

Aug. 27, 1940.

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2,212,946

CARBURETOR

Filed May 10, 1937

2 Sheets-Sheet 1

Fig. 1

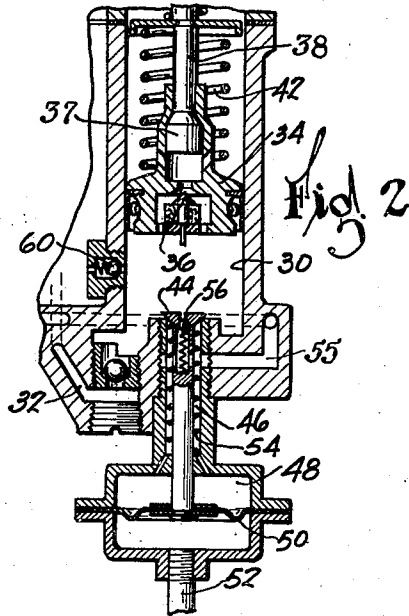
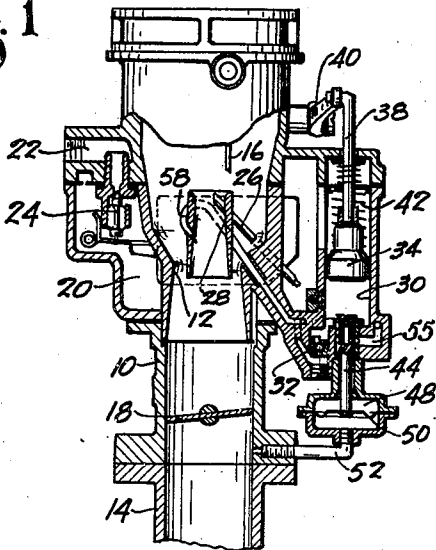


Fig. 2

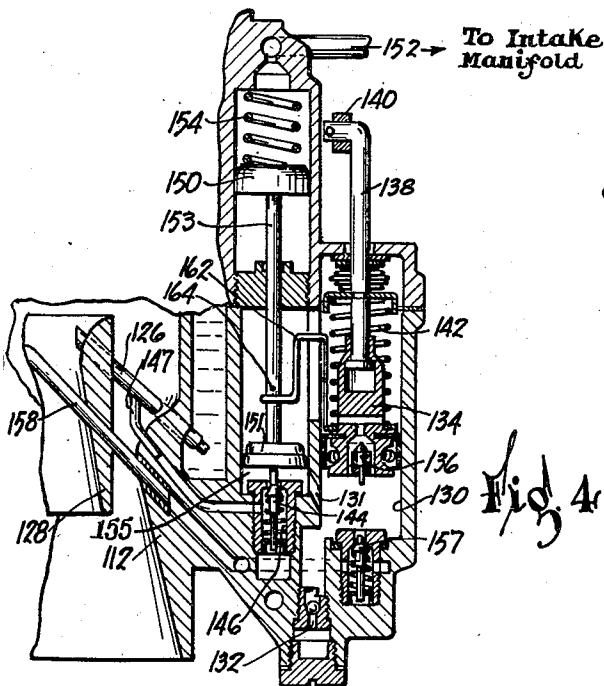


Fig. 4

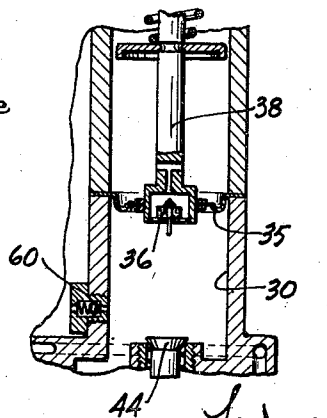


Fig. 3

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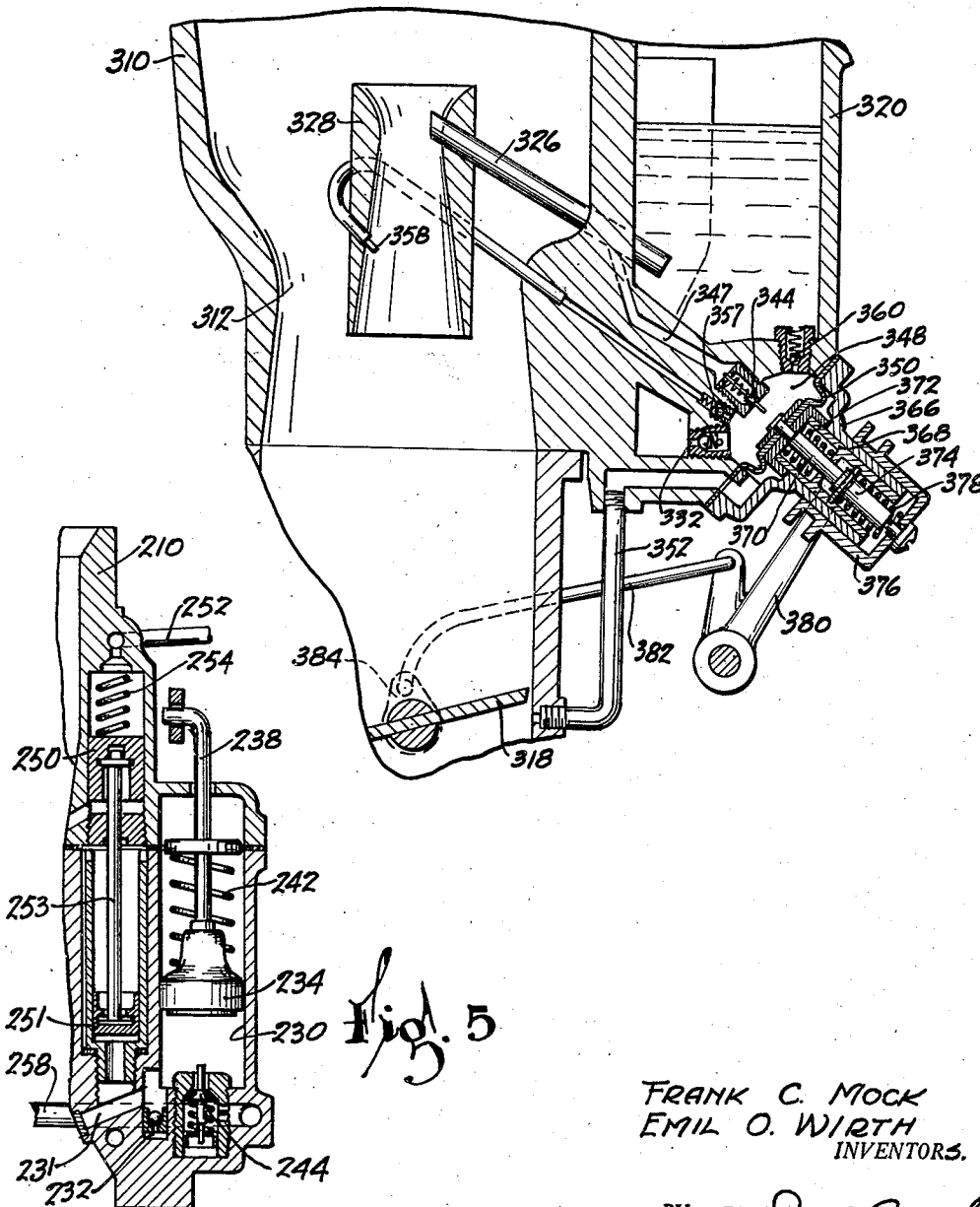
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2 Sheets-Sheet 2

Fig. 6



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CARBURETOR

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Application May 10, 1937, Serial No. 141,820

16 Claims. (Cl. 261-41)

This invention relates to carburetors and more particularly to carburetors for supplying a combustible mixture of fuel and air to an internal combustion engine.

One of the objects of the invention is to provide a carburetor in which the fuel supply is increased during acceleration to provide a richer mixture, the increased fuel supply being maintained over an appreciable period of time so that the engine can accelerate properly.

Another object of the invention is to provide a carburetor in which the richness of the mixture is increased during operation under heavy load or at high speed.

Other objects, advantages and novel features of the invention will be apparent from the following description when read in connection with the accompanying drawings, in which:

Figure 1 is a central section with parts in elevation of a carburetor embodying the invention;

Figure 2 is an enlarged partial view of the carburetor of Figure 1; and

Figures 3 to 6 are views similar to Figure 2 showing various modified constructions.

Referring more particularly to Figures 1 and 2, there is shown a carburetor including a down-draft conduit 10 constricted at 12 to form a venturi and connected at its lower end to an engine manifold 14. The carburetor is provided with the usual choke and throttle valves 16 and 18 and has a fuel chamber 20 formed around the conduit 10 receiving fuel from a passage 22 leading to any suitable source under the control of a float operated valve 24. Fuel from the chamber 20 is supplied to a stream of air flowing through the conduit 10 by a main nozzle 26 opening at its lower end through a metering orifice into the lower part of the fuel chamber and discharging into an auxiliary venturi 28 which is mounted in the conduit 10 substantially at the throat of the main venturi 12.

In order to provide a temporary increase in the supply of fuel as the throttle is opened, there is provided a pump cylinder 30 communicating at its upper end with the top of the fuel chamber and having an inlet 32 provided with a check valve connecting its lower end to the lower part of the fuel chamber. A piston 34 is slidably mounted in the cylinder 30 and is formed with a central vent closed by a float valve 36. If any vapor collects in the pump cylinder the valve 36 will open to permit its escape through the vent in the piston but as the liquid rises the valve 36 will float to closed position to prevent its escape.

The piston 34 is connected, by a lost motion connection indicated at 37, to a rod 38 operated by an arm 40 which is connected through suitable linkage, not shown, to the throttle valve 18 so that when the throttle is opened the rod

will be moved down. A spring 42 urges the piston 34 down and tends to maintain a continuing pump discharge within the limits of the lost motion connection as the throttle is opened.

Fuel from the cylinder 30 discharges past a tapered valve 44 into an annular chamber 46 which communicates with a chamber 48 closed on one side by a flexible diaphragm 50. The valve 44 is connected directly to the diaphragm 50 which is connected on its other side to the conduit 10 posterior to the throttle by a pipe 52 to be responsive to the suction therein. A spring 54 in the chamber 46 urges the valve 44 off its seat in opposition to the suction on the diaphragm 50 and the valve 44 is formed with a by-pass controlled by a check valve 56 to permit discharge of fuel from the pump cylinder 30 even when the valve 44 is closed. The chamber 46 is connected by a passage 55 to an auxiliary nozzle 58 discharging into the venturi 28, pressure developed on the nozzle by the piston 34 being limited by a relief valve 60 discharging into the fuel chamber.

When the engine is running and the throttle is opened the piston 34 will be operated to force an increased charge of fuel through the auxiliary nozzle 58 to provide a rich mixture for acceleration. The amount of fuel supplied is proportional to the amount of throttle opening and is continued as long as opening movement of the throttle continues. A difficulty with acceleration pumps of known types has been that at low engine speeds with small throttle opening, a relatively small amount of throttle movement will provide a full air charge to the engine but will not operate the pump sufficiently to provide a full fuel charge. With the present device, however, under conditions just mentioned, suction on the diaphragm 50 decreases allowing the diaphragm to move up under the influence of spring 46 to force fuel from the chamber 48 through the nozzle 58 to provide a full fuel charge. Suction on the diaphragm 50 will also drop if a load is applied to the engine without moving the throttle and under these conditions the diaphragm will also operate as a vacuum controlled fuel pump to increase the fuel charge. Thus the combination of the throttle operated pump and vacuum pump provides an accelerating charge of fuel under all conditions when it is desired.

The valve 44 controlled by the diaphragm 50 also serves to increase the fuel charge when there is a full air charge (low suction) by slightly raising valve 44 from its seat to open a passage from the fuel chamber to the nozzle 58. Thus when the engine is working under heavy load or at or near wide open throttle the valve 44 will open and fuel will flow from the fuel chamber through passage 32, past valve 44, through

chamber 46 and passage 55 into the nozzle 58 to increase the fuel charge to the engine.

Figure 3 illustrates a slight modification of the structure of Figure 1 in which the piston 34 is replaced by a diaphragm 35. Otherwise the structure and operation are the same and parts corresponding to like parts in Figure 1 have been indicated by the same reference numerals.

Figure 4 shows another carburetor embodying the invention, parts therein corresponding to like parts in Figures 1 and 2 being indicated by the same reference numerals plus 100. In this form the diaphragm 50 is replaced by a vacuum actuated piston 150 connected to a plunger 151 by a rod 153. The spring 154 urges these pistons downwardly and a suction connection 152 transmits suction from a point posterior to the throttle valve to the top of the piston 150 to tend to raise it. The valve 44 has been replaced by a spring closed economizer valve 144 controlling communication from the space 155 below the plunger 151 to the space 146 which communicates through a passage 147 with the main nozzle 126 above the metering orifice therein. The valve 144 has an elongated stem projecting upwardly to be engaged by the plunger 151 when it moves down thereby to open the valve and increase the supply of fuel to the main nozzle.

A passage 131 connects the pump cylinder to the space below plunger 151 and a passage controlled by a check valve 157 connects it to the auxiliary fuel nozzle 158. Preferably the spring holding the valve 157 closed is weaker than that closing the valve 144 so that under normal pumping operation the fuel from the pump will flow through valve 157 and out the auxiliary nozzle 158.

In order that the economizer valve 144 may be operated in accordance with throttle position as well as by variations in suction, the piston 134 carries a bracket 162 having a split end straddling the piston rod 153. Thus when the throttle is opened substantially fully, as for high speed operation, the bracket will force plunger 151 downwardly so that valve 144 will be opened to increase the supply of fuel to the main nozzle. With this construction it is desirable to proportion the piston 150 and spring 154 so that the piston will not move down until the suction falls to approximately two inches of mercury or less so that the plunger 151 will not open valve 144 during small throttle openings as in driving an automobile in traffic. This increases the economy and at the same time provides an increased fuel supply at high speed when the suction is greater than two inches of mercury because the throttle under such circumstances is substantially fully open and bracket 162 is bearing down on piston 151.

With a vacuum pump of usual design, each time the engine is stopped the vacuum is broken and the pump discharges, which is not desirable. Also at extremely low speed with the throttle nearly closed it is desired to keep the economizer valve closed regardless of the suction since a rich mixture is provided at this time by the usual idling mechanism. In the carburetor of Figure 4 the vacuum pump is kept from discharging and the economizer valve is retained closed during closed throttle operation by providing a pin 164 on the piston rod 153 above the end of the bracket 162. When the throttle is closed as when the engine is stopped the pin 164 engages the bracket 162 to prevent the pistons 150 and 151 from moving down to any appreciable extent so that

no fuel can be pumped thereby. When the throttle is opened only slightly for slow speed operation the plunger 151 may move down to some extent but not enough to open the economizer valve 144. However, in the normal operating range the bracket 162 does not materially restrict movement of the plunger 151 which is then free to move an amount equal to the distance between itself and the pin 164.

Figure 5 illustrates another embodiment of the invention, parts therein corresponding to like parts in Figure 4 being indicated by the same reference numerals plus 100. In this embodiment the economizer valve 244 is placed in the lower part of the pump cylinder 230 with its end projecting into that cylinder to be engaged by the piston 234. The economizer valve also serves as a pump outlet check valve and the discharge from both the mechanical pump 234 and the vacuum pump 251 is conducted past it and through the nozzle 258. The operation of this embodiment is similar to that of Figures 1 and 2 except that the economizer valve is operated by the throttle and it represents a simplification of the form shown in Figure 4 with omission of certain of the functions.

Figure 6 illustrates still another embodiment of the invention, parts therein corresponding to like parts in Figures 1 and 2 being indicated by the same reference numerals plus 300. In this construction a housing part 366 formed with a cylindrical extension is secured to the fuel chamber clamping the diaphragm 350 between them. The diaphragm is not connected to the economizer valve 344 but is adapted to engage a stem thereon to open the valve.

A sleeve 368 is slidably mounted in the part 366 and has a lost motion connection with a rod 370 which is connected to the diaphragm 350, a spring 372 urging the rod and diaphragm to the limit of their travel in the downward direction away from the valve 344. The sleeve 368 carries a second rod 374 which is connected through a lost motion connection to a yoke member 376, a spring 378 urging the yoke member away from the sleeve. The yoke member is connected to one arm of a bell crank lever 380, the other arm of which is connected through a link 382 to a lever 384 which is carried by the throttle valve shaft.

The valve 344 controls flow of fuel through a passage 347 into the main nozzle above the metering orifice. The auxiliary nozzle 358 communicates with the chamber 348 past a check valve 357 which is urged onto its seat by a spring weaker than the spring urging the valve 344 closed so that in normal pumping operation fuel will be discharged past the valve 357 through the auxiliary nozzle. However, when the diaphragm moves far enough it will engage and open the valve 344 to increase the supply of fuel to the main nozzle.

In operation, the diaphragm 350 is responsive to variations in suction within the limits permitted by the lost motion connection between sleeve 368 and rod 370 and also to movements of the throttle. The lost motion connection is so arranged that when the throttle is closed substantially no movement of the diaphragm is permitted, when the throttle is only slightly open the diaphragm can move but not enough to open valve 344 and when the throttle is in the normal operating range the diaphragm is substantially free to move in response to variations in suction in much the same manner as described in con-

nection with Figure 4. When the throttle is opened wide it moves the sleeve 368 sufficiently to open the valve 344 so that this valve is controlled at partial throttle openings by suction and at wide open throttle by throttle position and suction.

While several embodiments of the invention have been shown and described, it will be apparent that many changes might be made therein and it is not intended to limit the scope of the invention to the illustrated embodiments nor otherwise than by the terms of the appended claims.

What is claimed is:

1. A carburetor comprising a mixture conduit, a throttle valve in said conduit, a fuel reservoir, a pump chamber connected to said fuel reservoir, a fuel displacement member forming a closure for said pump chamber and connected to the throttle valve to be operated thereby, said member formed with a by-pass opening, valve means including a float in said opening and adapted to open by gravity when insufficient fuel is in contact therewith to permit escape of vapor but to close the opening against the passage of liquid fuel thereby to maintain the pump chamber full of liquid fuel, and a nozzle connected to the pump chamber and discharging into the mixture conduit.

2. A carburetor comprising a mixture conduit, a throttle valve in said conduit, a fuel chamber, a pump chamber connected to said fuel chamber and having the pumping portion thereof positioned below the normal level of the fuel in said fuel chamber, a fuel displacement member forming a closure for the top of the pumping portion of the pump chamber and connected to the throttle valve to be operated thereby, said member formed with a by-pass opening, valve means including a float in said opening to open the opening and permit escape of vapor but to close the opening against the passage of liquid fuel thereby to maintain the pumping portion of the pump chamber full of liquid fuel, a second pump chamber having a movable member, a passageway interconnecting said pump chambers whereby said last movable member is subjected to pressures created in the first mentioned pump chamber, a nozzle connected to one of said chambers and discharging into the mixture conduit, and a pressure responsive member subjected to the pressure in the mixture conduit posterior to the throttle valve and connected to said second named movable member.

3. A carburetor comprising a mixture conduit having a throttle valve therein, fuel supply means, a pair of interconnected pump chambers communicating with said fuel supply means, plunger members for discharging fuel from said chambers, throttle operable means for actuating one of said plungers, means subjected to the suction in the mixture conduit posterior to the throttle and attached to the other plunger whereby said second named plunger is actuated conjointly by variations in said suction and by variations in the fuel pressure in said chambers, resilient means acting on said last means in opposition to said suction, and a nozzle communicating with said chambers and discharging into the mixture conduit.

4. A carburetor comprising a mixture conduit, a throttle valve therein, fuel supply means, a pair of interconnected pump chambers communicating with said fuel supply means, plunger members for discharging fuel from said chambers, throttle operable means for actuating one of said

plungers, resilient means for urging the other plunger into its chamber, means subjected to the suction in the mixture conduit posterior to said throttle for urging said other plunger out of its chamber, and a nozzle communicating with said chambers and discharging into the mixture conduit.

5. A carburetor comprising a mixture conduit having a throttle valve, fuel supply means, a pair of interconnected pump chambers communicating with said fuel supply means, plunger members for displacing fuel from said chambers, throttle operable means for actuating one of said plungers, means responsive to the suction in the mixture conduit posterior to said throttle and connected to the other plunger thereby to make the other plunger responsive both to the suction in the mixture conduit and the fuel pressure in said chambers, means including a nozzle connected to one of said chambers and discharging into the mixture conduit, and a normally closed check valve in said last named means, said check valve adapted to open when the pressure in said chambers exceeds a predetermined value.

6. A carburetor comprising a mixture conduit having a throttle valve, fuel supply means, a pair of interconnected pump chambers communicating with said fuel supply means, plunger members for displacing fuel from said chambers, manually operable means for actuating one of said plungers, means subjected to the suction in the mixture conduit posterior to said throttle and attached to the other plunger to cause said other plunger to move responsive both to the suction in the mixture passage and the fuel pressure in said chambers, means including a nozzle connected to the chamber containing said other plunger and discharging into the mixture conduit, and a valve in said last named means, said valve including a part projecting into the last named chamber to be engaged by said other plunger to open the valve.

7. A carburetor comprising a mixing conduit, a throttle therein, a fuel reservoir, a main nozzle conducting fuel from said reservoir to said mixing conduit and including a metering restriction, an accelerating pump connected to the throttle to be operated thereby, an auxiliary nozzle discharging fuel from said pump into the mixing conduit, a supplemental fuel conduit for conducting an auxiliary supply of fuel to the main nozzle posterior to said restriction, a normally closed economizer valve in said conduit, and means subjected jointly to variations in the pressure in the mixing conduit posterior to the throttle and to variations in the fuel pressures produced by actuation of the pump for opening said economizer valve.

8. The invention defined in claim 7 including means operated by the accelerating pump and operative at or near wide open throttle to open the economizer valve regardless of the degree of suction in the mixing conduit.

9. A carburetor comprising an induction passage, a throttle valve therein, a fuel reservoir, a main nozzle having a metering restriction therein and connecting the reservoir and mixing conduit, an accelerating pump connected to the throttle to be actuated by throttle opening movement, a supplemental fuel conduit connecting the reservoir to the main nozzle posterior to said restriction, single means subjected to pressures in the induction passage posterior to the throttle and to fuel pressure produced by operation of the pump for controlling flow through said sup-

plemental fuel conduit, and a mechanical connection between the throttle and said means for positively opening the supplemental fuel conduit whenever the throttle is at or near its wide open position.

10. A carburetor comprising a mixture conduit having a throttle valve therein, a fuel supply source, a main nozzle conducting fuel from said source into the conduit including a metering restriction, an accelerating pump connected to the throttle to be operated thereby, an auxiliary fuel passage to conduct fuel from said pump into the conduit, a normally closed economizer valve controlling said passage, and means subjected both to variations in the pressures in the mixture conduit posterior to the throttle valve and to variations in the fuel pressures created by actuation of the pump for opening said economizer valve.

11. In a carburetor having an induction passage and a throttle valve therein, a pump chamber having a pumping member actuated by throttle movement, a second pump chamber connected to said first pump chamber by a pressure equalizing passage, a second pumping member in said second pump chamber yieldingly positioned to respond to both variations in the pressure in the induction passage posterior to the throttle valve and to variations in the fuel pressure in said chambers, a valve controlled outlet from one of said pump chambers controlled by the pressure of fuel in said chambers, and a second valve controlled outlet from one of said pump chambers controlled by the position of one of said pumping members.

12. A carburetor having a mixture passage, a throttle valve therein, a fuel chamber, a main nozzle for supplying fluid from said chamber to said passage, said nozzle having a metering restriction therein, a throttle operated accelerating pump having a chamber communicating with the fuel chamber and having a valve controlled outlet conduit discharging into the passage, a suction operated pump including a chamber communicating with the fuel chamber and with the first named pump chamber and with the nozzle posterior to said restriction, said suction operated pump including means subjected to suction in said passage posterior to the throttle, and resilient means associated with said last named means and tending to cause a discharging operation of said suction operated pump in opposition to the effect of said suction and the pressure of the fuel created in said first pump chamber by operation of said accelerating pump.

13. A carburetor having a mixture passage, a throttle valve therein, a fuel chamber, a main nozzle for supplying fluid from said chamber to said passage, said nozzle having a metering restriction therein, a throttle operated accelerating pump having a chamber communicating with the fuel chamber and having a valve controlled outlet conduit discharging into the passage, a suction operated pump including a chamber communicating with the fuel chamber and with the first named pump chamber, a conduit connecting said last chamber with the nozzle posterior to said restriction, a valve in said last named conduit, said suction operated pump including means subjected to suction in said passage posterior to the throttle, and resilient means associated with said last means and tending to cause a discharging operation of the suction operated pump in

opposition to the effect of said suction and the pressure of the fuel created in said first pump chamber by operation of said accelerating pump, said second named valve being opened by said suction operated pump when the latter attains its discharged position under the action of said resilient means.

14. A carburetor having a mixture passage, a throttle valve therein, a fuel chamber, a main nozzle for supplying fluid from said chamber to said passage, said nozzle having a metering restriction therein, a throttle operated accelerating pump having a chamber communicating with the fuel chamber and having a valve controlled outlet conduit discharging into the passage, a suction operated pump including a chamber communicating with the fuel chamber and with the first named pump chamber, a conduit connecting said last chamber with the nozzle posterior to said restriction, a valve in said last named conduit, said suction operated pump including means subjected to suction in said passage posterior to the throttle, resilient means associated with said last means and tending to cause a discharging operation of the suction operated pump in opposition to the effect of said suction and the pressure of the fuel created in said first pump chamber by operation of said accelerating pump, said second named valve being opened by said suction operated pump when the latter attains its discharged position under the action of said resilient means, a pair of spaced abutments carried by said suction operated pump, and means carried by said accelerating pump and arranged to engage said abutments whereby the suction operated pump is prevented from moving to discharge position when the throttle is in normal closed position and is moved to discharge position when the throttle is fully opened.

15. A carburetor comprising an induction conduit, a throttle valve in said conduit, a fuel reservoir, a fuel duct interconnecting the reservoir and conduit and having a metering restriction therein, and an acceleration pump comprising a fuel chamber having fixed and two spaced movable walls, throttle operated mechanism to move one of said walls inwardly when the throttle is opened, means communicating with the induction conduit posterior to the throttle for withdrawing the other of said walls when suction in the conduit increases, a spring urging said other wall inwardly in opposition to the suction, a passageway from the reservoir to the chamber and a restricted passageway from the chamber to the induction conduit.

16. A carburetor comprising a mixture conduit, a throttle valve in said conduit, a fuel reservoir, two parallel vertically extending acceleration pump wells, depending fuel displacement members in said wells, passages intercommunicating the lower portions of said wells with each other and with the fuel reservoir and the mixture conduit, the passage to the mixture conduit being restricted, a throttle operated device for actuating one of said members, and a suction operated element subjected to the suction in the mixture conduit posterior to the throttle and including resilient means opposing the suction for actuating the other of said members.

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