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J. G. GAMBLE

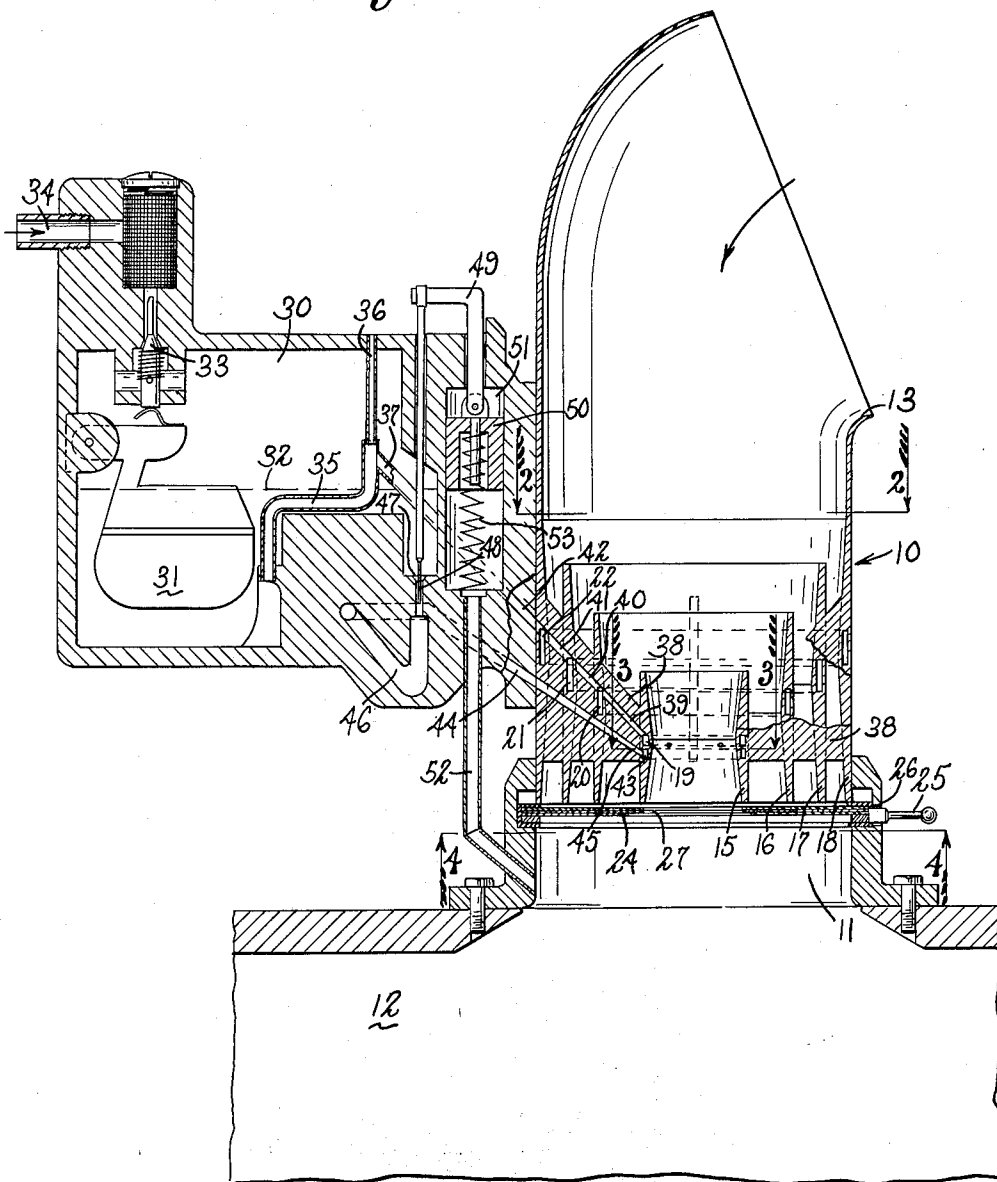
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CARBURETOR FOR INTERNAL COMBUSTION ENGINES

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2 Sheets-Sheet 1

Fig. 1.



INVENTOR

John G. Gamble

BY

Rockwell, Buchanan

ATTORNEYS

Feb. 21, 1956

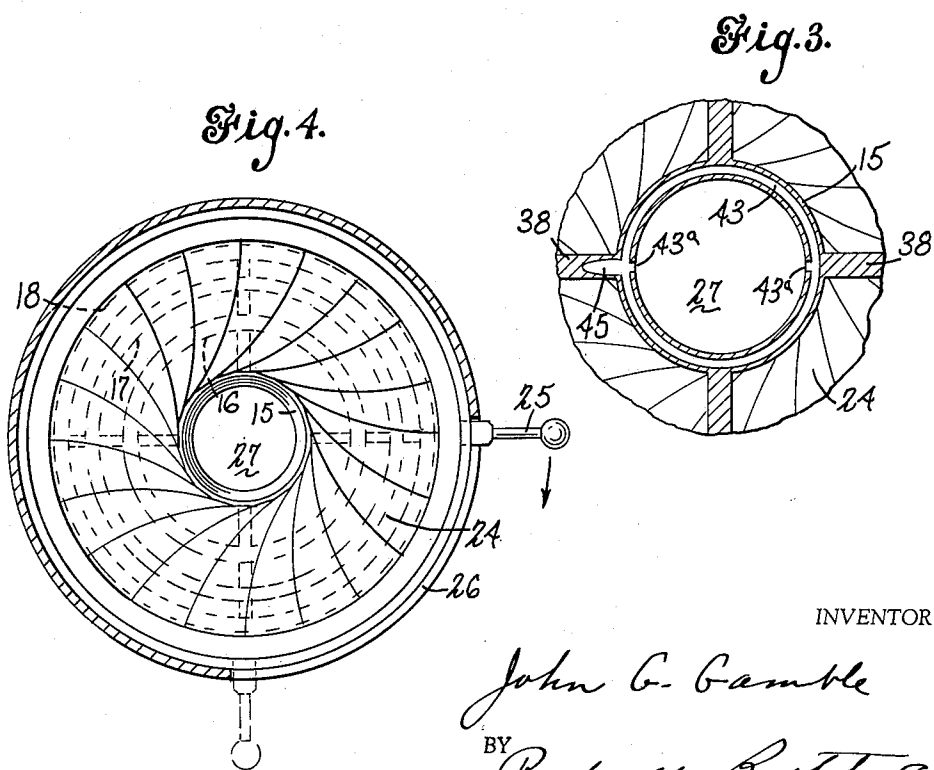
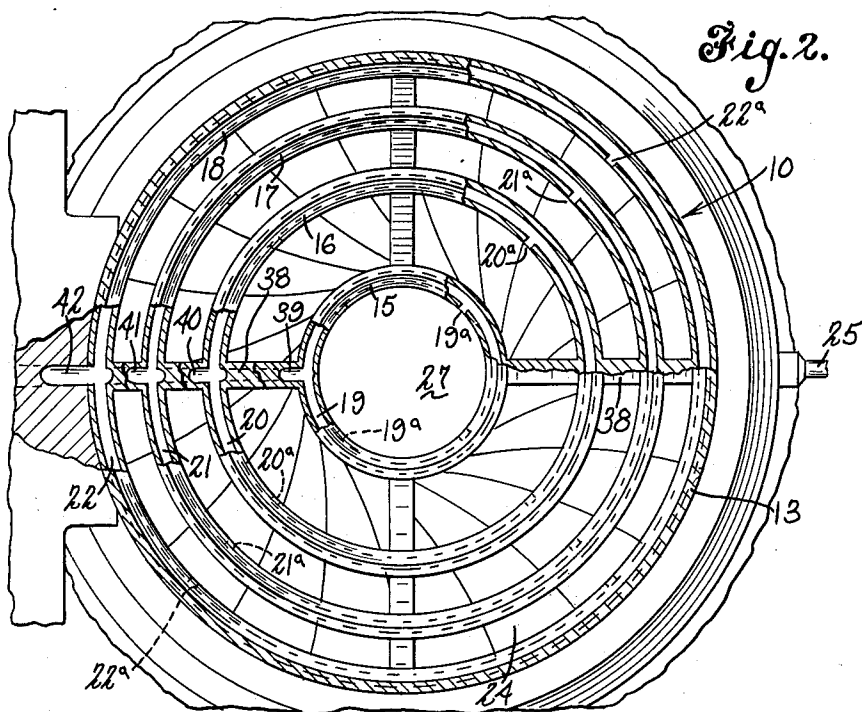
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INVENTOR

John G. Gamble

BY

Rockwell & Sachse

ATTORNEYS

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CARBURETOR FOR INTERNAL COMBUSTION ENGINES

John G. Gamble, Milford, Conn.

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11 Claims. (Cl. 261—23)

This invention relates to carburetors for internal combustion engines, and more particularly to a multiple venturi carburetor in which there are provided a plurality of venturis instead of one as in the usual carburetor, these venturis becoming operative consecutively or in series as the engine speed is increased.

As illustrated, these venturis are arranged concentrically and a throttle valve is provided in the form of a diaphragm which first opens the inner or central venturi and thereafter, as the valve opening increases, to deliver more fuel to the engine, opens the surrounding venturis consecutively. Thus each venturi may be so formed as to deliver a proper mixture to the engine, and the charge delivered to the engine at any time is, of course, equal to the sum of the charges delivered by the total number of venturis which may be uncovered or in operation. Thus, regardless of the amount of charge delivered to the engine, the desired mixture will always be obtained, and this result will be effected in an economical and efficient manner.

As illustrated, the diaphragm throttle valve lies flush against the low-pressure or manifold end of the venturi chamber as distinguished from the conventional pivotally mounted throttle valves in use at the present time. At low or idling speeds the central venturi or a part thereof will be open and, as the throttle valve is manipulated, the next outwardly adjacent venturi will be uncovered until at wide open throttle the fuel air flow will exactly meet the engine demands for operation at peak speed. It will be understood that while the present invention is applicable to an engine provided with tapered cams to hold the intake valves open for different periods depending upon the speed of the engine, it will also be understood that the invention may also be used to advantage on the conventional engine.

Thus by increasing the effective size of the throat of the venturi according to the fuel demands of the engine, better breathing is secured which increases the pressure differential across the intake valve and thus increases the velocity of the air passing through the carburetor, resulting in increased volumetric efficiency. When the throttle is open to a point beyond piston velocity demand, or that portion of the demand that can be transmitted to the manifold, pressure rises in the intake manifold and a trimming jet is provided to sense this pressure rise and increase the fuel flow.

In the conventional carburetor with a single venturi and the usual pivoted disk-type throttle valve, definite limitations are apparent. A venturi which is small enough in bore to create a sufficiently low pressure condition at low R. P. M. when the manifold velocity is low, to atomize a given fuel, is too small to permit free flow of the necessary air to burn the fuel charge at a high R. P. M. This problem has resulted in compromising the size of the venturi to give proper operating conditions at an average speed and also by providing a series of fuel jets that cut in as the carburetor velocity increases. However, the problem remains since at high R. P. M. the manifold

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pressure will drop and a drop in the manifold pressure means a reduction in the fuel charge which would otherwise be delivered to the engine, and thus the power drops below the engine potential.

In the multiple venturi carburetor illustrated there is provided a substantially constant manifold pressure at all constant speeds while permitting the flow rate to vary with engine demands as the total cross-sectional flow area at open throttle is the summation of the maximum economy units of the carburetor and, therefore, the total flow is also at maximum economy. For a given venturi bore, there is an optimum velocity for a given fuel jet opening, and in design this velocity should be reached at wide-open position so that the venturi throat does not act to restrict the volume flow. Therefore, as the venturis are progressively opened, the low-to-high rate range passes through a series of these critical points whereas in a single throat carburetor there is but one critical point with a result that additional jets or pump systems may be required to compensate. In the present carburetor, one trimming jet is provided, which trimming jet is linked to sense manifold pressure, and this serves a two-fold purpose in that it compensates fuel flow for fractional venturi openings by the edge of the diaphragm, and secondly it compensates for sudden acceleration or deceleration.

One object of the present invention is to provide a new and improved carburetor for internal combustion engines.

A further object of the invention is the provision of a multiple venturi carburetor, the venturis being consecutively opened by the throttle valve according to the demands of the engine for an increased fuel charge.

A still further object of the invention is to provide a multiple venturi carburetor having a plurality of venturis, each arranged for maximum economy in the delivery of a charge to the engine, these venturis being opened consecutively as a throttle valve is opened so that the charge delivered to the engine will be the sum of the charges passing through the venturis in operation at any given time.

Still another object of the invention is to provide a carburetor for internal combustion engines having a plurality of concentrically arranged venturis and a throttle valve designed to open these venturis consecutively and cumulatively so that the charge delivered to the engine will be the sum of the charges passing through the venturis uncovered by the throttle valve.

A still further object of the invention is to provide a carburetor for internal combustion engines of the character described wherein a trimming jet is also provided to compensate for fuel flow when one of the venturis is not fully open and to also provide for conditions of sudden acceleration or deceleration, this trimming jet being controlled by pressure in the engine manifold.

To these and other ends the invention consists in the novel features and combinations of parts to be hereinafter described and claimed.

In the accompanying drawings:

Fig. 1 is a sectional view of a carburetor for an internal combustion engine embodying my invention;

Fig. 2 is a sectional view through the venturi chamber on line 2—2 of Fig. 1;

Fig. 3 is a sectional view through the inner venturi of the system on line 3—3 of Fig. 1; and

Fig. 4 is a sectional view on line 4—4 of Fig. 1.

As illustrated in the drawings, I have shown a carburetor consisting of a venturi chamber designated generally by the numeral 10, the chamber being mounted on and adapted to communicate with the throat 11 of the engine intake manifold 12 so as to deliver a charge to the latter. Above the chamber 10 is the usual air intake tube 13 through which air passes to the venturi chamber.

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Within the venturi chamber are a plurality of venturi tubes designated by the numerals 15, 16, 17 and 18. As illustrated, these tubes were arranged concentrically so that, while a tapered circular opening is provided within the venturi 15, annular openings are provided within the outer venturi members or between each of these members and the next inner one. It will be noted that the walls of each of the venturi tubes are somewhat thicker at the center than at each end so that each of the openings tapers in size from the outer ends toward a relatively restricted central portion as is usual.

In the wall of each of the tubes is provided an annular passage or duct, these ducts being indicated by the numerals 19, 20, 21 and 22, respectively. As shown more especially in Fig. 2, openings 19^a are provided through the wall separating the duct 19 from the throat of the venturi 15 so as to permit passage of the fuel charge from the annular duct 19 into the venturi throat. Any number of these openings may be provided as is suitable depending upon their size. There will, however, be a number of such openings arranged in spaced relation so that the fuel charge will be delivered to the venturi throat from all sides.

Likewise, a plurality of openings 20^a, 21^a and 22^a are provided through the inner walls of the ducts 20, 21 and 22, respectively, to permit these ducts to communicate with the throats of the venturis 16, 17 and 18, respectively, and similarly there will be a number of such openings in each wall so that the charge will enter the annular venturi throats from all sides and in sufficient quantity.

A throttle valve is provided to open the venturi tubes consecutively and cumulatively. As illustrated, this valve is in the form of a diaphragm valve 24 shown more especially in Figs. 1 and 4. The valve as illustrated is provided in the throat 11, and is substantially flush with the lower end of the venturi chamber 10. The diaphragm is actuated by the lever 25 which operates in a slot 26 in the wall of the throat 11. This diaphragm may be arranged to be completely closed at one position of the lever 25 or may, as shown, be arranged to have a relatively small opening in the closed position of the lever, as shown at 27. As will be understood from a later description, this will be the idling position of the carburetor, and a conventional provision may be made for limiting the closed position of the lever so as to permit a desired idling position of the throttle valve. It will be apparent that as the lever 25 is turned in the direction of the arrow shown in Fig. 4, the diaphragm will be opened to present successively larger concentric openings and thus uncover the lower ends of the venturi throats consecutively and cumulatively. It will be, of course, understood that as the lever is moved to enlarge the opening 27, it will uncover each of the venturi openings by gradual degrees and not by distinct steps. That is, when moved from idling position, the diaphragm may uncover only a part of the throat of the venturi 16 and not necessarily all thereof, and the same with the venturis 17 and 18.

A float chamber of more or less conventional form is shown at 30, this chamber being provided with a float 31 so as to maintain a quantity of gasoline within the chamber at a desired level such as 32, the float controlling an inlet valve 33 which, in turn, controls the fuel inlet duct 34. It will be understood that the float chamber and associated parts above described are merely illustrated conventionally.

A tube 35 has its lower end immersed within the fuel in the float chamber, this tube having a bleed opening 36 to the atmosphere and a jet tube 37 leading to the venturi chamber as will be later described. This provides for the introduction of fuel to the venturi tubes from the chamber 30 when the pressure in the jet tube 37 is reduced.

As shown in Fig. 2, the jet tube 37 passes through a web 38 connecting the walls of the venturis, and this tube communicates by passages 39, 40, 41 and 42 with the annular

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ducts or channels 19, 20, 21 and 22, respectively, so that the fuel drawn through the jet tube 37 will fill these annular channels and thus be delivered to the various venturis when the latter are open through the openings 19^a, 20^a, 21^a and 22^a.

A trimming jet is also provided as shown more especially in Figs. 1 and 3. As illustrated, this trimming jet communicates only with the central venturi 15, although it may, if desired, also communicate with one or more of the surrounding venturi tubes. The wall of the venturi 15 is provided with an annular chamber 43, and openings 43^a are provided permitting communication between this chamber and the throat of the venturi. A trimming jet 44 (Fig. 1) opens into this chamber as shown at 45 (Fig. 3) so as to permit the fuel to be delivered to the chamber 43. This fuel jet 44 communicates at its upper end with a passage 46 in a wall of the float chamber, which passage, in turn, communicates with the float chamber through an opening 47 of reduced size. The effective size of the opening 47 is controlled and varied by a metering pin 48, this pin being slidably mounted in the wall of the float chamber 30 and secured at its upper end to an L-shaped member 49 also slidably mounted in the wall of the slot chamber.

The member 49 is secured at its lower end to a piston 50 mounted in a cylinder 51 provided in the wall of the float chamber and the lower end of this cylinder communicates through a tube 52 with the throat 11 of the intake manifold so as to reflect the pressure therein. It will be noted that as the upper end of the cylinder 51 above the piston 50 is exposed to atmospheric pressure, the reduced pressure in the manifold tends to draw the piston downwardly and thus draw the metering pin downwardly and restrict the opening 47. A compression spring 53 is mounted in the cylinder below the piston and tends to urge the piston upwardly so that when pressure rises in the manifold, the piston will be moved upwardly by the spring, thus raising the metering pin 48 and permitting greater flow through the opening 47.

In operation, when the motor is idling, the lever 25 will be in a position adjacent one end of its movement, thus effecting a relatively small opening at the center of the diaphragm throttle valve 24, which opening may uncover a part or all of the outlet of the central venturi 15 depending upon the size of the latter. As stated, the venturi will be properly proportioned for the optimum fuel mixture so that this proper mixture will be delivered at idling speed of the engine.

If it is desired to increase the speed of the engine, the lever 25 will be moved in the direction of the arrow, thus increasing the opening 27 of the diaphragm. As this opening increases, the remainder of the venturi opening 15 will be uncovered and upon a further increase, a part or all of the next outer venturi will likewise be uncovered until, when the lever is moved to full open position, all of the venturi tubes will become operative, and thus the air entering through the air intake 13 will pass through all of these tubes. It will also be noted that as a fuel is delivered to each of the venturi tubes, it will be entrained by the air in the usual manner, and as each is properly proportioned, and as the total fuel charge is equal to the sum of the charges delivered to each of the venturi tubes, the proper fuel air ratio will be maintained regardless of the setting of the throttle valve.

In the event that manifold pressure varies either due to the fact that the venturi tubes may be opened fractionally or due to condition of sudden acceleration and deceleration, the trimming jet 44 will compensate for such a condition. For example, if the throttle valve opened to a considerable extent to accelerate the engine or it upon an increase in load such as when the vehicle propelled by the engine is ascending a hill, there is a relatively greater opening of the throttle valve with respect to the speed of the engine and the manifold pres-

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sure will rise. A rise in manifold pressure will permit the spring 53 to raise the piston 50 and the metering pin 48, thus providing for an increased charge to the central venturi 15 through the trimming jet 44. When conditions are restored to normal and the manifold pressure decreases to its normal value, the piston 50 will be drawn downwardly by this reduction in pressure and thus restrict the opening 47 so as to restrict or cut off entirely any fuel delivered through the trimming jet.

While I have shown and described a preferred embodiment of my invention, it will be understood that it is not to be limited to all of the details shown, but is capable of modification and variation within the spirit of the invention and within the scope of the claims.

What I claim is:

1. A carburetor for an internal combustion engine, said carburetor comprising a chamber having a plurality of venturi tubes therein, means to admit air and fuel to each of said tubes, and a single diaphragm throttle valve having a central expandable opening therein controlling the discharge ends of said tubes, said valve being movable to enlarge the valve opening to permit discharge from said tubes serially and cumulatively.

2. A carburetor for an internal combustion engine, said carburetor comprising a chamber having a plurality of venturi tubes therein, one of which is arranged centrally of the chamber and another comprising an annular passage surrounding said first tube, means to admit air and fuel separately to said tubes, and a throttle valve movable to one position to open the centrally arranged tube and to another position to open both said tubes.

3. A carburetor for an internal combustion engine, said carburetor comprising a chamber having a plurality of venturi tubes therein, said tubes being concentrically arranged whereby they consist of a central passage and a plurality of annular passages surrounding said central passage, means to admit air to said tubes at one end thereof and to admit fuel thereto, a throttle valve to control discharge of the mixture of fuel and air from said tubes, said valve when actuated first opening said central passage and then said annular passages in turn.

4. A carburetor for an internal combustion engine, said carburetor comprising a chamber having a plurality of venturi tubes therein, said tubes being concentrically arranged whereby they consist of a central passage and a plurality of annular passages surrounding said central passage, means to admit air to said tubes at one end thereof and to admit fuel thereto, the discharge ends of said tubes being arranged in substantially a single plane, and an iris diaphragm throttle valve arranged adjacent said discharge ends to control the discharge of the fuel mixture therefrom.

5. A carburetor for an internal combustion engine, said carburetor comprising a chamber having a plurality of venturi tubes therein, said tubes being concentrically arranged whereby they consist of a central passage and a plurality of annular passages surrounding said central passage, means to admit air to said tubes at one end thereof and to admit fuel thereto, the discharge ends of said tubes being arranged in substantially a single plane, and an iris diaphragm throttle valve arranged adjacent said discharge ends to control the discharge of the fuel mixture therefrom, said valve provided with a central opening adjustable to various diameters to first open said central passage and thereafter said surrounding passages cumulatively.

6. A carburetor for an internal combustion engine, said carburetor comprising a chamber having a plurality of passages therethrough, each of which is constricted at an intermediate portion thereof, means to supply air

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to said passages at one end thereof, means to supply a liquid fuel to the constricted portion of said passages, a valve controlling the discharge end of said passages, and means for actuating said valve to effect discharge from said passages cumulatively, said passages being concentric, and said valve comprising a diaphragm presenting an opening adjustable in diameter by said actuating means.

7. A carburetor as set forth in claim 2 wherein a trimming jet is also provided to deliver additional fuel to one of said tubes.

8. A carburetor as set forth in claim 2 wherein the engine is provided with a manifold to which the charge is delivered from the carburetor, and wherein a trimming jet, responsive to pressure in the manifold, is provided for delivering fuel to one of said tubes.

9. A carburetor for an internal combustion engine, said carburetor comprising a chamber having a plurality of venturi tubes therein, one of which is arranged centrally of the chamber and another comprising an annular passage surrounding said first tube, means to admit air and fuel separately to said tubes, and a throttle valve movable to one position to open the centrally arranged tube and to another position to open both said tubes wherein the engine is provided with a manifold to which the carburetor delivers the mixed fuel and air, a valve controlled trimming jet is also provided to deliver fuel to one of said tubes, and said last-named valve is controlled by means responsive to pressure in the engine manifold.

10. A carburetor for an internal combustion engine, said carburetor comprising a chamber having a plurality of venturi tubes therein, one of which is arranged centrally of the chamber and another comprising an annular passage surrounding said first tube, means to admit air and fuel separately to said tubes, a throttle valve movable to one position to open the centrally arranged tube and to another position to open both said tubes wherein the engine is provided with a manifold to which the carburetor delivers the mixed fuel and air, a valve controlled trimming jet is also provided to deliver fuel to one of said tubes, a piston is connected to said valve, a cylinder is provided in which the piston is mounted, and including means affording communication between the cylinder and engine manifold whereby reduced pressure in the latter tends to close said last-named valve.

11. A carburetor for an internal combustion engine, said carburetor comprising a chamber having a plurality of venturi tubes therein, one of which is arranged centrally of the chamber and another comprising an annular passage surrounding said first tube, means to admit air and fuel separately to said tubes, a throttle valve movable to one position to open the centrally arranged tube and to another position to open both said tubes wherein the engine is provided with a manifold to which the carburetor delivers the mixed fuel and air, a valve controlled trimming jet is also provided to deliver fuel to one of said tubes, a piston is connected to said valve, a cylinder is provided in which the piston is mounted, including means affording communication between the cylinder and engine manifold whereby reduced pressure in the latter tends to close said last-named valve, and a spring to urge said piston in a direction to open said valve.

References Cited in the file of this patent

UNITED STATES PATENTS

793,498 Ash _____ June 27, 1905

FOREIGN PATENTS

87,647 Switzerland _____ Dec. 1, 1920

305,115 Great Britain _____ Feb. 7, 1929