specified and comprising a casing, a loaded air control valve within said casing and movable in one direction by suction against opposing means, such valve being a geometrical figure of rotation and a wall in said casing and arranged around and coaxial with said valve so as to leave between them an annular choke of variable cross sectional area, and the cross sectional area of said choke at any instant depending upon the relative positions of the wall and said valve, the said casing having an inlet for secondary air coaxial with the said loaded valve, a seat around said inlet closely fitting such valve when at rest and annularly and coaxially disposed with respect to the valve, and the casing also having a primary mixture inlet, a slidable primary mixture throttle valve controlling the latter and adapted to move in unison with the loaded valve, an annular chamber between said wall and said casing and communicating with said primary mixture inlet, such chamber from its communication with the primary mixture inlet decreasing in cross sectional area in opposite directions and having annular and coaxial communication with said choke between said valve seat and the adjacent end of said choke, and said primary throttle valve having one or more holes therethrough adapted to communicate with said chamber and the primary mixture inlet and to move out of or into register with said primary mixture inlet as the valve opens or closes.

6. A carburetor of the type specified and comprising a casing, a loaded air control valve within said casing and movable in one direction by suction against a loading, a wall in said casing and arranged around and co-axial with said valve so as to leave between them an annular choke of variable cross sectional area, the said casing having an inlet for secondary air coaxial with said loaded valve, and the casing also having a primary mixture inlet, a slidable primary mixture throttle valve adapted to control the latter and to move in unison with the loaded valve,

an annular chamber communicating with said primary mixture inlet, and having annular and co-axial communication with said choke, a primary mixture supply conduit in communication with said primary mixture inlet, and a primary mixture regulating valve disposed between, and having a port adapted for communicating simultaneously with, said primary mixture supply conduit and by-pass means leading from the conduit side of said primary mixture throttling valve to the opposite side thereof, such regulating valve being adapted to be moved manually so as to bring said port out of and into communication with said by-pass means.

7. A carburetor according to claim 6, in which a further primary mixture throttle valve by-pass is provided which the primary mixture throttle valve is adapted to obstruct as it opens.

8. A carburetor according to claim 4 and having a primary mixture throttling valve by-pass communicating with a primary mixture supply conduit on the one side of the primary mixture throttling valve and the subsidiary air inlet disposed on the other side of the said valve and communicating with the said chamber.

9. A carburetor of the type specified and comprising a casing, a loaded air control valve within said casing and movable in one direction by suction against loading, a wall in said casing arranged around and coaxial with said valve so as to leave between them an annular choke of variable cross sectional area, the said casing having an inlet for secondary air coaxial with said loaded valve, and the casing also having a primary mixture inlet, a slidable primary mixture throttle valve adapted to control the latter and to move in unison with said loaded valve, an annular chamber communicating with said primary mixture inlet, such chamber having annular and co-axial communication with said choke and the said casing having an inlet for subsidiary air, and manually operated means for retaining the loaded valve closed when required.

10. A carburetor according to claim 2 and having a body forming an induction passage within which a main throttle valve is situated, the said casing carrying the liner, loaded air valve, valve guide and primary mixture throttle valve, and being detachable from the said body.

11. A carburetor of the type specified and comprising a casing, a loaded air control valve within said casing and adapted to be moved in one direction by suction, the air control valve being so disposed with relation to said casing as to provide a variable annular choke between the valve and the casing, the said casing having an inlet for secondary air controlled by said loaded air valve, and having also a primary mixture inlet communicating with said choke, such communication being annularly and co-axially arranged with respect to said loaded air control valve, within which casing is a throttle valve associated with said loaded air control valve and operated thereby and adapted to control the flow of primary mixture through the said primary mixture inlet, the carburetor having also an engine supply passage, said loaded valve being disposed at one end of said passage, a main throttle valve disposed also in said passage, a duct communicating at one end with the supply passage on the engine side of said main throttle valve and at the other end with the lowest part of the passage on the opposite side of said main throttle valve, and means for regulating the flow through said duct

of any fluid deposited at the lowest part of said passage.

12. A carburetor of the type specified and having an induction passage, a main throttle valve situated therein, a casing, a loaded air control valve within said casing and adapted to be moved by suction in a direction which is substantially horizontal, the air control valve and casing being so formed, and so disposed with relation to one another as to provide a variable annular choke between the valve and the casing, the said annular choke having a communication with the said induction passage and the said casing having an inlet for secondary air controlled by said loaded valve, and also having a primary mixture inlet communicating with said choke, such a communication being annularly arranged with respect to said loaded air control valve, and within which casing is a primary mixture throttle valve associated with said loaded air control valve and operated thereby and adapted to control the flow of primary mixture through the said primary mixture inlet, said casing having an aperture communicating with the atmosphere and with the lowest part of the annular passage forming the variable annular choke and its communication with the said induction passage, for admitting air into said part to remove automatically fuel deposited there.

13. A carburetor of the type specified and comprising a casing, a loaded air control valve within said casing and adapted to be moved in one direction by suction, the air control valve being so disposed with relation to said casing as to provide a variable annular choke between the valve and the casing, the said casing having an inlet for secondary air controlled by said loaded air valve, and having also a primary mixture inlet communicating with said choke, such communication being annularly and co-axially arranged with respect to said loaded air control valve, within which casing is a throttle valve associated with said loaded air control valve and operated thereby and adapted to control the flow of primary mixture through the said primary mixture inlet, a liner within the said casing and surrounding the said loaded air control valve, the said liner and valve forming the said variable annular choke, and the liner being externally annularly and eccentrically shaped so that a chamber substantially of crescent shape is formed within the casing, the said primary mixture inlet communicating with the said chamber and the said chamber having annular communication with the said variable annular choke.

14. A carburetor of the type specified and comprising a casing, a loaded air control valve within said casing and adapted to be moved in one direction by suction, the air control valve being so disposed with relation to said casing as to provide a variable annular choke between the valve and the casing, the said casing having an inlet for secondary air controlled by said loaded air valve, and having also a primary mixture inlet communicating with said choke, such communication being annularly and co-axially arranged with respect to said loaded air control valve, within which casing is a throttle valve associated with said loaded air control valve and operated thereby and adapted to control the flow of primary mixture through the said primary mixture inlet, said casing having also subsidiary air inlet means adapted to admit subsidiary air into the stream of primary mixture after the latter has passed the primary mixture throttle valve

and at a position adjacent to the latter and control means for regulating said subsidiary air inlet means, said control means being operated by connection to the suction actuated valve.

5 15. A carburetor of the type specified and comprising a casing, a loaded air control valve with-
10 in said casing and adapted to be moved in one direction by suction, the air control valve being so disposed with relation to said casing as to provide a variable annular choke between the valve
15 and the casing, the said casing having an inlet for secondary air controlled by said loaded air valve, and having also a primary mixture inlet, a primary mixture throttle valve associated with
20 said loaded air control valve and operated thereby and adapted to control the flow of primary mixture through the said primary mixture inlet, said casing having an annular chamber disposed around said choke and communicating with said
25 primary mixture inlet and with said choke, and such latter communication being arranged annularly and co-axially with respect to said loaded air control valve.

16. A carburetor of the type specified and comprising a casing, a loaded air control valve with-
25 in said casing and adapted to be moved in one direction by suction, the air control valve being so disposed with relation to said casing as to provide a variable annular choke between the
30 valve and the casing, the said casing having an inlet for secondary air controlled by said loaded air valve, and having also a primary mixture inlet communicating with said choke, such com-

munication being annularly and co-axially arranged with respect to said loaded air control valve, within which casing is a throttle valve adapted to control the flow of primary mixture
5 through the said primary mixture inlet, said throttle valve being movable with and operated by the said loaded air control valve, and said loaded air control valve being sharp cornered and grooved at the periphery of its inlet end.

17. A carburetor of the type specified and comprising a casing, a loaded air control valve with-
10 in said casing and adapted to be moved in one direction by suction, the air control valve being so disposed with relation to said casing as to provide a variable annular choke between the
15 valve and the casing, the said casing having an inlet for secondary air controlled by said loaded air valve, and having also a primary mixture inlet communicating with said choke, such communication being annularly and co-axially ar-
20 ranged with respect to said loaded air control valve, within which casing is a throttle valve adapted to control the flow of primary mixture through the said primary mixture inlet, said
25 throttle valve being movable with and operated by the said loaded air control valve, and said carburetor having a further inlet for supplying primary mixture to the said primary mixture inlet, one of said inlets having means adapted to restrict permanently the flow therethrough of
30 the primary mixture.

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