Sept. 14, 1937. J. F. MULLEN, JR 2,093,205

CARBURETOR

Filed Dec. 5, 1934 3 Sheets-Sheet 1

Fig. 1

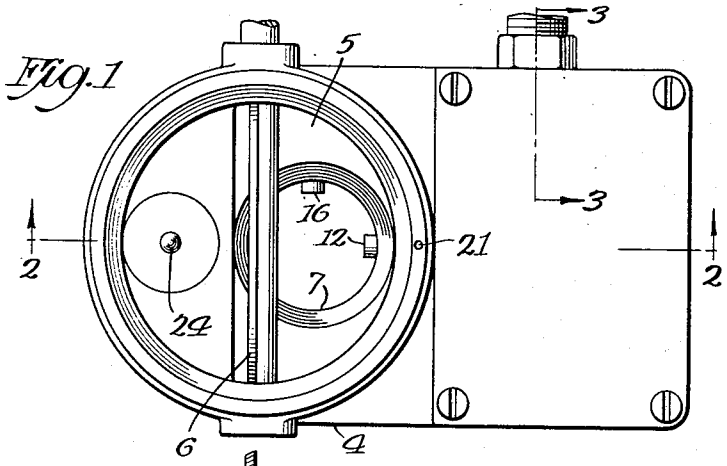


Fig. 9

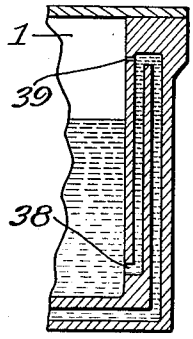


Fig. 2

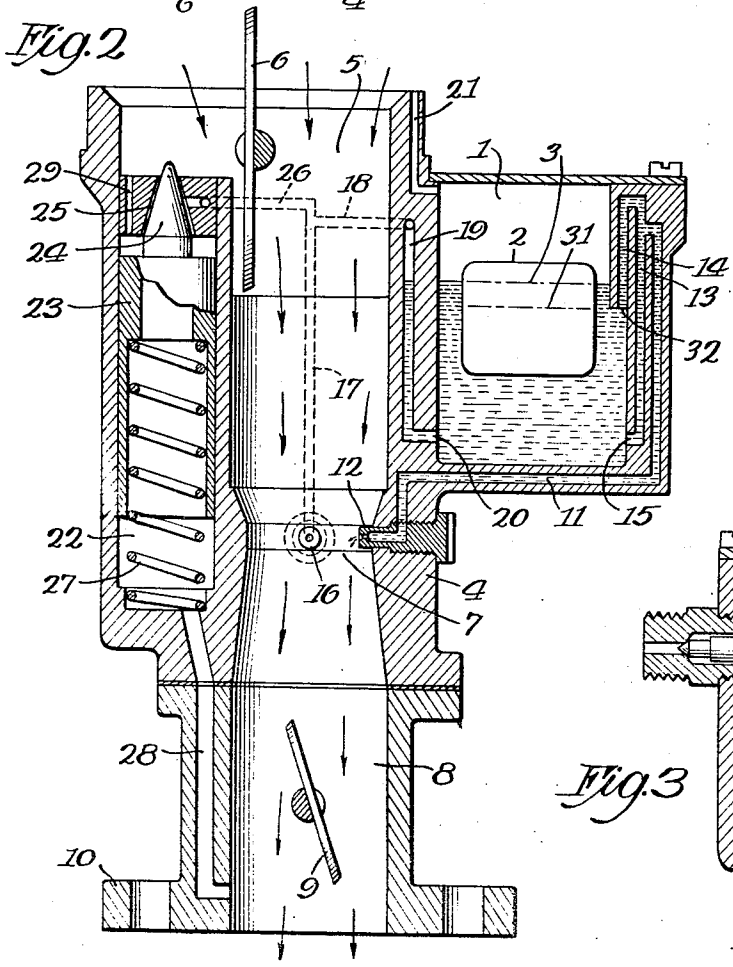


Fig. 10

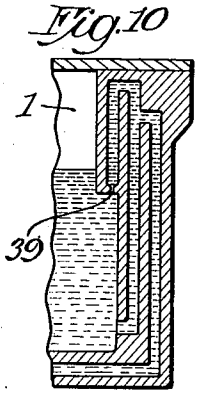
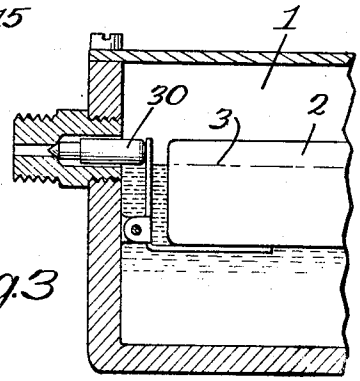


Fig. 3



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CARBURETOR

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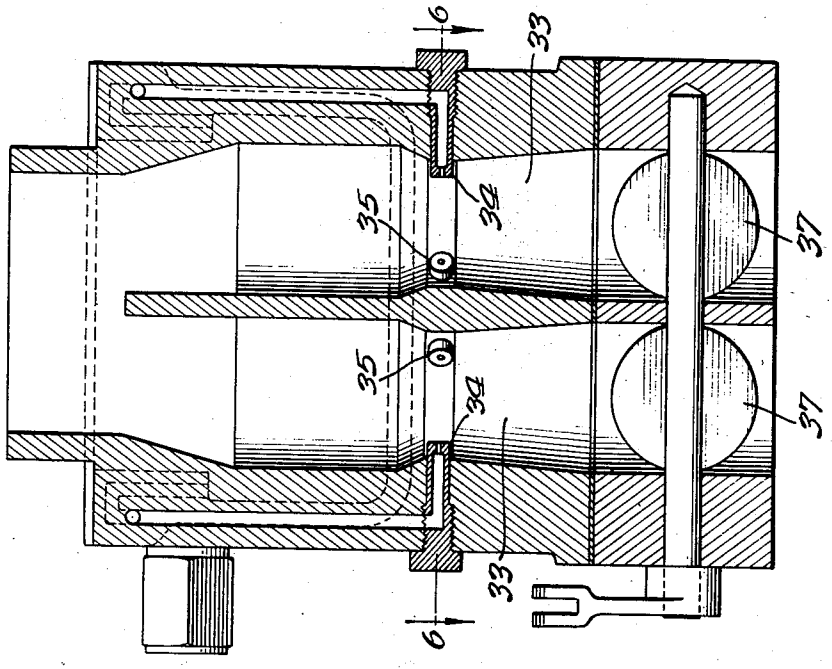


Fig. 5

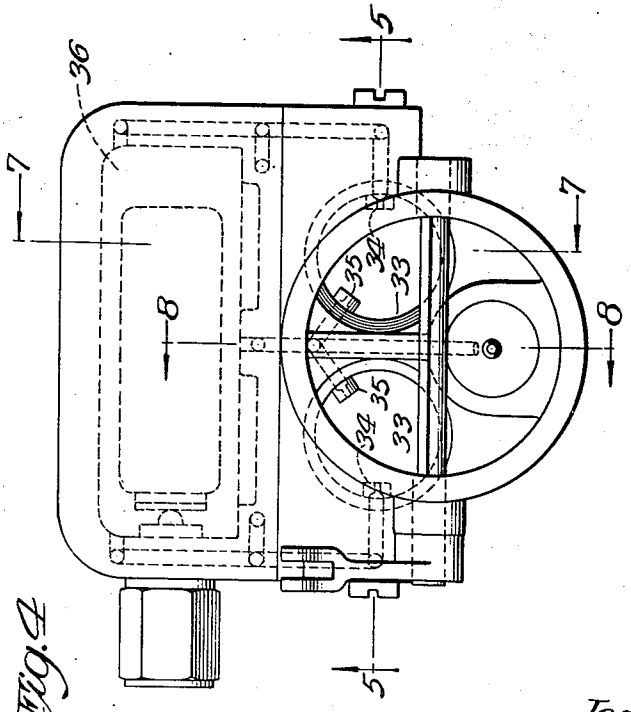


Fig. 4

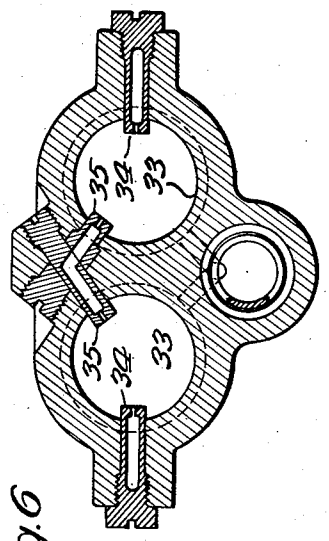


Fig. 6

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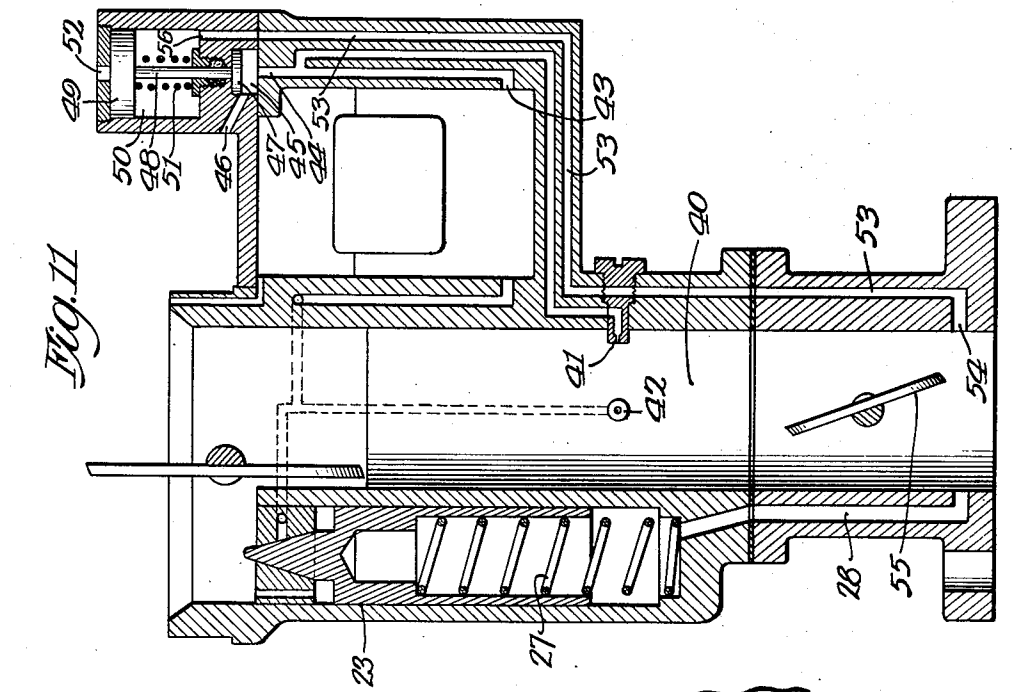


Fig. 11

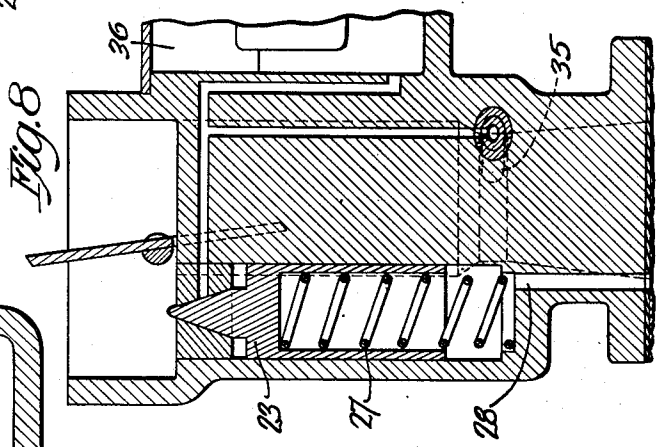


Fig. 8

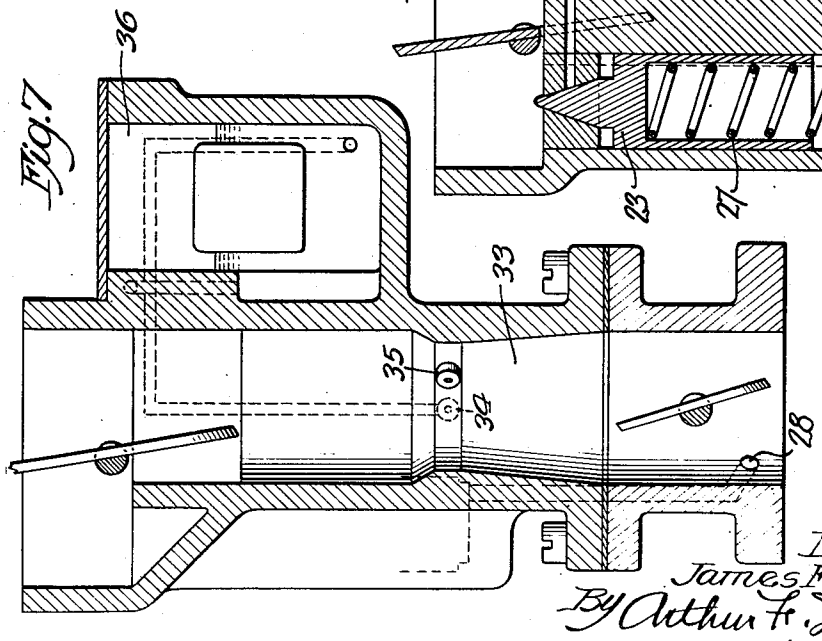


Fig. 7

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UNITED STATES PATENT OFFICE

2,093,205

CARBURETOR

James F. Mullen, Jr., Detroit, Mich.

Application December 5, 1934, Serial No. 756,061

19 Claims. (Cl. 261—41)

This invention relates to carburetors, such as those employed on internal combustion engines, and more particularly to those in which the gasoline or other liquid fuel is automatically fed into the incoming stream of air by gravity, as well as by suction.

Generally stated, the object of the invention is to provide a novel and improved construction and arrangement whereby the combined gravity and suction feed is more efficiently employed in a carburetor of this general character, thereby to increase the efficiency of the engine or motor, and to increase the mileage per gallon of fuel.

It is also an object to provide certain details and features of construction and combinations tending to increase the general efficiency and the desirability of a carburetor of this particular character.

To the foregoing and other useful ends, the invention consists in matters hereinafter set forth and claimed and shown in the accompanying drawings, in which—

Fig. 1 is a plan view of the carburetor embodying the principles of the invention.

Fig. 2 is a section on line 2—2 in Fig. 1 of the drawings.

Fig. 3 is a detail or fragmentary section on line 3—3 in Fig. 1 of the drawings.

Fig. 4 is a plan view showing a double-barrelled carburetor, instead of the single-barrelled carburetor previously described.

Fig. 5 is a vertical section on line 5—5 in Fig. 4 of the drawings.

Fig. 6 is a horizontal section on line 6—6 in Fig. 5 of the drawings.

Fig. 7 is a vertical section on line 7—7 in Fig. 4 of the drawings.

Fig. 8 is a vertical section on line 8—8 in Fig. 4 of the drawings.

Fig. 9 is a fragmentary detail sectional view showing a different form of the invention.

Fig. 10 is a similar view showing another form of the invention.

Fig. 11 is a view similar to Fig. 2, showing a different form of the invention.

As thus illustrated, referring to Figs. 1, 2 and 3 of the drawings, the carburetor has a float chamber 1 provided with a float 2 of ordinary form, which maintains the level of the fuel at line 3, normally, in the manner shown in Fig. 2 of the drawings. The body 4 of the carburetor has an upper air intake chamber 5, provided with the ordinary choke valve 6, and this chamber is connected by the Venturi tube passage 7 with the lower chamber 8, containing the ordinary throttle valve 9, as shown. This is what is called a "down draft" carburetor, and the bottom portion 10 is bolted to the intake manifold of the engine or motor.

It will be seen that the walls of the float chamber 1 are provided with a passage 11 that connects at one end to the fuel inlet nozzle 12, in the Venturi tube passage 7, and that connects at its upper end to the vertical passages 13 and 14, the latter having its inlet end slightly below the level of the fuel, and the passage 13 having its lower inlet end 15 near the bottom of the float chamber. An auxiliary fuel nozzle 16 is also disposed in the Venturi tube passage, as shown, and is connected by passages 17, 18 and 19 with the outlet 20 near the bottom of the float chamber. It will also be seen that the float chamber has an air inlet passage 21 to maintain the required atmospheric pressure in the upper portion of the float chamber.

In the other side of the carburetor body, there is a vertically disposed cylindrical chamber 22 in which the valve body 23 is movable up and down, this valve body having an upper cone-shaped valve 24 for engagement with the tapered valve seat 25 at the top of the said chamber.

This valve seat 25 is connected by a passage 26 with the passages 17 and 18, as shown in dotted lines in Fig. 2 of the drawings. A coil spring 27, applied as shown, serves to hold the valve 24 in normally raised or closed position. The lower end of the chamber 22 is connected by a passage 28 with the throttle valve passage 8, at a point below the valve 9, as shown in the drawings. An air vent 29 connects the upper portion of the chamber 22, above the valve body 23, to the chamber 5 where the air enters the carburetor.

As shown in Fig. 3, the float 3 operates the ordinary or suitable inlet valve 30 to automatically admit fuel to the float chamber, and to shut off the fuel at the right time, thereby to normally maintain the fuel level at the line 3, as shown in Fig. 2 of the drawings.

The height of the fuel level 3 above the jet or nozzle 12 provides what is known as a positive static head.

Before the engine is started, the liquid fuel level is approximately at the line 31, which is a slight distance below the inlet opening 32 of the passage 14, and the valve 24 is tightly against its seat 25, so that no air can enter the passage 26 and the passage 17, but when the motor is started, then the liquid fuel from the pump, such as the ordinary feed pump on a motor vehicle, brings the level of the fuel in the float chamber a slight

distance above the opening 32, in the passages 13 and 14, and thereby seals these passages, in order that no air may gain an entrance through the opening 32, in a manner that will be readily understood. The suction caused by the pistons of the motor causes air to flow into the carburetor at the inlet passage 5, through the Venturi passage 7, past the throttle 9, and then to the intake manifold of the motor. This suction, operating through passage 28, causes the valve 24 to move downwardly away from its seat 25, and causes a suction action at the outlets of the jets and nozzles 12 and 16, and the suction causes the fuel to flow through passage 11 to jet 12 where it mixes with the air flowing through the carburetor. The suction which acts on jet 16 tends to cause the liquid fuel to flow through passages 17, 18 and 19, but this is prevented, for the reason that air is free to enter through the passage 26, and consequently the suction is not sufficient to raise the fuel in passage 19 high enough to overflow through the passage 18 into the passage 17. When, however, the throttle 9 is suddenly opened, or the suction of the intake manifold is decreased sufficiently, the spring 27 forces the valve 24 upwardly against its seat 25 and thereby closes the air passage 26, so that the suction is then effective to raise the fuel in passage 19 and cause it to overflow through the passage 18 into the passage 17, and to cause it to discharge from the jet 16 into the air flowing through the carburetor. In this way, the acceleration is automatic, so to speak, and the fuel is fed into the air stream by gravity, as well as by suction, for the passages 11 and 17, it will be seen, are really parts of two siphons that would permit the feeding of the fuel by gravity until the level of the fuel reaches the outlet openings 15 and 20 near the bottom of the float chamber; but, of course, as shown in Fig. 2, the passage 17 cannot function as a gravity siphon if the passage 26 is open, and, of course, for the siphon passage 11 to drain the fuel in the carburetor down to the level of the opening 15 would require that the opening 32 be closed; but, in effect, as stated, the passages 11 and 17, in combination with the passages 13 and 19, constitute siphons that operate by gravity to feed the fuel into the incoming current of air, and that also operate by suction.

And, in addition, it will be understood that in Fig. 2 of the drawings the valve 24 is shown nearly closed, inasmuch as at this time, with the throttle 9 in the position shown, or even in a somewhat more closed position, there is some suction exerted in the passage 28, sufficient to maintain the valve 24 slightly open, so that the siphon passage 17 will not function to feed fuel to the mixing chamber; but, when the engine is accelerated, by completely opening the throttle 9, suction on the passage 28, by the engine, will practically cease, and the valve 24 will close, thereby shutting off the emission of air to the passage 26, and at such time the passages 17 and 18 and 19 will operate to feed fuel into the mixing chamber.

The carburetor shown and described is, in general principle, what is ordinarily called a "down draft" carburetor. However, it is obvious that the invention can be employed in an up draft or a side draft carburetor, equally well, inasmuch as the combination suction and gravity feed, with the positive static head principle, is adapted to work or function on all of these different types of curburetor.

Obviously, when the motor stops, there will be a little discharge of fuel into the passages 7 and 8, from the jet 12, and perhaps from the jet 16, but this will simply serve to prime the engine when it is again started.

In Figs. 4, 5, 6, 7 and 8, the construction is substantially the same as that previously described, but in this case the device is what is called a double-barrelled carburetor, instead of being single-barrelled like the one previously described. In this case, therefore, the carburetor has two downwardly extending mixing passages 33 and 33, arranged side by side, and with the fuel jets 34 and 35 extending into the restricted or Venturi portions of these passages, these jets being connected to the float chamber 36 in the manner previously described, and the arrangement being substantially the same, except that the carburetor is double, so to speak, having twice as many fuel jets and having a throttle valve 37 for the lower end of each passage 33, to throttle or regulate the mixture passing from the carburetor into the intake manifold of the motor.

Referring to Fig. 9, the construction is similar to that shown in Fig. 2 of the drawings, but in this case the action is somewhat different, inasmuch as the float chamber has no siphon inlet 32, and has instead merely the one inlet 38, and a small air hole 39 communicating with the top or bend of the siphon.

In Fig. 10, the construction is similar to that shown in Fig. 2 of the drawings, except in this case there is no full opening 32, but instead there is a very small restricted opening 39 at the lower end of the upper leg of the siphon.

Referring to Fig. 11, it will be seen that the construction here is similar to that previously described, but in this case the mixing chamber 40 is straight and has no Venturi portion where the jets 41 and 42 are located therein. Also, in this form of the invention, the float chamber has no siphon inlet 32, but has only the lower siphon opening 43, so that the jet 41 is only connected through the opening 43 with the fuel chamber. However, the top of the siphon has a passage 44 leading to the air chamber 45, into which air enters through the passage 46, when the valve 47 is in raised or normal position. The upper end of the valve stem 48 has a plunger head 49 that fits the chamber 50 in which the coil spring 51 is located, which spring keeps the valve and the plunger in normally raised position. The top of the chamber 50, above the plunger 49, is provided with an air vent 52, as shown. A passage 53 extends from an opening 54 in the side of the passage 40, below the throttle 55, to an opening 56 at the bottom of the chamber 50, whereby, under the suction of the engine, exerted through the passage 53, the plunger 49 will be sucked downwardly, causing the valve 47 to close the passages 44 and 46, thereby shutting off the entrance of any air into the siphon passage which leads to the jet 41 previously mentioned.

In each form of the invention, therefore, except in Fig. 11, it will be seen that the fuel has two levels in the float chamber, the normal level being somewhat lower than the level at which the fuel is maintained during the running of the engine or motor, as in each case some fuel drains out of the siphon passages when the motor stops, thus lowering the level of the fuel in the float chamber. Also, therefore, in each form of the invention, there is a positive static head that characterizes the combined suction and gravity feed of the fuel. This, it is found, in actual practice, insures greater efficiency for the engine or motor,

and better mileage per gallon in the consumption of the fuel.

With further reference to Fig. 9, it will be understood that the air inlet 39 is preferably so small that the passage of air therethrough will not break the siphon action while the engine is running; but, when the engine stops running, then the opening 39 is sufficient to admit enough air to break the siphon action, preventing the siphon passages from draining the fuel down to the level of the opening 38, as will be readily understood.

Furthermore, in connection with Fig. 10 of the drawings, it will be understood that the opening 39 is also so small that, should the automobile lurch to one side, and thereby cause the level of the fuel to momentarily go below this opening, the intake of air will not be sufficient to break the siphon action at such time; but, of course, when the engine stops running, and the level of the fuel then goes below the level of the opening 39, the latter is then operative to admit enough air to break the siphon action and stop the draining of the fuel into the mixing passage or chamber of the carburetor.

It will be seen, therefore, that in each form of the invention there are means forming in effect a siphon between the float chamber and the air passage, adapted to feed the fuel by suction of gravity into the air stream, forming the main fuel passage from the float chamber to the mixing chamber, all of the elements being co-ordinated to maintain the level of the fuel in the float chamber at a point high enough above the lower outlet end of the siphon to maintain a positive static head, while the motor is in operation, and that this is true of each of the different forms of the invention shown and described.

In each form of the invention, it will be seen, both gravity and the suction of a Venturi tube are employed, along with a main fuel passage that is normally open and free from direct manual control, for the main fuel passage in each form of the invention is without any manual throttle control, and is normally open, and this also holds good for the power range, in each form of the invention. For acceleration, in each form of the invention, there is a vacuum operated valve, to increase the flow of fuel, but without restricting the intake of air. Also, the flow at idling, in each form of the invention, is almost entirely by gravity because of the low velocity of air through the main barrel of the carburetor. Then, as the flow of air increases, the suction of the venturi becomes stronger, and the gravity feed alone gets weaker, relatively, as the air flow increases, whereas the suction feed gets stronger, thus insuring more approximately the ideal combination of gravity and suction feed.

Thus, with the construction shown in Fig. 2 of the drawings, when the throttle 9 is opened sufficiently to cause an appreciable drop in the intake manifold vacuum, the valve 23 automatically seats itself, thus cutting off the air supply to the nozzle 16, which causes fuel to discharge from the nozzle 16, thus giving the needed increase in mixture strength for acceleration, or for carrying an increased load at about the same speed. Of course, the throttle 9 need not be opened wide to cause the appreciable drop in the intake manifold vacuum. In Fig. 11 of the drawings, the valve 47 remains closed as long as the engine is running, or is being turned over by the starting motor or by hand, for as long as the engine is being turned over there is always more or less vacuum at 54, which serves to keep the valve 47 closed. Preferably, the spring 51 under the valve 47 is of such strength or tension that the valve 47 opens when an appreciable drop in the intake manifold vacuum occurs, and under such conditions fuel stops discharging from the nozzle 41 and the engine runs on the discharge from nozzle 42 only. Therefore, the spring 27 under the valve 23 is preferably slightly stronger than the spring 51 under the valve 47, in order that fuel may flow out of the auxiliary siphon before the flow in the main siphon is stopped, and will continue for a short time after the valve 47 is closed, to give the main passage time to start. This overlapping of flow, as between the two siphons, tends to prevent any stoppage of the flow of fuel to the engine or motor. Therefore, air is admitted to the main siphon, in Fig. 11, to stop the flow of fuel, so that the float bowl will not be drained when the engine stops. Similarly, air is admitted to the auxiliary siphon to prevent acceleration, when acceleration is not wanted, and to prevent the draining of the float bowl when, in starting the engine, the motor fails to respond promptly. The spring under the valve 23 may be sufficiently strong to hold this valve in seated position while the engine is being turned over by the starter or by hand. This causes fuel to flow out of the nozzle 16, as well as out of the nozzle 12, and then, if the motor fails to respond, and the starting is momentarily abandoned, the air inlet to the auxiliary siphon prevents draining of the float bowl.

It will be seen that, in each form of the invention, the passage 26 forms the sole air admission to the auxiliary fuel feed passage formed by the passages 17, 18, and 19, as there is no other way in which air can enter this siphon passage, and hence the suction opening at the lower end of the passage 28 has entire control over the admission of air to the auxiliary fuel feed passage.

In each form of the invention, therefore, the main siphon fuel passage has means for admitting air thereto, in one way or another, to prevent drainage of the float chamber. In Fig. 2 air is admitted at 32, when the level of the fuel is lowered, while in Fig. 9, air is admitted at 39, sufficiently to insure the desired result, and in Fig. 10 air is admitted at 39 to prevent drainage; and in Fig. 11, as explained, air is admitted to the main fuel passage at 44, in the manner explained; whereby, in each form of the invention, the main fuel passage is incapable of draining the float chamber, as for example when the engine stops running.

What I claim as my invention is:

1. In a throttle controlled carburetor for a motor, means providing a general air passage through which the air flows to the motor, providing a mixing chamber, means providing a float chamber for the liquid fuel, and means forming in effect a siphon between the float chamber and the air passage, with a fixed inlet and fixed outlet, adapted to feed the fuel by suction and gravity into the air stream, forming the main fuel passage from the float chamber to the mixing chamber, normally open, free at all times from any direct manual regulation or valve control, with means to admit air to said passage to prevent draining of the float chamber, all co-ordinated to maintain the level of the fuel in the float chamber at a point high enough above the outlet end of the siphon to maintain a positive static head, while the motor is running, to provide the same gravity and suction feed for both the power range and the economy range.

2. A structure as specified in claim 1, comprising an auxiliary siphon passage for feeding fuel from the float chamber to the air passage, by suction and gravity, together with an automatic valve and an air passage controlled thereby to the auxiliary siphon, for automatically feeding additional fuel to the air stream for acceleration.

3. A structure as specified in claim 1, said siphon having two inlets in the float chamber, one inlet a substantial distance below the other.

4. A structure as specified in claim 1, said siphon having two inlet openings in said float chamber, one above the other, the upper opening being below the said level of the fuel when the engine is running, but above the level of the fuel when the engine is not in operation, and the other opening being near the bottom of the float chamber.

5. A structure as specified in claim 1, comprising auxiliary means for automatically feeding fuel from the float chamber to the air stream, by suction and gravity, for acceleration, and valve means controlling the air stream and thereby indirectly controlling the feeding of fuel to said stream.

6. In a carburetor for a motor, means providing a general air passage through which the air flows to the motor, means providing a float chamber for the liquid fuel, means forming in effect a siphon passage between the float chamber and the air passage, adapted to feed the fuel by suction and gravity into the air stream, cooperating with the float and the inlet controlled by the latter to maintain the level of the fuel in the float chamber at a point high enough above the lower outlet end of the siphon to maintain a positive static head, while the motor is running, said siphon having two inlets in the float chamber, one inlet a substantial distance below the other.

7. In a carburetor for a motor, means providing a general air passage through which the air flows to the motor, means providing a float chamber for the liquid fuel, means forming in effect a siphon passage between the float chamber and the air passage, adapted to feed the fuel by suction and gravity into the air stream, cooperating with the float and the inlet controlled by the latter to maintain the level of the fuel in the float chamber at a point high enough above the lower outlet end of the siphon to maintain a positive static head, while the motor is running, said siphon having two inlet openings in said float chamber, one above the other, the upper opening being below the said level of the fuel when the engine is running, but above the level of the fuel when the engine is not in operation, and the other opening being near the bottom of the float chamber.

8. In a carburetor for a motor, means providing a general air stream passage through which the air flows to the motor, means providing a float chamber for the liquid fuel, means forming in effect a siphon passage between the float chamber and the air passage, adapted to feed the fuel by suction and gravity into the air stream, co-operating with the float and the inlet controlled by the latter to maintain the level of the fuel in the float chamber at a point high enough above the lower outlet end of the siphon to maintain a positive static head, while the motor is running, an auxiliary siphon passage between the float chamber and the air stream passage, for feeding fuel from the float chamber to the air passage, by suction and gravity, together with means including an automatic valve and an air passage controlled thereby, for automatically feeding additional fuel through the auxiliary siphon passage to the air stream for acceleration.

9. In a carburetor for a motor, having an air inlet control, suction and gravity siphon feed means providing a main feed passage for feeding the fuel in the same way for both the economy range and the power range, and separate auxiliary suction and gravity siphon feed means to increase the flow of fuel for acceleration, operable independently of said air inlet control.

10. A structure as specified in claim 9, said siphon means having a plurality of fluid inlets.

11. A structure as specified in claim 9, said auxiliary means comprising a siphon fuel feed passage having a plurality of fluid inlets one of which is an air inlet controlled by a suction operated valve.

12. A structure as specified in claim 9, said siphon means having an air inlet.

13. A structure as specified in claim 9, said auxiliary means having an air inlet.

14. A structure as specified in claim 9, said siphon means having a plurality of fuel inlets.

15. A structure as specified in claim 9, said main fuel passage being free from direct manual control.

16. In a carburetor for a motor, a throttle valve, means forming a siphon fuel feed passage, for feeding the fuel by suction and gravity to the interior of the carburetor, in the same way for both the power and the economy range, and valve means controlled by a suction passage leading to an opening between the throttle valve and the motor for at certain times preventing feeding of the fuel by admitting air to the top of the siphon, forming the sole air admission to said fuel passage, said siphon forming an auxiliary acceleration fuel feed passage, and another siphon forming the main fuel feed passage.

17. A structure as specified in claim 1, in which the carburetor is of the double-barrelled type, having two air passages with the said siphon fuel feed passage arrangement for each barrel or air passage, and with the said single float chamber common to both barrels of the carburetor.

18. In a carburetor for a motor, means providing a general air passage through which the air flows to the motor, means providing a float chamber for the liquid fuel, means forming in effect a siphon passage between the float chamber and the air passage, forming the main fuel passage to the mixing passage, normally open, free at all times from any direct manual regulation or valve control, adapted to feed the fuel by suction and gravity into the air stream, cooperating with the float and the inlet controlled by the latter to maintain the level of the fuel in the float chamber at a point high enough above the lower outlet end of the siphon to maintain a positive static head, while the motor is running, said siphon having an air inlet at the bend or top thereof, normally open, forming the sole air admission to said fuel passage, and the carburetor having a normally open suction passage separate from said fuel passage and a valve controlled thereby for automatically closing and opening said inlet.

19. In a throttle controlled carburetor for a motor, means providing a general air passage through which the air flows to the motor, means providing a float chamber for the liquid fuel, means forming in effect a siphon passage between the float chamber and the air passage, forming

the main fuel passage to the mixing passage, normally open, free at all times from any direct manual valve control, adapted to feed the fuel by suction and gravity into the air stream, cooperating with the float and the inlet controlled by the latter to maintain a positive static head, while the motor is running, the said carburetor being of the double-barrelled type, having two air passages with the said siphon fuel passage arrangement for each barrel or air passage, and with the said single float chamber common to both barrels of the carburetor, a throttle for each barrel, and air admission control means having a suction control opening between each throttle and the engine.

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