March 19, 1935. G. A. WAHLMARK **1,995,110**

CARBURETOR

Filed Oct. 7, 1931 2 Sheets-Sheet 1

Fig. 1.

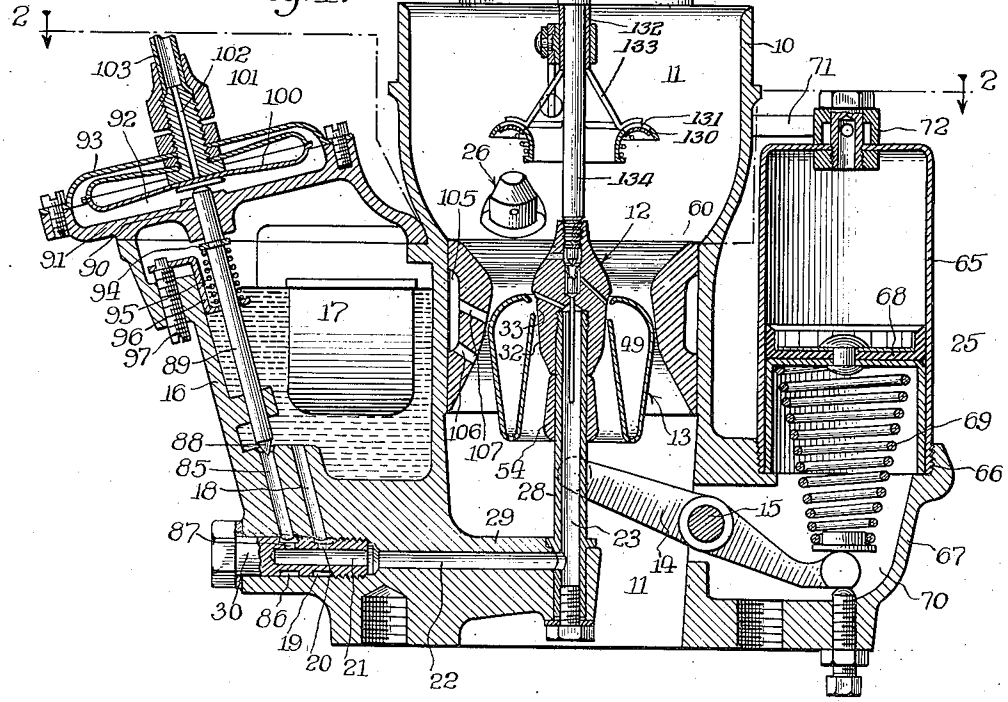
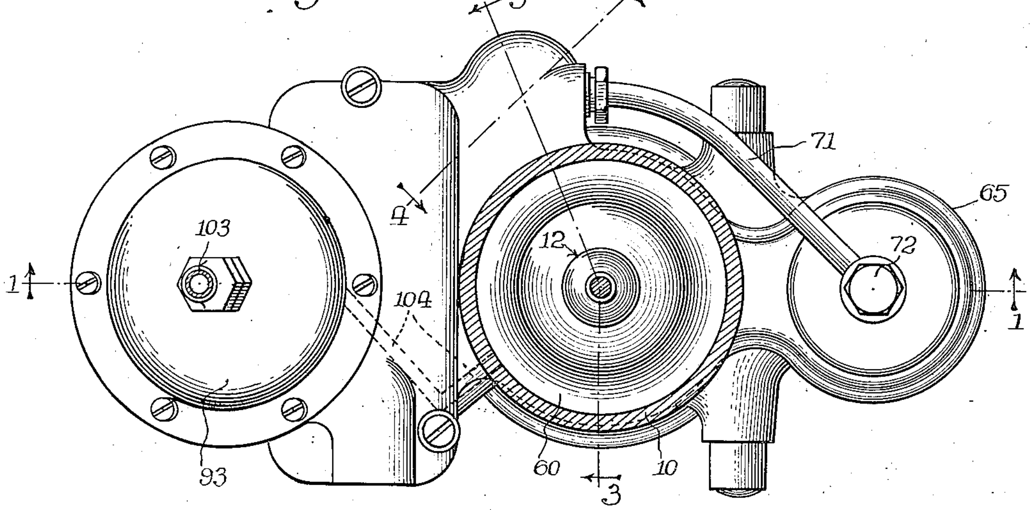


Fig. 2.



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CARBURETOR

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Fig. 3.

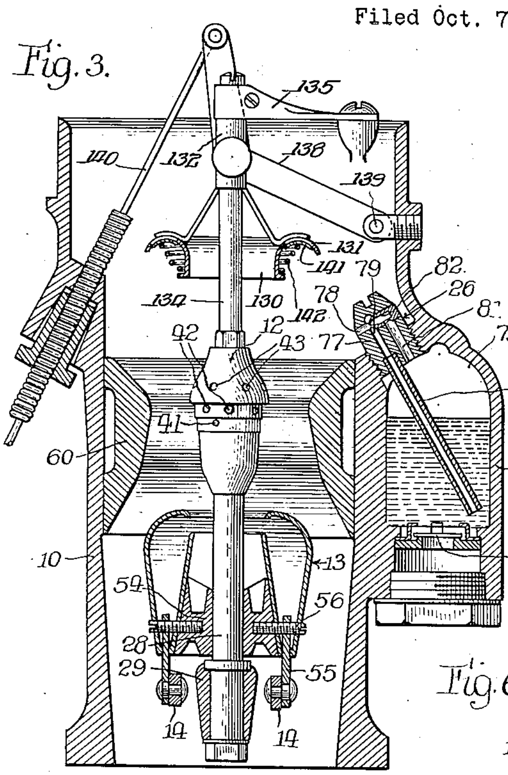


Fig. 4

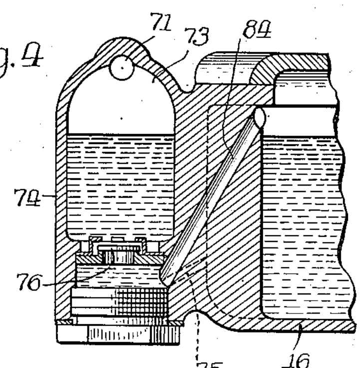


Fig. 8.

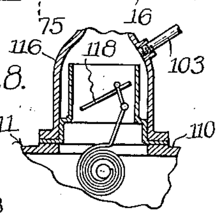


Fig. 6.

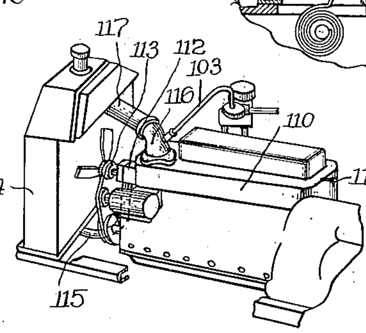


Fig. 7.

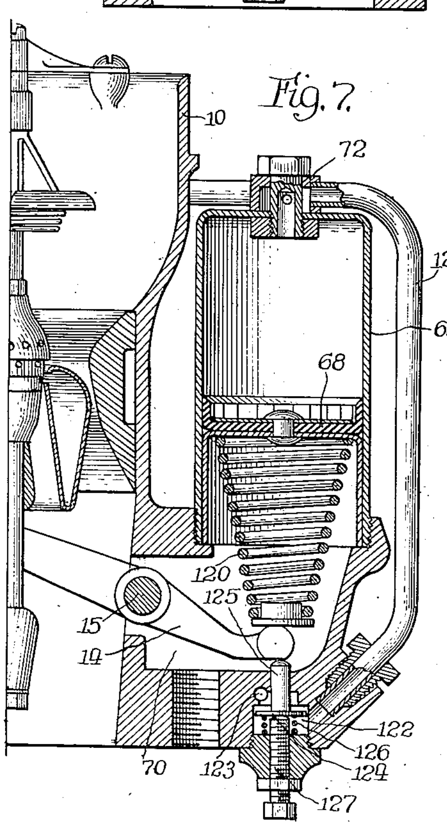
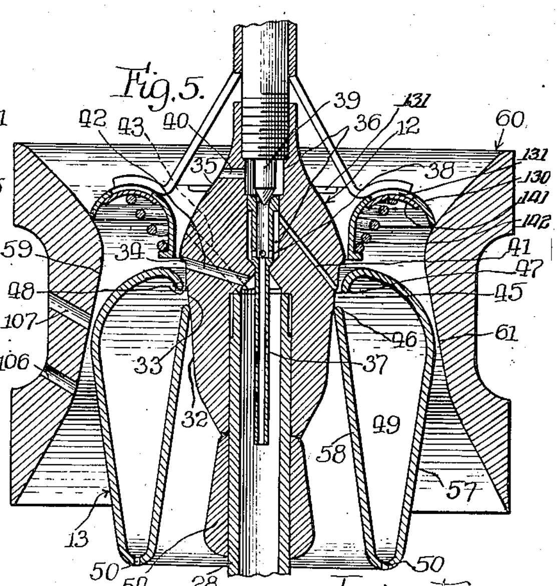


Fig. 5.



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Patented Mar. 19, 1935 1,995,110

UNITED STATES PATENT OFFICE

1,995,110

CARBURETOR

Gunnar A. Wahlmark, Rockford, Ill., assignor of one-third to Ernest J. Svenson and one-third to Charles H. Rystrom, both of Rockford, Ill.

Application October 7, 1931, Serial No. 567,342

6 Claims. (Cl. 123—119)

The invention relates generally to carburetors and more particularly to an improved carburetor for internal combustion engines for motor vehicles.

The general object of the invention is to provide a new and improved carburetor which is simple in construction and efficient in operation so as to secure the proper fuel mixture for the engine at all operating speeds and during acceleration.

Another object is to provide an improved carburetor embodying an auxiliary accelerator mechanism having a combined manual and automatic movement arranged to increase the volumetric capacity of the carburetor and thereby quickly increase the speed of an engine.

Another object is to provide an improved carburetor embodying means for supplying limited quantities of fuel during idling and normal operating conditions, together with auxiliary means for supplying added quantities of fuel when there is a demand on the engine for increased power.

Further objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a longitudinal central vertical section through a preferred form of the invention, the view being taken approximately along the line 1—1 of Fig. 2.

Fig. 2 is a plan view of the device illustrated in Fig. 1, partly in section along the line 2—2 of Fig. 1.

Fig. 3 is a transverse vertical section approximately along the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary section along the line 4—4 of Fig. 2.

Fig. 5 is an enlarged view of the main fuel discharge means and the throttle.

Fig. 6 is a fragmentary perspective view on a reduced scale disclosing the preferred form of the invention installed in operative relation on an automobile engine.

Fig. 7 is a fragmentary section through a modified form of the invention.

Fig. 8 is a fragmentary section of a part of the cooling system of the engine shown in Fig. 6.

While the invention is susceptible of embodiment in many different forms, I have shown in the drawings and shall herein describe in detail one such embodiment, together with a modification thereof, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

In the form selected for purposes of disclosure, the invention comprises generally a casing 10 having a vertical passage 11 extending therethrough with the intake at its upper end and a fuel discharge means or member 12 positioned substantially centrally of the passage so that air is drawn downwardly past the discharge orifices. An annular throttle member 13 is mounted in the passage for movement from an idling position such as illustrated in Fig. 1 to a wide open position such as illustrated in Fig. 3, and is arranged to be actuated by means including a lever 14 secured to a rock shaft 15. A fuel reservoir 16 is formed in one side of the casing and is preferably provided with a suitable float 17 and an intake control mechanism, for example, of the type disclosed in my prior application Serial No. 534,003, filed April 30, 1931. Fuel from this reservoir is arranged to pass to the fuel discharge means through intermediate connecting ports 18, 19, 20, 21, 22 and 23 (Fig. 1) to supply the idling and normal running fuel for the motor. An auxiliary fuel supply for accelerating purposes is obtained by means of an accelerating mechanism comprising generally a piston and cylinder device 25 (Fig. 1), and an auxiliary fuel discharge means 26 (Figs. 1 and 3). In addition, in order to enable the motor to be operated efficiently throughout the full range of engine speeds and still provide sufficient fuel for acceleration and other conditions requiring maximum power, the invention provides means for increasing the fuel supply to the main fuel discharge means 12 when such heavy power demands are made upon the engine.

In the form illustrated in Figs. 1 to 5 of the drawings, the casing 10 is adapted to be mounted in an upright position and is arranged to have its lower end connected to the intake manifold of an engine so that air will be drawn in through the top and downwardly through the passage 11 past the fuel discharge means 12 which is mounted centrally therein. The fuel discharge means is secured to the upper end of a stem 28 which is positioned centrally in the passage and is secured at its lower end to an arm 29 which extends inwardly from the side wall of the casing. The port 23 is formed in the stem 28 and at its lower end connects with the port 22 which is formed in the arm 29, the port 22 being in turn connected with the fuel reservoir 16 by means of the ports 18, 19, 20 and 21. Preferably this fuel supply passage is formed with a restricted portion of predetermined size for the purpose of limiting the quantity of fuel which may pass therethrough. As illustrated herein, a detachable plug 30 is screw threaded into a recess in the casing 10 and has a central bore in its inner end forming the port 21. The port 20 extends radially between the port 21 and the port 19 which is herein shown to be annular in form and in communication with the port 18. The port 20 is preferably of a predetermined size so as to limit the quantity of fuel which may pass therethrough to the fuel discharge means.

In the exemplary embodiment of the invention the discharge member 12 (Figs. 1, 3 and 5) has an inwardly tapering lower conical portion 32, a somewhat cylindrical central portion 33 having an outward flare 34 adjacent the upper edge thereof, and an inwardly tapered or conical upper end 35. A cylindrical chamber 36 is formed centrally in the discharge member and a tube 37 extends downwardly through said chamber and into the upper end of the stem 28. The upper end of the tube 37 is flared outwardly into engagement with the wall of the chamber 36 so as to provide an annular recess surrounding the tube, communication being established intermediate said recess and the interior of the tube by means of a plurality of ports 38. A valve 39 is adjustably mounted in the upper end of the discharge member 12 and is arranged to control the flow of air through said tube and thereby control the fuel for idling, a port 40 being provided intermediate the upper end of the chamber 36 and the outside of the discharge member. A plurality of inclined radial ports 41 extend through the discharge member in peripherally spaced relation to supply the fuel for idling purposes. Intermediate the ports 41 are provided a plurality of substantially larger radial ports 42 which communicate at their inner ends with the upper end of the stem 28 and at their outer ends at a level above the idling position of the annular orifice 45. Additional ports 43 are preferably provided discharging at even a higher level on the discharge member so as to be substantially ineffective at lower engine speeds and effective at the higher speeds.

The throttle 13 is preferably hollow as illustrated in Figs. 1 and 3, and is annular in form and provided with an annular orifice 45 in its inside wall adjacent the upper end. This orifice is so positioned that when the throttle is in its upper or idling position as illustrated in Figs. 1 and 5, the outer ends of the ports 42 are above said orifice and the outer ends of the ports 41 communicate with said orifice. The lower edge 46 of the orifice then engages the central portion of the discharge member 12 and the upper edge 47 of the orifice cooperates with the discharge member to form a restricted annular intake passage 48 to the chamber 49 in the throttle. At its lower end the throttle is provided with a plurality of apertures 50. The throttle is slidably mounted on the stem 28 by means of a member 54 (Fig. 3) and is operable by means of the control lever 14 (Fig. 1). One end of the lever is bifurcated and is connected to the throttle by means of a pair of links 55 (Fig. 3) which are pivotally connected at one end to the lever and at the other end to pins 56 carried on the throttle.

The lower outer surface 57 of the throttle tapers inwardly and the inner wall 58 of the throttle taper outwardly, the upper portion of the throttle being curved at 59. In this way, the throttle is shaped or stream-lined so as to offer a minimum of resistance to the passage of air through the carburetor. The outer surface of the throttle cooperates with a sleeve 60 in the casing passage 11 to form an outer Venturi passage 61 therebetween, and the inner surface of the throttle cooperates with the adjacent surface 32 of the discharge member 12 to form an inner Venturi passage therebetween. The throttle thus cooperates to form and control two Venturi passages, the inner being very close to the main discharge ports so as to control the mixture for the slower engine speeds. The outer venturi is away from the main discharge ports and controls the fuel mixture for the higher engine speeds. When the throttle is in its idling position, as illustrated in Figs. 1 and 5, air passing between the discharge member 12 and the upper edge of the orifice 45 mixes, in the throttle chamber 49, with the fuel drawn out through the ports 47. Since the chamber 49 has a lower vacuum than exists in the passage 11, due to the fact that the opening at 48 is larger than the apertures 50, a reduced suction is obtained on the orifices 41 at idling and the mixture is therefore sprayed out of the apertures 50 into the main passage 11 where it is mixed with the additional air which passes around the throttle. When the throttle is opened slightly the suction on orifices 41 is increased, thereby feeding more gasoline. This makes a very smooth running motor, when opening the throttle, and obtains an extremely efficient mixing of the fuel and air for idling purposes.

The volumetric fuel capacity of the preferred form of the invention is normally limited by the port 20 in the fuel supply passage, but in order to increase the volumetric capacity of the carburetor for the purpose of quickly increasing the speed of the engine the invention provides an auxiliary accelerating means. This means is generally of the form disclosed in my prior application hereinbefore referred to, although in the present embodiment certain improvements have been made which insure practically instantaneous injection of additional quantities of premixed fuel and air into the passage 11 in advance of the Venturi passages when the throttle is moved manually to accelerate the motor. This auxiliary accelerating means is operable simultaneously with movement of the throttle and also after such manual movement to supply additional quantities of pre-mixed fuel to the passage 11.

As illustrated in the drawings, a cylinder 65 is positioned with its lower portion in an annular recess 66 in a projecting portion 67 of the casing 10 and has mounted therein a piston 68. This piston is operable manually in an upward direction by means of the right-hand end of the lever 14 (Fig. 1) and a coiled spring 69 positioned intermediate the piston and lever. Thus when the throttle 13 is lowered manually by turning the rock shaft 15 for the purpose of increasing the speed of the engine, the piston 68 is moved upwardly in the cylinder 65 and compresses air in the upper end thereof. The lower end of the cylinder is in open communication with the passage 11 by means of a recess 70 in the casing portion 67 so that the suction in the passage 11 acts continuously to lower the piston and keep the coiled spring 69 compressed to a certain extent. The spring 69 and piston 68 are preferably so designed that the spring is compressed even when the motor is running at a constant speed around 50 and 55 miles per hour. The throttle at 55 miles is open about one-third, and if the throttle is then fully opened, the acceleration charge of fuel is as great as when the throttle is opened from its idling position.

A conduit 71 communicates at one end with the upper portion of the cylinder 67 through a suitable fitting 72 and at its other end is connected to the upper portion 73 of an auxiliary fuel reservoir 74 formed in the casing 10. This fuel reservoir is positioned adjacent the main reservoir 16 and is connected thereto at its lower end by means of a port 75 (Fig. 4). A disk type of check valve 76 is herein illustrated intermediate the intake port 75 and the main portion of the reservoir for permitting fuel to flow into the auxiliary reservoir from the main reservoir and for preventing return flow into the main reservoir.

The compressed air delivered by the conduit 71 is utilized for discharging additional quantities of fuel and air into the passage 11 for accelerating the engine quickly. As illustrated most clearly in Figs. 1 and 3, the means 26 for utilizing the compressed air comprises an auxiliary discharge member 77 provided with a discharge orifice 78 which is connected by means of a port 79 to a tube 80 which extends downwardly into the fuel. It will be obvious that the compressed air entering the upper portion of the auxiliary fuel reservoir will increase the pressure therein and force fuel out through the tube 80, port 79, and orifice 78. Preferably a port 81 is provided leading to a nozzle 82 in the auxiliary fuel discharge member so that some of the compressed air may pass therethrough and mix with the fuel prior to its discharge into the passage 11. In this way pre-mixed fuel and air are supplied by the accelerating means.

Thus when the lever 14 is actuated to lower the throttle 13, the piston 68 compresses air in the cylinder 65 and forces it into the auxiliary reservoir 74. Since the coiled spring 69 is normally contracted due to the suction on the piston, the decrease in suction as the motor accelerates permits the coiled spring to expand and continue the movement of the piston to a considerable extent beyond that of the throttle 13. In order to provide for a substantially instantaneous operation of the auxiliary fuel discharge means, the necessary air is drawn in, during the downward movements of the piston 68, through a port 84 (Fig. 4) which is provided intermediate the upper portion of the main fuel reservoir above the fuel level and the lower portion of the auxiliary reservoir below the check valve 76. Air is drawn through this port and bubbles up through the fuel in the auxiliary fuel reservoir.

In present day motor car operation, it is desirable to obtain rapid acceleration at low speeds and still provide for efficient operation and minimum fuel consumption at all speeds. In order to provide for efficient fuel consumption at the higher operating speeds, the supply duct intermediate the main fuel reservoir and the fuel discharge means are generally provided with a restricted portion of predetermined area. While this provides for the desired fuel economy under normal operating conditions, and the auxiliary accelerating mechanism herein described enables the motor to be accelerated quickly, it has been found that under some conditions of operation it is desirable to supply additional fuel to the engine. Such a condition arises, for example, when the engine is called upon to develop relatively more power as in climbing hills at lower speeds. Under such conditions, if the motor is limited to the fuel which will pass through the restricted supply duct, the necessary power is not developed. The invention therefore provides a mechanism for supplying additional fuel to the main fuel discharge means under abnormal operating conditions.

In the form illustrated herein, this means comprises a valve-controlled by-pass around the restricted port 20 of the main fuel passage, and as shown in Fig. 1, includes a port 85 communicating at its upper end with the main fuel reservoir and at its lower end with an annular recess 86 formed in the plug 30. A port 87 in said plug connects said recess with the axially extending port 21 so that fuel may pass from the main reservoir into the port 22 in addition to that passing through the port 20. For controlling the flow of additional fuel a valve 88 is formed on the lower end of a cylindrical stem 89 which is slidably mounted within the fuel reservoir. At its upper end this stem passes through a bore 90 in a cover 91 of the reservoir and into a chamber 92 formed between said cover and a cap 93. The valve stem 89 is preferably provided with a collar 94 and a coiled spring 95 is positioned intermediate said collar and one end of an adjustable bracket 96, so as normally to urge the stem upwardly and raise the valve 88 to open the port 85. The other end of the bracket 96 is secured to a screw device 97 so that the spring tension tending to open the valve may be adjusted.

The upper end of the valve stem 89 is normally in abutment with one end of a diaphragm 100 which is mounted within the chamber 92 and has its other end secured to the cap 93. A suitable fitting 101 is provided for securing the diaphragm to the cap and has a port 102 extending therethrough communicating with a conduit 103 through which a suitable fluid may be conducted to the interior of the diaphragm for the purpose of closing the valve 88. In addition to this means for closing the valve against the action of the spring 95, there are preferably provided suitable passages between the chamber 92 and the passage 11 for the purpose of exhausting or vacuumizing the chamber 92 and in that way expanding the diaphragm 100. As illustrated herein, a passage 104 (Fig. 2) connects at one end with the chamber 92 and at its other end with an annular recess 105 formed intermediate the casing 10 and the sleeve 60. This recess is connected with the passage 11 by means of ports 106 and 107 extending through said sleeve, the port 107 preferably being positioned, as illustrated most clearly in Fig. 5, so as to communicate with the passage 11 above the throttle when it is in its idling position. The port 106 communicates with the passage 11 below the port 107.

It has been found with a certain make of automobile equipped with the preferred form of the invention that the vacuum in the chamber 92 at a speed of 5 miles per hour is approximately $4\frac{7}{8}$ inches of mercury and that it decreases substantially uniformly so that at 55 miles per hour the vacuum is 4 inches of mercury. Thereafter the vacuum decreases more rapidly so that at 75 miles it is only $2\frac{1}{2}$ inches of mercury. These mercury readings were obtained in the chamber 92 although at 5 miles per hour the suction in the main passage 11 was approximately 21 inches of mercury, and at 75 miles per hour it was $1\frac{1}{2}$ inches of mercury. Since at 75 miles per hour the suction in the passage 11 was below that in the chamber 92 it appeared that at least a part of the vacuum in the chamber 92 was due to the aspirating effect of the air passing over the ends of the ports 106 and 107. The spring 95 is normally adjusted so that the valve 88 will be closed when the vacuum in the chamber 92 is equal to or greater than 4 inches of mercury.

Since the vacuum in said chamber falls off rapidly at the higher speeds, means is preferably provided for maintaining the valve in its closed position at such speeds. As disclosed herein, this is accomplished by subjecting the interior of the diaphragm 100 to a pressure and preferably a variable pressure which builds up as the speed of the engine increases. For example, the conduit 103 may be connected to the water manifold 110 of an engine 111, as illustrated in Figs. 6 and 8, so as to subject the diaphragm to the water pressure. The engine is provided with a water pump 112 driven by the engine through the fan shaft 113, the intake of the pump being connected to the lower part of a radiator 114 by a conduit 115. The outlet of the pump was connected directly to the water jacket of the engine. The outlet of the water manifold is connected to the upper end of the radiator by means of a fitting 116 and a conduit 117. The water pressure in the installation under consideration was found to be approximately $\frac{2}{10}$ of a pound per square inch at 30 miles per hour, $\frac{6}{10}$ of a pound per square inch at 55 miles per hour, and 1.08 pounds per square inch at 75 miles per hour. A pressure of 1.08 pounds per square inch was sufficient to close the valve 88 approximately half way without any vacuum in the chamber 92. By this arrangement, it will be evident, the pressure within the diaphragm increases as the speed increases so as to compensate for the decrease in vacuum outside of the diaphragm with the result that under normal operating conditions the valve is held in its closed position. The conduit 103 is preferably connected ahead of the thermostatic valve 118 which controls the water circulation in the engine. Thus when the engine is cold and this valve is closed, there is no pressure within the diaphragm 100, the valve 88 then remaining open and supplying fuel for a richer mixture.

In operation, when increased power demands are placed on the engine, the suction in the passage 11, in inches of mercury, drops to a marked extent. It is under conditions such as this that the vacuum in the chamber 92 also drops with the result that the valve 88 is opened so as to admit additional quantities of fuel to the main fuel discharge means and enable the engine to deliver the increased power demanded.

In adapting the invention for use with different types of engines and for providing various operating characteristics of the engines, the coiled spring 69 provided in the auxiliary accelerating mechanism may be varied to a considerable extent both as to length and strength. In some types of installations it has been found that a maximum expansion of ½ or ⅝ of an inch is adequate. When such is the case there is not any great danger of the carburetor becoming "flooded" when the engine is stopped. It is to be understood that when the engine stops there is no suction on the underside of the piston 68 to keep the coiled spring contracted with the result that the spring expands. However, when it is desired to give the piston 68 a greater stroke for accelerating purposes, a coiled spring may be provided capable of expanding to a much greater extent. When this is done, means is preferably provided to prevent flooding of the carburetor when the engine is stopped.

One form of such a means is illustrated in the modified form of the invention shown in Fig. 7. In this form a coiled spring 120 is arranged to give the piston 68 a much longer movement, for example 1¼ inches, when the suction in the recess 70 drops. This movement of the piston would ordinarily occur during the accelerating movements of the throttle but it will also be apparent that it would occur when the engine is stopped. As illustrated in Fig. 7, a conduit 121 is connected at its upper end to the fitting 72 so as to be in communication with the upper end of the cylinder 65 and at its lower end said conduit communicates with a chamber 122 formed in the casing 10 beneath the recess 70. This chamber may be exhausted through a port 123, the exhaust being controlled by means of a valve 124 slidably mounted in the casing and normally held in its open position when the throttle is in its idling position. For this purpose a stem 125 on the valve passes into the recess 70 and into engagement with the lever 14. In this way, when the engine is shut off, the pressure due to the rise of the piston 68 is relieved through the conduit 121. When, however, the throttle 13 is lowered to increase the speed of the engine, the valve 124 is closed by means of a coiled spring 126 so that the pressure in the upper end of the cylinder 65 is available for accelerating purposes.

A screw device 127 is preferably threaded in the lower end of the casing beneath the right-hand end of the lever 14 (Fig. 1) to facilitate the adjustment of the idling position of the throttle. In the form of the invention disclosed in Fig. 7, this screw device is arranged to engage the lower surface of the valve 124 and acts through the valve and stem as a means for adjusting the idling position of the throttle.

The invention also provides an improved choke device for obtaining a rich fuel mixture for starting purposes. In its preferred form this means is illustrated as comprising an annular member or ring 130 of arcuate cross section having a plurality of apertures 131 therein. This ring is secured to a supporting sleeve 132 by means of a plurality of arms 133, the sleeve being slidably mounted on a stem 134 which extends upwardly from the discharge member 12 and is secured at its upper end to a bracket 135 attached to the upper end of the casing by suitable screws 136. This stem is preferably screw threaded at its lower end for attachment to the discharge member and has the valve 39 secured thereto so that by inserting a suitable tool in a slot 137 provided in the upper end of the stem said valve may be adjusted from the exterior of the carburetor. The ring 130 is arranged to be moved from an inoperative or raised position, as illustrated in Fig. 3, to an operative or lower position, as illustrated in Fig. 5, by means including a lever 138 (Fig. 3) which is pivotally mounted on the casing at 139 and connected at its free end to an operating wire 140. Intermediate its ends said lever is suitably connected to the sleeve 132.

The ring 130 is preferably arcuate in cross section, as illustrated most clearly in Fig. 5, and when the ring is in its position to restrict the passage 11 the outer edge of the ring is in abutment with the sleeve 60 and the inner edge of the ring is spaced a slight distance from the discharge member 12 so as to define a restricted annular passage therebetween. Thus the choke device restricts the flow of air and directs the air so that it is effectively mixed with the fuel drawn from the discharge ports in the member 12. In order to prevent flooding of the carburetor an annular check valve member 141 is provided which normally closes the apertures 131 in the ring 130 and is secured in its closed position by means of a coiled spring 142. Thus if the operator neglects to raise the choke device after the engine has started and sufficient suction is established to overcome the action of the spring 142 the annular check valve is drawn downwardly to enlarge the effective opening through the passage 11 and increase the quantity of air passing therethrough.

The invention not only provides a carburetor capable of supplying the necessary quantities of fuel to an engine under all operating conditions, but also embodies improved means for thoroughly mixing the fuel and air prior to its passage to the engine so as to utilize to the fullest extent the added fuel supplied for accelerating and also for meeting the load requirements at low speeds. It will be apparent by referring to Fig. 5 that when the throttle is in its idling position the fuel is supplied through the tube 37 and ducts 47, air being drawn in through the port 40 and down through the upper end of the tube 37, then out through the ports 38 and the annular recess formed in the chamber 36 to the ports 47. Thus the fuel and air is first mixed within the annular recess portion of the chamber 36 and this mixture then passes through the ports 47, and as it passes into the hollow throttle is mixed with additional air drawn through the annular orifice 48. Furthermore this fuel mixture then passes down through the hollow throttle and is sprayed out through the ports 50 in a completely atomized condition. As the throttle is lowered for the purpose of increasing the engine speed, this flow of fuel through the channels just described continues and is augmented by additional fuel which is supplied through the ports 42 and mixed with air as it passes through the annular orifice 48. For idling and in the lower range of engine speeds the fuel is mixed in the hollow throttle and then sprayed out of the ports 50 after which it is mixed with additional quantities of air which pass around the throttle through the venturi 61. The means for thus completely mixing the fuel and air is extremely efficient and is readily effective to mix with air the added quantities of fuel which are supplied to the discharge member when the valve 88 is opened. For this reason in actual installations it has been found that a carburetor which will increase the mileage per gallon of gasoline to a marked extent over other devices will at the same time provide a phenomenal "pick-up" and will so effectively mix the fuel and air that a car may be driven up grades at less than five miles per hour.

It will be apparent that by providing a restricted portion in the main fuel supply passageway the efficiency of the carburetor is increased during normal operating conditions and particularly at the higher engine speeds and that by providing means for supplying quantities of premixed fuel and air for accelerating purposes the capacity of the carburetor is greatly increased by this means only during the accelerating periods. The restricted portion in the main fuel supply passageway provides a relatively lean mixture for continuous running conditions and thereby improves the efficiency and the accelerating mechanism provides additional fuel for increasing the power during acceleration. The provision of a by-pass port around the restricted portion of the main supply passageway for supplying added quantities of fuel when the power demands on the engine are increased permits the fuel supplied for normal running conditions to be cut down to a minimum, since it will be evident that whenever additional fuel is required it is immediately available through the by-pass. As disclosed herein, the means for controlling the valve for the by-pass operates automatically to supply added quantities of fuel in the lower speed ranges when the power demands on the engine increase, so that the by-passed fuel is available not only for increased load conditions, while running at a uniform speed, but is also effective to supply additional fuel to the discharge member for accelerating purposes. Furthermore the means for controlling the by-pass valve is effective at the higher engine speeds to close the valve and limit the amount of fuel supplied to the engine to that passing through the restricted port of the main supply passage.

The air drawn in by piston 68 through port 84 becomes sufficiently moistened with fuel when bubbling through the fuel in the auxiliary reservoir, that it dampens the walls in cylinder 65. This provides automatic lubrication for piston 68 and cylinder 65 which are preferably provided with a close fit.

The lower conical portion 32 of the discharge member preferably tapers very gradually so that when the throttle is lowered from the idling position, as shown in Fig. 5, the inner Venturi passage controls accurately and with a precision-like degree the increase of fuel and air passing through the carburetor. This gradual increase in the size of the inner venturi cooperates with the other features of the device to use the fuel efficiently.

I claim as my invention:

1. A carburetor comprising, in combination, a casing having a passage therethrough, fuel discharge means positioned to discharge into said passage, a fuel reservoir, a passageway intermediate said reservoir and discharge means having a restricted portion determining the normal volumetric capacity of the carburetor, a throttle for controlling the supply of fuel and air through said passage, and means for supplying added quantities of fuel to said discharge means when the load on the engine increases at the lower speeds comprising a by-pass from said reservoir around the restricted portion of said passage, a valve controlling the flow of additional fuel through said by-pass, means operable by the suction in said passage normally holding said valve closed, resilient means arranged to open the valve when said suction drops below a predetermined amount, and means including pressure producing means driven by the engine effective at higher engine speeds to partially close said valve.

2. A carburetor comprising, in combination, a casing having a passage therethrough, fuel discharge means positioned in said passage, a fuel reservoir, a passageway intermediate said reservoir and discharge means, a throttle for controlling the supply of fuel and air through said passage, and means for supplying added quantities of fuel when the load on the engine increases at the lower speeds comprising an auxiliary fuel supply port, a valve controlling the flow of fuel through said port, means normally holding

said valve closed, means arranged to open the valve automatically when said load on the engine increases, and means operable at the higher engine speeds to partially close said valve.

3. A downdraft carburetor comprising, in combination, a casing having a vertical passage therethrough, fuel discharge means positioned substantially centrally of said passage, a fuel reservoir, a passageway intermediate said reservoir and discharge means having a restricted portion determining the normal volumetric capacity of the carburetor, a throttle for controlling the supply of fuel and air through said passage, and means for supplying added quantities of fuel when the load on the engine increases at the lower speeds comprising an auxiliary supply port, a valve controlling the flow of additional fuel through said port, means operable by the passage of air through said passage normally holding said valve closed, resilient means arranged to open the valve when said suction drops below a predetermined amount, and means operable at the higher engine speeds to partially close said valve.

4. A carburetor having, in combination, a casing with a passage extending therethrough, fuel discharge means positioned to discharge into said passage, a throttle for controlling the flow of fuel and air through said passage, a fuel reservoir, a fuel supply passageway connecting said reservoir to said discharge means, and means for supplying added quantities of fuel to said passage when the load on the engine increases at the lower operating speeds comprising an auxiliary supply port, a valve for controlling the inlet of fuel to said port, means tending to hold said valve open, means for closing said valve comprising an expansible bellows device, a chamber in which said device is positioned, and means for exhausting said chamber to expand said device and close said valve comprising a duct communicating at one end with the chamber and at its other end with said passage, and means for supplying fluid to the interior of said bellows device including pressure producing means driven by the engine.

5. A carburetor having, in combination, a casing with a passage extending therethrough, fuel discharge means positioned in said passage, a throttle movable longitudinally of said passage for controlling the flow of fuel and air therethrough, a fuel reservoir, a fuel supply passageway connecting said reservoir to said discharge means, and means for supplying added quantities of fuel to said discharge means when the load on the engine increases at the lower operating speeds comprising an auxiliary supply port, a valve for controlling the inlet of fuel to said port, means tending to hold said valve open, and means for closing said valve comprising an expansible bellows device, a chamber in which said device is positioned, means for exhausting said chamber to expand said device and close said valve comprising a duct communicating at one end with the chamber and at its other end with said passage, and means for supplying a pressure fluid to the interior of said bellows device including pressure producing means driven by the engine.

6. In combination, a water cooled engine having a cooling chamber connected at its opposite ends to a radiator, a pump in said connections for circulating the water, a thermostatic valve controlling the flow of water from said chamber to the radiator and which closes at a predetermined low temperature to prevent circulation, a carburetor for supplying fuel and air to the engine, a main fuel supply means in said carburetor, an auxiliary fuel supply means for said carburetor, means for shutting off said auxiliary fuel supply means including a device responsive to the pressure in said circulating system, and a connection to said system on the radiator side of said thermostatic valve so that when the engine is cold said auxiliary fuel supply means is effective.

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