Aug. 7, 1923. 1,464,333

W. P. PEMBROKE

CARBURETOR

Filed May 22, 1917 3 Sheets-Sheet 1

Fig. 1.

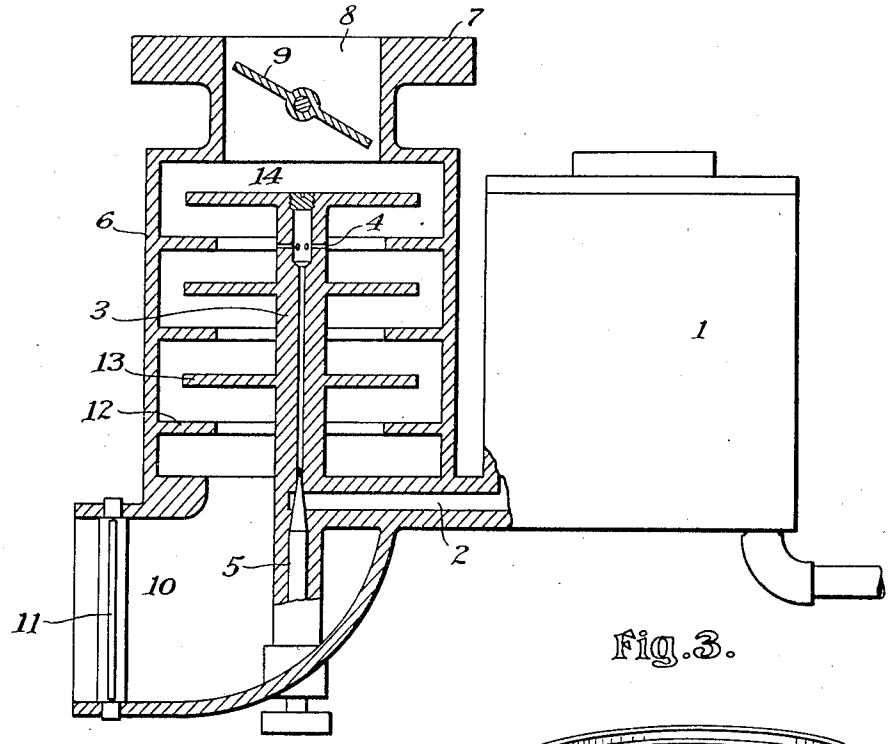


Fig. 3.

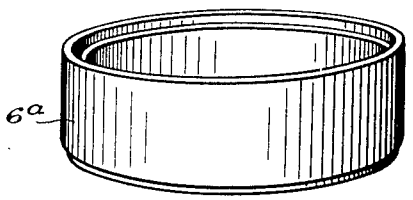
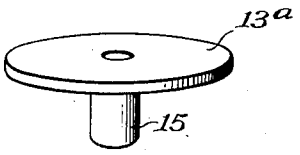


Fig. 4.



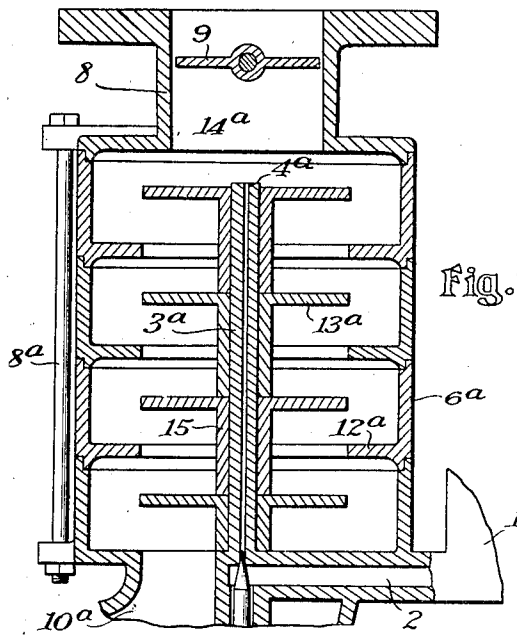


Fig. 2.

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Fig. 9.

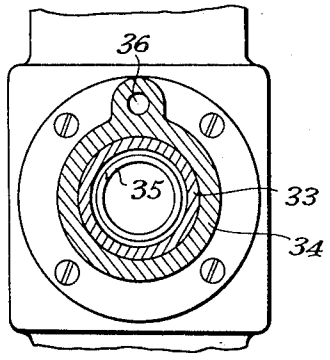


Fig. 10.

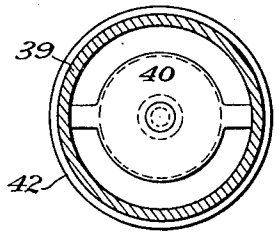


Fig. 5.

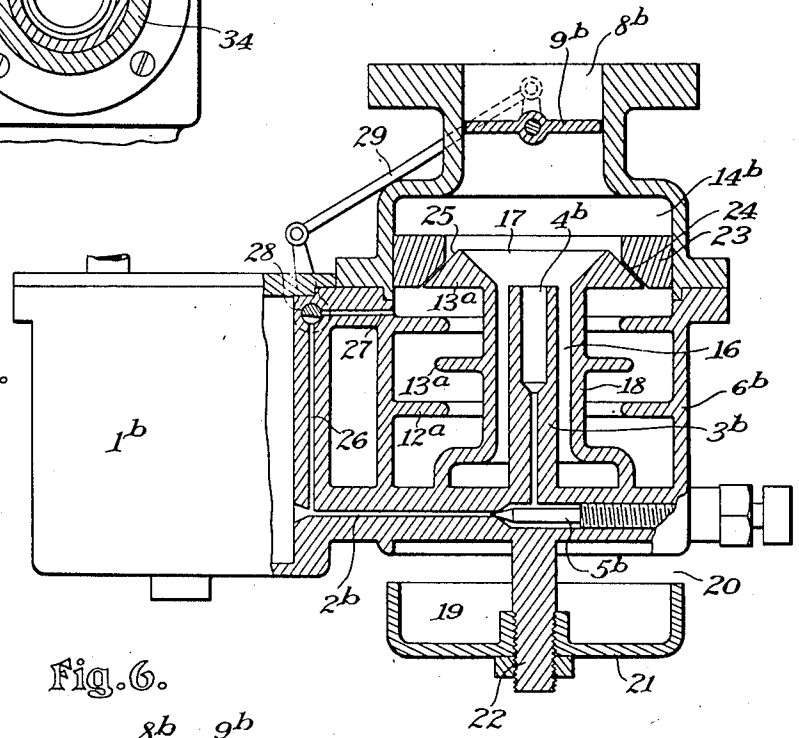
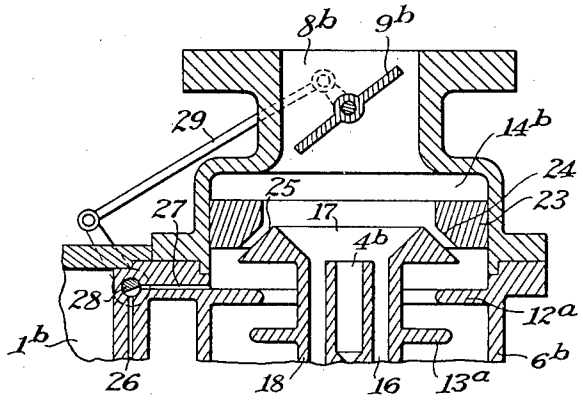


Fig. 6.



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CARBURETOR

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Fig. 7.

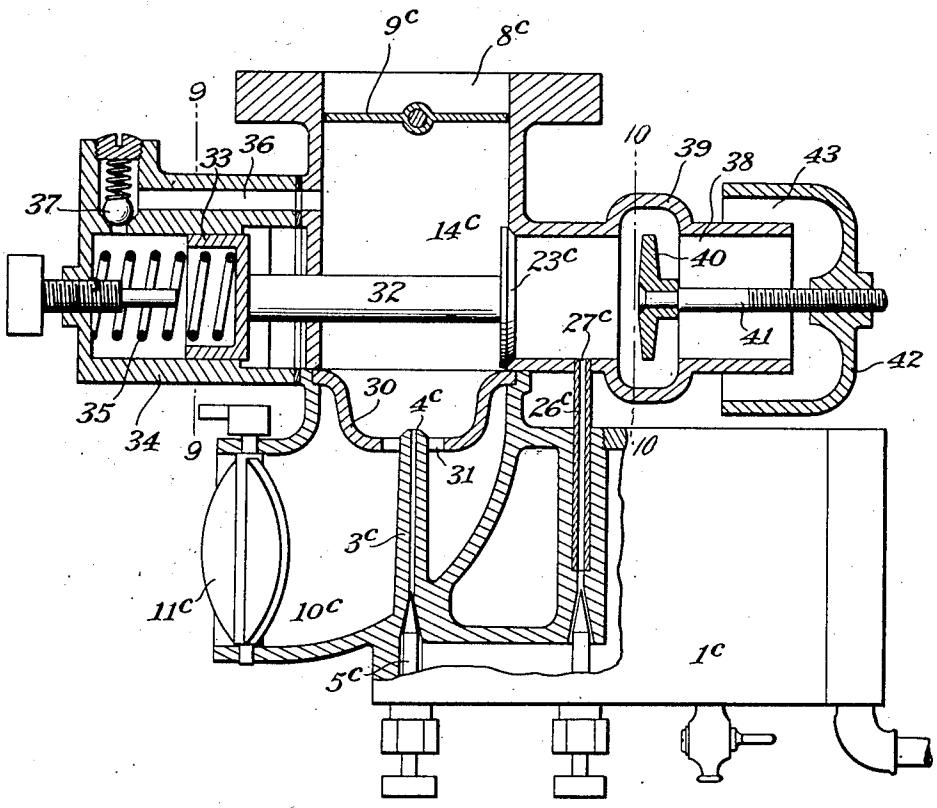
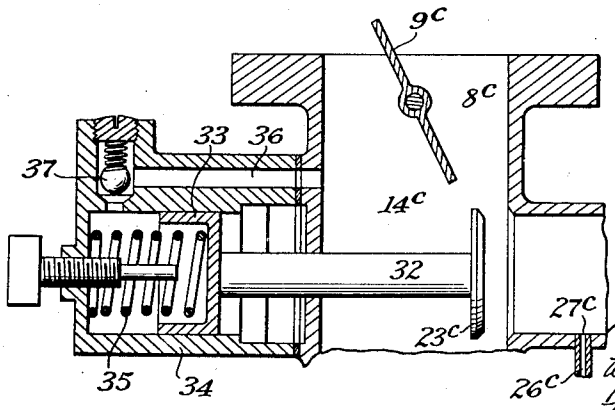


Fig. 8.



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Patented Aug. 7, 1923. 1,464,333

UNITED STATES PATENT OFFICE.

WINFIELD P. PEMBROKE, OF ROCHESTER, NEW YORK.

CARBURETOR.

Application filed May 22, 1917. Serial No. 170,183.

To all whom it may concern:

Be it known that I, WINFIELD P. PEMBROKE, a citizen of the United States, and resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Carburetors, of which the following is a specification.

The present invention relates to carburetors.

To produce a mixture for internal combustion engines it has been the most general practice to employ a Venturi tube into the orifice of which a nozzle, supplying a hydrocarbon is arranged in such a way that the low speeds of the motor and increased speeds up to a certain limit can be taken care of, but high speeds are unattainable owing to the fact that a nozzle which will work properly in a Venturi tube for low speeds will not give sufficient liquid fuel for extremely high speeds, nor will the air opening through the Venturi tube supply sufficient air for such high speeds, this air opening being materially smaller in area than the outlet of the mixing chamber into which the liquid fuel and the air are discharged. To obtain a larger volume of gaseous fuel for high speed motors, an extra volume of hydrocarbon has been obtained by means of one or more secondary jets and one or more auxiliary air supply passageways. It is also common to increase the range of the single jet carburetor by providing an auxiliary air supply passage. This auxiliary air supply passage, whether in a multiple jet carburetor or in a single jet carburetor, has been controlled by a metering or measuring device which is operated either through the pressure of the outside air or mechanically by the operation of the throttle. These measuring or metering devices have to some extent enabled the obtaining of higher speeds but, at certain limits, they have become faulty, making the obtaining of still higher speeds impossible due to their failure to supply a gaseous fuel which will correspond to the demand of the motor.

It is an object of this invention to provide a carburetor with an air supply passage which is equal to any demands of the motor, having throughout the length thereof an area which is substantially equal to the area of the outlet of the passage, provision being made in said air supply passage whereby, with increased demands of the motor, friction will be produced on the air passing through the air supply passage to create about the fuel supply a vacuum which will be proportional to the motor demands, so that an increased amount of fuel will be drawn into the mixing chamber without choking the air supply passage by movable valves or the like during the effectiveness of such friction producing means.

To these and other ends the invention consists of certain parts and combinations of parts all of which will be hereinafter described, the novel features being pointed out in the appended claims.

In the drawings:—

Fig. 1 is a sectional view through the mixing chamber and the fuel and air supply passage of a carburetor constructed in accordance with this invention;

Fig. 2 is a sectional view similar to Fig. 1, with the fuel reservoir removed showing another embodiment in which the air supply passage is defined by a number of separate rings and disks;

Figs. 3 and 4 are perspective views, respectively, of one of the rings and one of the disks employed in the embodiment shown in Fig. 2;

Fig. 5 is a sectional view through the air and fuel supply and the mixing chamber of the carburetor, the improvement being embodied in the auxiliary air supply passage instead of the main air supply passage, as in the embodiment shown in Figs. 1 and 2;

Fig. 6 is a fragmentary section of the embodiment shown in Fig. 5, showing the throttle valve in open position and the auxiliary air valve open;

Fig. 7 is a sectional view of another embodiment of the invention in which the invention is embodied in an auxiliary air supply passage, and other features are combined with the improvement to further increase the efficiency of the carburetor.

Fig. 8 is a fragmentary view of the embodiment shown in Fig. 7, showing the throttle valve and the auxiliary air supply valve open;

Fig. 9 is a section on the line 9—9, Fig. 7; and

Fig. 10 is a section on the line 10—10, Fig. 7.

Referring more particularly to the draw-

ings, 1 indicates the fuel supply receptacle which, by way of a passage 2, connects with a fuel nozzle 3 which extends vertically and has lateral discharge ports 4, the nozzle being controlled by a needle valve 5 of any desired construction. Surrounding the nozzle 3 is a casing 6 provided with a flange 7 adapting it for attachment to the manifold of an engine, and having an outlet 8 in which the throttle valve 9 is mounted. At the lower portion of the casing is a lateral extension 10 serving as an air inlet, and controlled by a valve 11 which is preferably under the control of the operator of the machine. The central or body portion of the casing 6 is preferably enlarged with respect to the outlet and inlet portions, and is provided with a plurality of internal annular baffles or flanges 12. Extending between these baffles or flanges 12 are a number of annular baffles or flanges 13 arranged on the fuel supply nozzle 3. The flanges 12 and 13 provide a circuitous passage for the air which discharges with the fuel into the vacuum or mixing chamber 14. The area of this passage is such that any section thereof, taken transversely of the flow of the air, will have an area substantially equal to the cross-sectional area of the outlet of the passage. By this arrangement the air in passing through the air supply passage meets with a resistance or friction due to the number of return bends or turns it is required to make, and this resistance increases proportionately with an increased demand of the engine, so that the higher the demand in the engine, the greater will be the vacuum or suction about the fuel nozzle, the greater will be the amount of fuel drawn from the fuel discharging openings 4, and the greater will be the amount of air drawn through the air supply, and this while maintaining the air supply opening constant and without the manipulation or operation of any movable valves for varying the vacuum or suction in the mixing chamber with an increased demand by the motor.

In the embodiment shown in Figs. 2, 3 and 4 the discharge nozzle 3^a has its discharge opening 4^a at its upper end discharging into the mixing chamber 14^a. The casing which surrounds the nozzle is formed of a number of superimposed rings 6^a with internal annular baffles or flanges 12^a. The throttle 9 is mounted in the outlet member 8 which by bolts 8^a connects with the inlet section 10^a constructed similar to the inlet of Fig. 1. These bolts tend to hold the outlet section to the inlet section and secure the rings 6^a between them. It is apparent that the rings as well as the outlet and inlet sections, may be provided with suitable joints which will provide a substantially air tight casing. The annular baffles or flanges 13^a in the form of disks project from the annular supply nozzle 3^a, and have sleeves 15 depending therefrom and surrounding the nozzle 3^a to act as spacers to hold the flanges or disks 13^a separated. This construction, like that illustrated in Fig. 1, causes the air to pass in a circuitous path and to be resisted to such an extent that a vacuum will be created about the fuel nozzle proportional to the demand of the motor, so that a greater supply of fuel is obtained with an increased demand without reducing the cross-sectional area of the flow of air substantially below the cross-sectional area of the outlet 8 from the mixing chamber.

The embodiments of the invention shown in Figs. 1 to 4 are designed for use with motors which work under substantially constant loads and do not vary substantially below 25% of the normal working speeds, say, a motor having a speed of 2000 revolutions which would operate as low as 500. Below the minimum speed, the air passing through the air passage would be substantially free from friction, and it is for this reason that the valve 11 is introduced in the air passage in order that a vacuum may be created in the carburetor for starting the motor.

In the embodiment of the invention shown in Figs. 5 and 6, the fuel receptacle 1^b connects by a passage 2^b with a fuel nozzle 3^b, the latter having the outlet or discharge 4^b at its upper end, and being controlled by a needle valve 5^b. Surrounding the fuel supply nozzle is a main air supply passage 16 which discharges with the nozzle 3^b into the mixing chamber 14^b, the wall of the main air supply passage being extended above the nozzle and flaring as at 17. From the mixing chamber an outlet 8^b leads controlled by a throttle valve 9^b. Also delivering into the mixing chamber 14^b is an auxiliary air supply passage which is formed by a casing 6^b surrounding the wall 18 which provides the main air supply passage 16, the main air supply passage and the auxiliary air supply passage both opening to a chamber 19 at the bottom of the carburetor, said chamber opening to the atmosphere by way of the surrounding opening 20. In this instance, this surrounding opening may have its area increased or decreased, and to this end the lower wall 21 of the chamber 19 is of cup formation, and is adjustable toward and from the casing 6^b on a stem 22 which projects from parts carried by the casing 6^b. It will be noted that a circuitous path is formed for the air passing through the auxiliary air supply passage, this path, in this instance, being provided by internal annular flanges or baffles 12^a and annular projections 13^a on the wall 18 which forms the main air supply passage. Passage of air through the auxiliary air supply passage may be controlled by a valve 23, which oper-

ates within the mixing chamber 14, and has a beveled face 24 cooperating with a beveled face 25 on the projection 13^a.

The purpose of producing this circuitous passage is to create a vacuum in the auxiliary air supply passage that will be proportional to the demand of the motor, so that after the main fuel supply nozzle has reached its maximum efficiency, an auxiliary fuel supply will be brought into use, said auxiliary fuel supply, in this instance, being formed by a passageway 26 having its discharge 27 in the auxiliary air supply above the uppermost baffle or projection 12^a, this fuel supply being controlled preferably by a rotary valve 28 which, by a link 29, may be connected to the throttle valve 9^b, so that the closing of the throttle valve will close off the auxiliary fuel supply and the opening of the valve to a certain position will open the supply.

When the motor is running slowly, it will draw air through the main air supply passage 16, past the discharge opening 17, and into the mixing chamber 14^b. During such slow speed of the motor, the valve 23 remains closed, due to the fact that sufficient air can pass through the main air supply passage, and also to the fact that the valve has sufficient weight to maintain its seat under the above condition. As the speed of the motor further increases, the auxiliary air valve 23 will open, permitting the passage of air through the auxiliary air supply passage in order to supply sufficient air for the nozzle 3^b. The auxiliary air valve 23 will open to its full extent without imposing any material resistance to the passage of air through the auxiliary air supply passage, and no fuel will be drawn from the auxiliary fuel supply nozzle 27. With a still further increase in the demand of the motor, the mixture would become lean, and to prevent this the auxiliary fuel supply 27 is employed for the purpose of supplying additional liquid fuel. No material amount of liquid fuel passes from this auxiliary fuel supply until the valve 23 has reached its maximum opening movement, after which the increased demand of the motor produces a vacuum in the auxiliary fuel supply passage, due to the arrangement of the baffles 12^a and 13^a which create a friction on the air, producing a vacuum in the auxiliary air supply passage which is proportional to the demand of the motor, and thus increasing the supply of liquid fuel from the auxiliary fuel supply 27. Any section of the auxiliary air supply passage taken transversely of the flow of the air has an area substantially equal to the cross sectional area of the outlet of the passage, as is true also of the main air supply passage shown in Fig. 1, so that a maximum amount of air can pass through the auxiliary air passage. It will thus be seen that in Fig. 5 substantially two carburetors are embodied in one structure, the main carburetor which acts alone during the slow speeds of the motor utilizing the air passageway of the other carburetor as an auxiliary air supply passage up to the point at which the auxiliary air supply valve opens to the limit of its movement, without bringing into operation the liquid fuel supply of the second carburetor. When the auxiliary air supply valve has opened to the limit of its movement, then a vacuum is created in the air supply of such second carburetor, or the auxiliary air supply of the main carburetor, which is proportional to the demand of the motor, and thus acts upon the liquid fuel supply of the second carburetor to draw from the latter an amount of fuel corresponding to the demand of the motor.

In the embodiment shown in Figs. 7 to 10 1^c indicates the fuel receptacle from which leads the main fuel supply nozzle 3^c controlled by the needle valve 5^c and discharging into the mixing chamber 14^c, the latter having the outlet 8^c controlled by the throttle valve 9^c, and also having an inlet 10^c controlled by the valve 11^c. The mixing chamber 14^c is separated from the inlet 10^c by a partition 30 of cup formation having a central opening 31 through which the fuel nozzle 3^c projects, the discharge 4^c of the nozzle being slightly above the bottom of the cup portion and being spaced from the side walls of the opening 31 to provide an opening for the passage of air from the main air supply passage 10^c. This partition 30 has its edges resting in seats formed in an elbow in which the fuel nozzle 3^c is arranged, said elbow being detachably secured to the casing member in which the mixing chamber 14^c is formed. By this arrangement, the cupped partition may be readily removed and another partition introduced having the air opening of a different size.

Above the nozzle 3^c, the mixing chamber 14^c is provided with an auxiliary air supply passage which, in this instance, is controlled by a valve 23^c, this valve having a stem 32 projecting from one face thereof and secured to a piston 33 which operates within a cylinder 34. The valve is held in a closed position preferably by a helical spring 35 mounted within the cylinder 34. The opening of the valve is effected preferably by the suction produced within the mixing chamber 14^c, this being effected, in this instance, by a passageway 36 leading from the mixing chamber on the side of the throttle valve 9^c nearest the liquid fuel supply and connecting with the cylinder 34, so that the suction acts on the piston 33 as well as the valve 23^c to open the valve 23^c. Within this passageway 36 a check valve 37 may be arranged, this valve opening under the action of the suction of the engine to permit said suction to

act on the piston 33. It also closes upon the reduction of the suction due to the pulsation of the motor, so that the vacuum in the cylinder 34 is maintained during the successive pulsations in order to prevent the valve 23ᵉ closing under the action of the spring 35. This action prevents an increase of vacuum in the mixing chamber on every pulsation due to the closing of the valve on each pulsation and to the necessity of opening the valve thereafter.

Until the valve 23ᵉ has opened to the limit of its movement, the air passes through the auxiliary air supply passage without material resistance, to supply additional air for the liquid fuel from the nozzle 4ᵉ. After a time, if no additional fuel supply were provided, the gaseous fuel would become lean, and to prevent this, an auxiliary fuel supply 27ᵉ is introduced into the auxiliary air supply passage. Such auxiliary fuel supply does not become effective until a vacuum of sufficient strength has been created in the auxiliary air supply passage. This vacuum, in this instance, is obtained by causing the air to pass in a circuitous path, or to make one or more return bends in order to produce a friction on the air so that the vacuum in the auxiliary air supply passage will be proportional to the demand of the motor. In this instance, the air supply passage is enlarged at 39, and the baffle plate 40 is arranged in the enlarged portion, so that the air is caused to pass about the plate and to make a return bend. From this plate a stem 41 projects to support a cup-shaped member 42, which is adjustable on the stem and surrounds the end of the tube in which the baffle 40 is arranged, to provide a passageway 43 between the outer walls of the tube and the inner walls of the cup-shaped member, the extreme edge of the cup-shaped member lying in proximity to the enlarged portion 29, so that a passageway is formed between the enlarged portion and the edge of the cup-shaped member, causing the air to make a turn at this point.

In all embodiments of the invention there has been provided an air supply passage in which is maintained a suction or vacuum that is proportional to the demand of the motor. The cross sectional area of the opening throughout the air supply passageway is substantially equal to the area of the outlet from the air supply passageway, and during the effectiveness of the vacuum producing means of the air supply passageway is not controlled by any movable part such as valves. By this arrangement it is possible to obtain the desired amount of air while at the same time increasing the vacuum or suction within the passageway to such an extent that an increased amount of fuel will be obtained. These results are secured by causing the air to pass through a circuitous path under the suction of the motor, thus tending to hold back the air without restricting the size of the passageway. Preferably this result is obtained by making the air travel through a number of return bends, and preferably about baffles arranged within the air inlet without restricting the area of the passageway.

A carburetor constructed in accordance with this invention is adapted for motors of the largest type and the greatest speed where a great amount of power is to be developed and where a large amount of flexibility is desired, that is, where the engine is to be run at a very low speed and to be uniformly run up to the extreme or highest speed and to develop the highest power at the different speeds.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a carburetor, a fuel supply and an air supply passageway having fixed means therein, inoperative at starting or on slow speeds, but operative on high speeds for maintaining a vacuum about the fuel supply to draw an amount of fuel corresponding to the demand of the motor in running at high speeds, the opening throughout said air supply passageway having a cross sectional area substantially equal to the area of the discharge from the passageway, while such means in the air supply passage is effective, and means associated with the carburetor for effecting the functioning of the carburetor an starting and for slow speeds.

2. In a carburetor, a fuel supply and an air supply passageway for said fuel supply having means, inoperative at starting or on slow speeds, but operative on high speeds for causing the air to make a number of return bends, the area throughout the air supply passageway being substantially equal to the area of the outlet of said passageway, while such means is effective, to produce a resistance to the air to cause an amount of fuel to be fed from the fuel supply corresponding to the demand of the motor in running at high speeds, and means associated with the carburetor for effecting the functioning of the carburetor for starting and for slow speeds.

3. In a carburetor, a fuel supply and an air supply passageway for said fuel supply having baffling means therein, inoperative on starting or slow speeds, but operative on high speeds the passageway about the baffling means having a cross sectional area substantially equal in area to the outlet from the passageway, while such baffling means is effective, to produce a resistance to the air to cause an amount of fuel to be fed from the fuel supply corresponding to the demand of the motor at high speeds, and means associated with the carburetor for

effecting the functioning of the carburetor for starting and for slow speeds.

4. In a carburetor, a fuel supply and an air supply passageway for said fuel supply provided with at least one return bend therein inoperative at slow speeds but operative on high speeds to produce a resistance to the air to cause an amount of fuel to be fed to the fuel supply corresponding to the demand of the motor at high speeds and means associated with the carburetor for effecting the functioning of the carburetor for starting and for slow speeds.

5. In a carburetor, a mixing chamber, a main fuel supply communicating therewith, a main air supply passage leading to said mixing chamber and having the air passing therethrough acting on said main fuel supply, an auxiliary air supply passage leading to said mixing chamber, a section-controlled valve for said auxiliary air supply passage, an auxiliary fuel supply acted on by the air passing through said auxiliary supply passage, and means provided in the auxiliary air supply passage and effective on the opening of the suction-controlled valve to maintain a vacuum in the auxiliary air supply passage to produce such resistance to the air as to cause an amount of fuel to be fed from the fuel supply corresponding to the demand of the motor, said means being constructed to maintain a cross sectional area throughout the auxiliary air supply passage substantially the same as the outlet from said auxiliary air supply passage.

6. In a carburetor, a mixing chamber, a main fuel supply communicating with said chamber, a main air supply passage having the air passing therethrough acting on said main fuel supply, an auxiliary air supply passage for said chamber, an auxiliary fuel supply acted upon by the air passing through said auxiliary air supply, and an automatic valve for controlling the passage of air through the auxiliary air supply passage, baffling means in said auxiliary air supply to produce a resistance to the air to cause an amount of fuel to be fed from the auxiliary fuel supply corresponding to the demand of the motor after the opening of the valve, said baffling means being constructed to maintain a cross sectional area throughout the auxiliary air supply passage substantially equal to the outlet from the auxiliary air supply passage.

7. In a carburetor, a mixing chamber, a main fuel supply communicating with said chamber, a main air supply passage for having the air passing therethrough acting on said main fuel supply, an auxiliary air supply passage, an auxiliary fuel supply acting upon the air passing through said auxiliary air supply passage, an automatic valve controlling the flow of air through said auxiliary air supply passage, means, effective only when the automatic valve is opened, to produce a resistance to the air in the auxiliary air supply passage to cause an amount of fuel to be fed from the auxiliary fuel supply corresponding to the demand of the motor, while maintaining a cross sectional area throughout the auxiliary air supply passage substantially equal to the outlet from the auxiliary air supply passage, and means for retarding the closing of the auxiliary of the automatic valve.

8. In a carburetor, a fuel supply, an air supply passage having the air passing therethrough acting on the fuel supply and having fixed means therein, inoperative during the starting or slow speeds of the motor and thereafter operative for maintaining a vacuum in the air supply passage to draw an amount of fuel corresponding to the demand of the motor in running, the opening throughout the air supply passage having a cross sectional area substantially equal to the outlet from said passage, and adjustable means for controlling the passage of air through said air supply passage for effecting operation of the carburetor for starting and during low speeds.

9. In a carburetor, a fuel supply, an air supply passage having air passing therethrough acting on said fuel supply and having fixed means therein inoperative during starting and low speeds, the end of said air supply passage being of tubular formation, a cup-shaped member fitting over the tubular end to provide a space between the inner wall of the cup-shaped member and the outer wall of the tubular end, and means for making said means operative on high speeds for maintaining a vacuum in the air supply passage to draw an amount of fuel corresponding to the demand of the motor in running.

10. In a carburetor, a main fuel supply, a main air supply, an auxiliary fuel supply, an air supply passage for said auxiliary fuel supply having its wall enlarged and provided with a tubular intake end beyond said enlargement, a cup-shaped member adjustable toward and from said enlargement over said tubular end to provide a circuitous path for the air for producing friction on the air after the motor has reached a certain speed which will maintain a vacuum about the fuel supply to draw an amount of fuel corresponding to the demand of the motor in running at high speeds, and means for rendering such auxiliary air supply passage ineffective on starting and slow speeds.

11. In a carburetor, a fuel supply, an air supply passage having the air passing therethrough acting on the fuel supply and having fixed means therein, inoperative during the starting and low speeds of the motor,

and thereafter operative for maintaining a vacuum in the passage to draw an amount of fuel corresponding to the demand of the motor in running, the opening throughout the air supply passage being substantially equal in cross sectional area to the discharge from the air supply passage, and an adjustable means for controlling the passage of air through said air supply passage, said means being situated at the intake end of the air supply passage for the purpose of varying the friction in the air to adapt the carburetor to the motor.

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