Sept. 15, 1964 L. J. SPRANGER 3,149,185

CONSTANT AIR VELOCITY CARBURETOR

Filed July 3, 1961 2 Sheets-Sheet 1

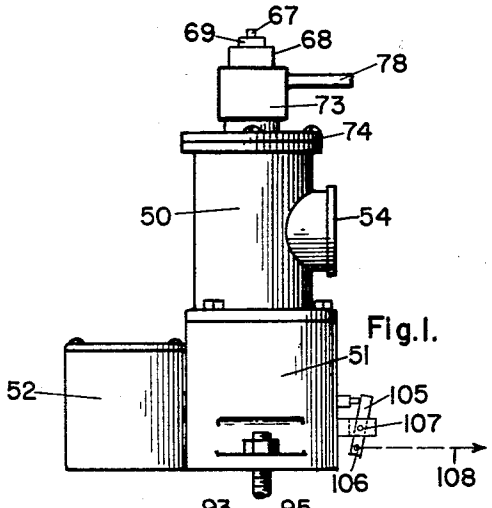


Fig. 1.

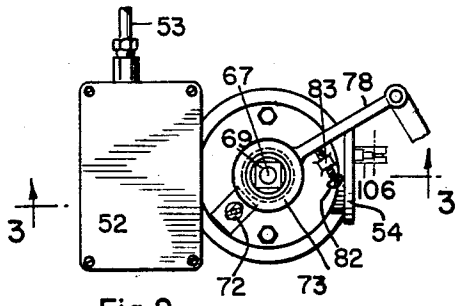


Fig. 2.

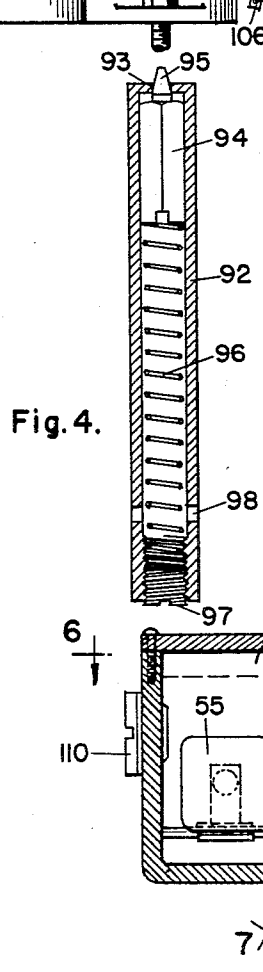


Fig. 4.

Fig. 3.

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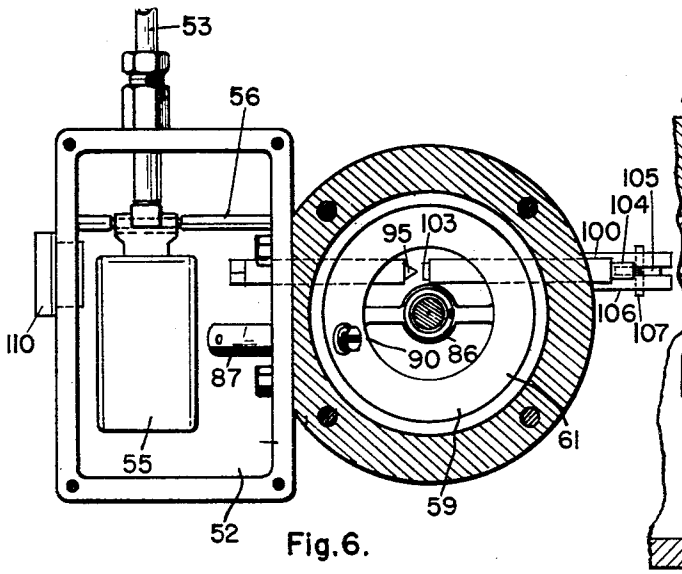


Fig.6.

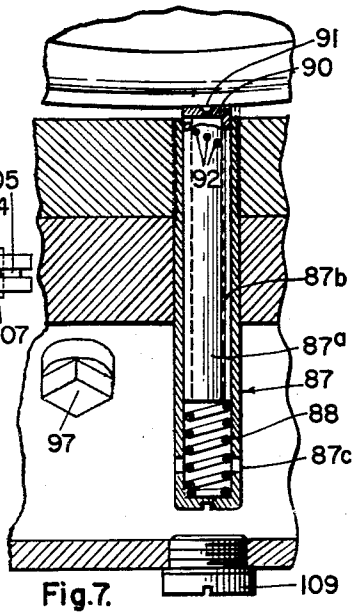


Fig.7.

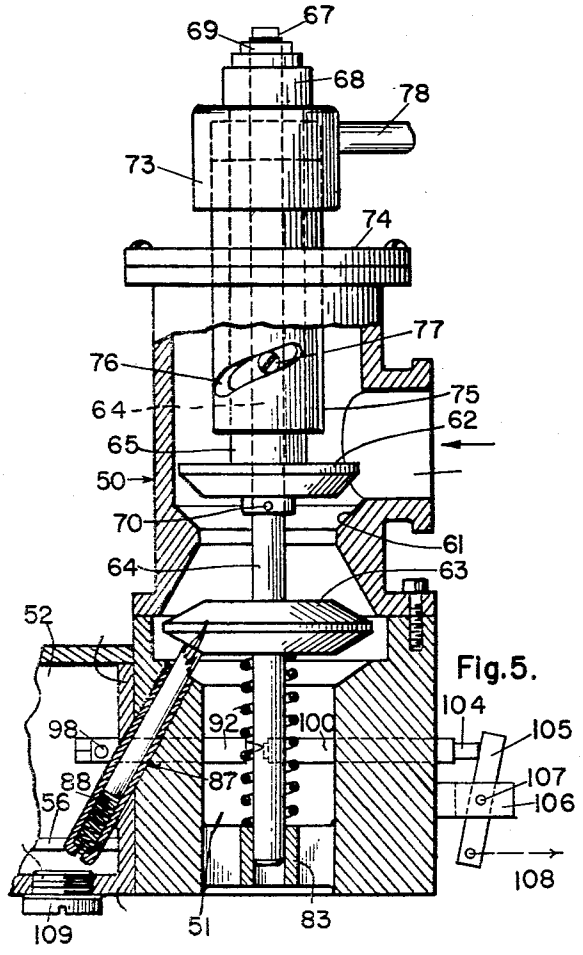


Fig.5.

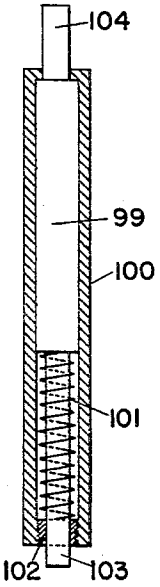


Fig.9

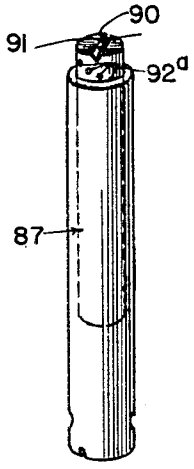


Fig.8.

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3,149,185

CONSTANT AIR VELOCITY CARBURETOR

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Filed July 3, 1961, Ser. No. 121,410
3 Claims. (Cl. 261—44)

This invention relates to improvements in constant air velocity carburetors, and the like. The improvements herein disclosed have particular reference to carburetors of the type shown in Letters Patent of the United States, Nos. 2,521,421, issued September 5, 1950, and 2,552,465, issued May 8, 1951, both on applications filed by me. I wish it understood, however, that by reference to such earlier patents I do not intend to limit the protection to be afforded by the present application, and the Letters Patent to be issued thereon, except as I may so limit myself in the claims to be incorporated in any such to be issued Letters Patent; and that reference to my said earlier patents is merely by way of illustration of one embodiment of the improvements hereinafter to be disclosed.

In each of such earlier patents I have disclosed a controlled air delivery passage provided with aligned air inlet port and mixture control port valve seats; one being the air inlet port valve seat, and the other being the mixture control valve seat; and I have also shown companion poppet valves, being an inlet poppet valve and a mixture poppet valve working with respect to such seats, and aligned with each other for valving movements in such alignment. I have also disclosed therein, liquid fuel supply valve means at the location of the mixture control port seat, and such liquid fuel supply valve means is constituted for valving operations coincidentally with the opening and closing movements of such mixture poppet valve, so that both the rate of flow of the air delivered to the mixture delivery passage, and the normal rate of supply of the liquid fuel into the air stream, are simultaneously controlled by the coordinated movements of such mixture poppet valve and such liquid fuel supply valve.

In that earlier type of construction I have also disclosed a common operating element connected to both such poppet valves, conveniently shown as a stem extending normal to the valve seats, and reciprocable in the direction of such stem. The inlet poppet valve in that earlier disclosure is connected directly to such operational stem; but the mixture poppet valve is connected to such operational stem through the medium of a lost-motion connection. Provision is made for urging such mixture poppet valve towards the inlet poppet valve as far as permitted by such lost-motion connection, such urge being produced by spring means. Normally, therefore, in such earlier construction a raising movement produced by a suitable control element, acting on the inlet poppet valve, also ensures a corresponding rising movement of the mixture poppet valve, the lost-motion being normally completely taken up by the aforesaid spring urge. Thus, under normal operational conditions of that earlier construction both of the poppet valves, are moved in either the opening or the closing direction, simultaneously, and by equal amounts of valving movement. It is, however, possible, in that earlier construction, to purposely cause the lower or outlet poppet valve to move downwardly, against the spring urge, an amount limited by the amount of the lost-motion, or until limited by engagement of such outlet poppet valve with its outlet valve seat. Normally, the valves of that earlier construction are both held in a slight degree of opening, or non-seating, by a suitable stop element which is adjustable to the desired degree of such slight opening or "cracking" of the two valves.

The aforesaid suitable stop element which is adjustable, acts, in that earlier construction, on a valve control element which in turn acts directly on the inlet poppet valve,

to raise and permit lowering of such valve. Thus, such stop element also acts to limit the normal closed position of the mixture poppet valve, since that valve is, in that earlier construction, normally held in the lost-motion position which gives positive drive of the lower or outlet poppet valve in the valve closing position. Thus, by suitable setting of the adjustable stop element, both of the valves are normally slightly "cracked" open; but it is possible, by a suitable connection, to force the mixture poppet valve into its fully closed position, without simultaneously fully closing the inlet poppet valve. In other words, an independent special control element is provided for, at times, forcing the mixture poppet valve of that earlier construction, into its more closed or fully closed position, without at the same time, altering the position of the inlet poppet valve.

In that earlier construction I have also shown a "priming" or raw gas supply valve, for use under such special conditions, as when starting the motor cold. That priming valve is, in that earlier patent, shown as having its delivery end and opening at or close to the mixture control port valve seat, such priming valve being normally closed and thus normally not delivering any liquid fuel to the air stream flowing past such outlet valve seat. However, such priming valve is so constructed that when the mixture poppet valve element is purposely forced beyond its normal "cracked" position it engages such priming valve, and opens such valve for delivery of raw gas into the air stream flowing through the mixture control port, it being understood that this purposeful opening of the priming valve by a special movement of the mixture poppet valve in its closing direction, does not completely close the mixture control port, but does reduce the amount of the "cracking" opening theerof. It is thus seen that in that earlier patent the special operations for control of such priming valve are produced by a special and supplemental movement of the mixture poppet valve, and not by a fully independent operational element. It is also seen that in that earlier construction the special operational movement of the mixture poppet valve in the closing direction, for special operation of the priming valve, reduced the amount of the "cracking" of that outlet valve during such priming operation; but did not reduce the amount of "cracking" of the inlet poppet valve during such priming operation. Therefore, under such special priming operation of that earlier construction, the previously existing condition of balance as between the crackings of both of the valves is destroyed at the time of and during the priming operation.

It is an important object and feature of the present invention to provide improvements in the type of such earlier carburetor construction, such that the priming of the mixture delivered from the carburetor is accomplished independently of any change in the positions of both the inlet and the mixture poppet valves. Thereby such carburetor construction may be further modified in such manner as to ensure exactly equal and simultaneous opening and closing movements of both such poppet valves at all times; and thus also ensuring that, when producing the priming operation, the "crackings" of both the inlet and the mixture poppet valves will remain unchanged, and both such crackings will remain of equal or relatively unchanged size. Thus, this objective may be stated to comprise the provision of means, completely independent of the poppet valves or either of them, for actuating the priming valve, when desired, and irrespective of the position occupied by the poppet valves during such priming operation. This independency of the priming valve operations, from those of the poppet valves, also makes it possible to bring the poppet valves to cracked positions most advantageous for idling and other motor operations, without imposing limitations on such cracking adjust-

ments, due to the presence of the priming valve as a portion of the elements which impose limitations on such cracking adjustments.

In connection with the foregoing objective it is a further object to provide a priming valve control of simple form and one which may be readily controlled from any suitable position, such as the dash-board of an automobile.

It is a further object to provide a simple form of such priming valve, and one which may be readily incorporated into carburetors of the type shown in said earlier patents, by way of illustration.

Other objects and uses of the invention will appear from a detailed description of the same, which consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings:

FIGURE 1 shows a side elevation of a carburetor of the type shown in said earlier patents, but modified to incorporate an independent control means for the priming valve, such control means being shown in its non-priming or non-operational position;

FIGURE 2 shows a plan view corresponding to FIGURE 1;

FIGURE 3 shows a vertical longitudinal section taken on the line 3—3 of FIGURE 2, looking in the direction of the arrows;

FIGURE 4 shows a longitudinal section through the priming valve element with its needle valve in closed position;

FIGURE 5 shows a partial vertical longitudinal section corresponding to the section of FIGURE 3, but with the poppet valves in raised or opened position, the main liquid fuel valve being correspondingly opened for supply of liquid fuel to the air stream flowing through the mixture control port;

FIGURE 6 shows a plan section taken on the line 6—6 of FIGURE 3, looking downwardly in the direction of the arrows; and this figure also shows the priming valve in plan view, and unopened;

FIGURE 7 shows a fragmentary perspective view section through the liquid fuel supply chamber, looking in the direction of the arrows in FIGURE 3; and with the main liquid fuel supply valve closed, the mixture poppet valve being correspondingly in closed position;

FIGURE 8 shows a perspective view of the main fuel supply valve, removed from the body of the carburetor, and with such main fuel supply valve in partially opened position; and

FIGURE 9 shows a longitudinal section through the priming valve actuator which may be at a convenient location from the body of the carburetor.

In the drawings I have shown, by way of illustration, only, the improvements of the present application as incorporated into a carburetor of the general construction shown in my said patent, No. 2,552,465. However, in so illustrating such improvements I do not intend to limit myself to their incorporation of carburetors constructed as shown in said Letters Patent, except as I may limit myself in the claims to follow. Accordingly:

The body of the present carburetor is formed to provide an air chamber 50 in line with a mixing chamber 51 to one side of which is a fuel chamber 52. The walls defining these three chambers are joined to provide a unitary structure. Leading into the fuel chamber 52 is a fuel pipe 53, and opening into the air chamber 50 is an air inlet passage 54. The bottom of the mixing chamber 51 is open for operative connection to the intake manifold (not shown) of an internal combustion motor.

The flow of liquid fuel into the fuel chamber 52 is controlled by a valve in the pipe 53, operated by a float 55 which is pivotally supported upon a rod 56 to swing up or down in response to fluctuations of the level of the fuel within the chamber. By such a conventional means it is possible to keep a substantially constant level of the fuel within the fuel chamber at all times.

Between the chambers 50 and 51 there is a controlled air delivery passage 57; and the ports 58 and 59 establish communication of such passage 57 with the air chamber 50, and with the mixture delivery passage 51, respectively, when such ports are open or unvalved. Thus the port 58 is an air inlet port, and the port 59 is a mixture control port to and from such passage 57, respectively. Such ports are provided with the upwardly facing valve seats 60 and 61, respectively, the seat 60 being an inlet poppet valve seat, and the seat 61 being a mixture poppet valve seat. The poppet valves 62 and 63 control the openings 58 and 59, respectively, for which purpose such valves are movable vertically from and towards their respective seats, and at fixed separation from each other. Conveniently, such valves are both connected to a telescoping element comprising the rod 64 extended axially through the sleeve 65; the inlet valve 62 being connected to such sleeve, and the valve 63 being connected to such rod. The rod and sleeve are factory adjustable endwise with respect to each other, thus factory adjusting the spacing between the two poppet valves. In the arrangement shown, such factory adjustment may be accomplished by use of a threaded connection 66 between the rod and sleeve elements, so that by turning the rod it can be threaded either upwardly or downwardly in the sleeve, with corresponding adjustment of the spacing between the two valves 62 and 63. Such turning of the rod is readily effected by use of a wrench applied to the flattened upper end 67 of the rod. The rod and sleeve are then locked in the adjusted relation by such means as the nut 68 threaded onto the rod and threaded into firm engagement with the top surface of the sleeve element, a lock nut 69 being then tightened against such nut 68. If desired, a set pin 70 may also be set through both the rod and the sleeve after they have been thus factory adjusted, to prevent unauthorized change or tampering with the adjusted relation between the parts. It is thus understood that the adjustment of the two poppet valves with respect to each other is of the type conventionally known as a "shop adjustment," being an adjustment made at the shop of assembly, and not intended to be changed or tampered with by unauthorized persons.

It is now noted that raising and lowering of either one of such poppet valves must be accompanied by an exactly corresponding and equal raising or lowering of the other such poppet valve. If the factory adjustment be such that the spacing between the seating surfaces of the valves is the same as the spacing between the valve seats 60 and 59, both valves will seat at the same moved position of the unit 64–65; and raising such unit will always unseat the valves by equal amounts. Accordingly, if such lowering movement be stopped short of dead seating of one of the valves against its seat, the other valve will necessarily also be stopped correspondingly; and when both of the seats are spaced apart exactly the same spacing as the spacing of the poppet valves from each other, the "crackings" of both valves will be equal. On the contrary, if the shop adjusted spacing between the two poppet valves is different from the spacing between the two seats, then the openings of the two ports will not be equal in amount. Under these conditions one or the other poppet valve may come to a dead seat while the other such valve is still "cracked"; or the movements of the two valves in the closing direction may be stopped under the condition that the "crackings" of the two valves are to be different in amount.

I have provided adjustable means for stopping the closing movements of the two valves at a pre-determined position; for example, such closing stoppage may be with one or both of the valves "cracked" an amount to produce idling of the internal combustion motor. Such adjustable stop means comprises the wedge shaped block 71 movably mounted on the upper end of the carburetor, in

position for engagement by an element of the telescoping unit 64–65 to arrest closing movement of the poppet valves at the pre-determined position. Such block is shown as provided with the slot and screw arrangement (see FIGURE 2) by which, upon loosening the screw the wedge block may be set back or forth to the desired position of adjustment, and the screw may then be locked by tightening. The slot and screw arrangement, 72, just defined, engages a flange 73 of an element presently to be described.

The up and down movements of the two-valve unit, including the two poppet valves, may be produced in convenient manner. In the arrangement shown, the cap 74 of the carburetor housing is provided with a downwardly extending stationary sleeve 75 within which the sleeve 65 fits with an easy sliding and rotary movement fit. Such sleeve 75 is provided with a cam-shaped slot 76 (see FIGURE 5), and a pin or stud 77 screwed or otherwise connected to the sleeve 65 rides in such slot during vertical movements of the poppet valve combination. Such vertical poppet valve movements are produced by turning the sleeve 65 in convenient manner, as by use of the outwardly extending arm 78. Such arm 78 is connected to a cap element 79 of which the flange 73 comprises a part, such flange being seated onto the upwardly extending flange 80 of the carburetor cap 74. A set screw 81 when tightened secures the flange 73 to the valve sleeve 65. The restoring movement of the arm 78 is limited by an adjustable stop pin or stud 82 set through a lug 83 extending up from the carburetor cap 74 (see FIGURE 2). By this means the movement of the poppet valve combination in closing direction is limited at the desired position of "cracking" of the valves, or even with such valves fully closed, if desired.

The lower portion of the telescoping rod-sleeve unit 64–65, together with the two poppet valves is guided by a supporting tubular guide 83^a connected to the lower portion of the carburetor housing 84 by the radial arms 85. If desired a spring 86 may be included between the lower valve 59 and such flange 83, to urge rising movement of the valve unit, with corresponding opening of both valves. Such spring, if provided, may serve to partially or wholly counterbalance the weight of the valve unit, and thus facilitate normal valve control operations. It is noted, however, that such spring, when thus provided in the present embodiment, does not serve the function assigned to it when provided in the constructions disclosed and described in said earlier patents.

The main liquid fuel valve of the carburetor is shown at 87 in various of the figures, especially FIGURES 3, 5 and 8, as well as FIGURE 7 in which it is shown in detail in longitudinal section. The valve embodiment shown in said figures is the same as that disclosed in said earlier patents, so detailed description of the same is not needed here. It is to be noted that when the valving elements are properly proportioned and properly adjusted for the idling condition, such valves are slightly cracked so that air and mixture may flow past the valves in sufficient but small quantity to care for the idling requirements. Furthermore, since the spring 88 of the valve element shown in its entirety and identified by the numeral 87, FIGURES 3, 5, 7 and 8, urges such valve to its fully opened position, and with the upper or outer end of such valve element in contact with the tapered or conical surface of the valve 63, the liquid fuel needed for all operations is supplied by the lateral end groove 90 which connects with the central small hole 91 with the vertical groove 87^b on the outside surface of the tube 87^a for supply of such fuel during the idling operations. As the valve element 63 is raised more and more from its seat, additional valve openings 92 are uncovered to thus ensure supply of the fuel entering the unit through the holes 87^c in amount proportionate to the needs of the increased quantity of air being flowed through the outlet port 59.

Next attention is called to the provision of valve means to "prime" the motor, to facilitate starting thereof, especially when the motor is cold. Such a priming valve is shown in various of the figures of the present case, notably in FIGURES 3, 4, and 9, to which attention is invited. This priming valve is completely independent of the valving elements thus far described, and thus the operations incident to priming are not disturbed or modified by the priming operations. On the contrary, in the earlier embodiments disclosed in said earlier patents, the priming operation is produced by a special operation of the mixture poppet valve, serving to move the same against the priming valve, to activate such priming valve. This special operation of such mixture poppet valve changes the relationship between the amounts of "cracking" of the two valves; whereas by use of the presently disclosed independent priming valve, neither of the poppet valves is actuated, and each retains its original setting of its cracking condition.

The presently disclosed priming valve, shown in FIGURE 4 in enlarged detail, is of substantially the same construction as the priming valve shown in said earlier patents; and is briefly described as follows:

The priming valve includes the tubular element 92, closed at its delivery end which is, however, provided with the small central needle valve orifice 93. The plunger 94 is located in said end portion of the tubular element 92, and is provided with the outwardly extending needle 95 of tapered form which extends into or through the needle opening 93. The spring 96 extending between such plunger 94 and the screw abutment 97 at the inner end of the tubular element 92, urges the element 94 outwardly into the full valve closed position. However, the tapered end portion 95 extends through the needle orifice far enough to be engaged by an operating element which, by forcing the needle plunger element 94 inwardly against the spring urge, serves to provide a needle opening of size proportionate to the extent of such inward forced position.

The tubular element 92 is provided with one or more lateral openings 98 behind the plunger element, for admission of liquid fuel into the space behind such plunger element; but the plunger element itself is of polygonal form, to thus provide one or more lengthwise extending passages between the external surface of such plunger element, and the interior surface of the tubular element 92. Thus the liquid fuel may flow endwise through such passages to the location of the needle opening.

The above described valve unit is extended through the walls of the float chamber and the controlled air delivery passage 57, so that communication is established between the fuel in the fuel chamber at a level below the normal surface of such fuel, and the central portion of the controlled air delivery passage. Accordingly, when the needle valve is forced back against the spring 96 fuel may flow by gravity from the fuel chamber 52 through the tube 92 and orifice 93, into the chamber 51. Such flow may be by gravity alone, when no vacuum exists in the chamber 51 (as would be the case before cranking of the engine was produced by the starter). On the other hand, when a lowered pressure is produced in such chamber 51 (as would be the case when the engine rotation was produced by the starter), the partial vacuum then existing in the air delivery passage will assist in drawing fuel through the needle opening into such passage, irrespective of any special operation of the mixture poppet valve element. On the contrary, if desired, such priming operation may be produced by depression of the needle element 94 while the mixture poppet valve is in raised condition. Thus, the priming operations are made independent of the normal operations of the mixture poppet valve. For this independent priming valve operation I have shown the following provisions:

In alignment with the priming valve unit just described is the actuating unit. This includes the plunger element 99 (see FIGURE 9) slidably set into the tubular element 100. In its central portion this plunger element is reduced

in size to receive the compression spring 101 which has its forward end engaged with the shoulder of the plunger element, and its rear end engaged with an adjustable nut 102 by which the urge of such spring may be adjusted. The rear end of such plunger element also extends through such nut far enough to be engaged by a drive element, such extension being legended as 103. The forward end portion of the plunger element is of reduced size as shown at 104, such reduced size portion extending through the front end of the tubular element 100, and being urged forwardly to bring its shoulder between the reduced size forward end portion of the plunger element, and its full size portion, into engagement with the inside of the front end of the tubular element.

Drive against the projecting portion 104 will shift the plunger element endwise against the spring urge, to increase the projection of the rear end portion 103 beyond the rear end of the tubular element.

This drive unit is set through the wall of the mixture delivery passage far enough to bring the plunger end 103 close to the projecting end portion of the needle 95 of the priming valve. Under these conditions pressure exerted against the projecting end portion 104 will shift such plunger element towards the priming valve, with corresponding drive of the needle valve 95 inwardly, to thus open the needle opening, for delivery of priming liquid into the mixture delivery passage.

The drive against the end portion 104 of the plunger element may be produced in any convenient manner. In the drawings I have shown the lever element 105 pivoted to the stud 106 carried by the carburetor, such pivot being shown at 107. The upper end portion of such lever aligns with the projecting end portion 104, so that pull on the lower end of the lever drives the plunger element 99 towards and against the needle valve, as already explained. Such pull on the lower end of the lever 105 may be effected by a tension element 108 carried to the dash-board or other convenient location for manual or other operation.

The plugs 109 and 110 are removably inserted into openings of the fuel supply chamber 52 at locations for convenient removal or adjustment of the main fuel valve 87, and the priming fuel valve 92, respectively.

Examination of FIGURE 3 shows the liquid level as determined by the float 55 substantially at the line 111. It is noted that the priming valve unit 92 is substantially horizontal, and that the inlet openings 98 are below the surface of the controlled level in the supply chamber. Accordingly, the priming liquid delivered through such priming unit finds substantially a gravity feed to the mixture delivery passage, in addition to the syphoning effect produced by the partial vacuum existing in such passage.

I claim:

1. In a carburetor, the combination of an air inlet passage and a controlled air delivery passage, an air inlet port between said passages, a mixture delivery passage, and a mixture control port between the controlled air delivery passage and the mixture delivery passage, inlet and mixture poppet valves for said air inlet port and said mixture control port, respectively, said ports and said poppet valves being in vertical alignment with each other, a vertically movable stem extending through the air inlet port and through the mixture control port, means to secure both of the poppet valves to said stem at a fixed distance between said poppet valves equal to the valve seating distance between said air inlet port and the mixture control port, a liquid fuel supply float chamber in horizontal alignment with the mixture delivery passage, means to move said stem in the direction of the axial alignment of the ports for simultaneous change of the openings of both of the ports by equal amounts, a main liquid fuel supply conduit having its inlet end in communication with the float chamber and its delivery end terminating at the location of the mixture control port and including valve means in the path of movement of the mixture poppet valve, constituted to cause opening and closing movement of the main liquid fuel supply conduit valve proportional to the opening and closing movements of the mixture poppet valve, together with a priming liquid fuel conduit having its inlet end in communication with the float chamber and its delivery end terminating in the mixture delivery passage beyond said mixture control port in the direction of mixture flow and in horizontal alignment with the float chamber, valve means in said priming fuel conduit for control of the delivery of priming liquid fuel from the float chamber to the mixture delivery passage, and means independent of the poppet valves and independent of the stem connection between said poppet valves to actuate the priming liquid valve means.

2. A carburetor as defined in claim 1, wherein the priming liquid fuel conduit terminates in the mixture delivery passage at a location below the mixture control port.

3. A carburetor as defined in claim 1, wherein the priming mixture fuel conduit valve means comprises a needle valve including a needle opening from the conduit into the mixture delivery passage, and a needle element movable axially of the conduit and projecting into the mixture delivery passage, and wherein the means to actuate the priming liquid valve means independent of the poppet valves, comprises an element movable axially with respect to the needle element of the priming fuel conduit valve means and into actuating engagement with such needle element, together with means to move said element which is movable axially with respect to the needle element, towards the needle element.

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