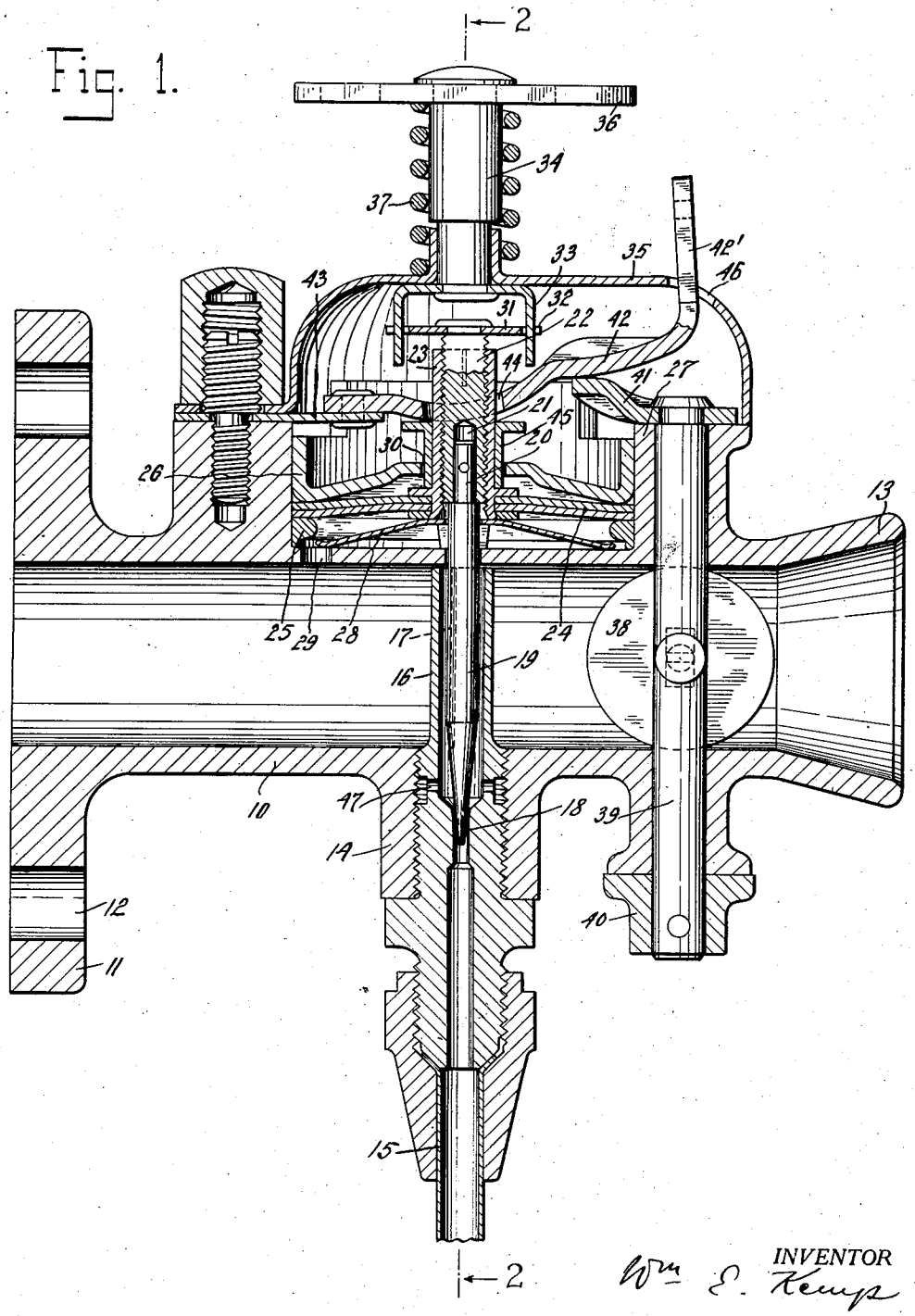
Nov. 3, 1925. 1,559,756

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CARBURETOR

Filed July 1, 1922 3 Sheets-Sheet 1

Fig. 1.



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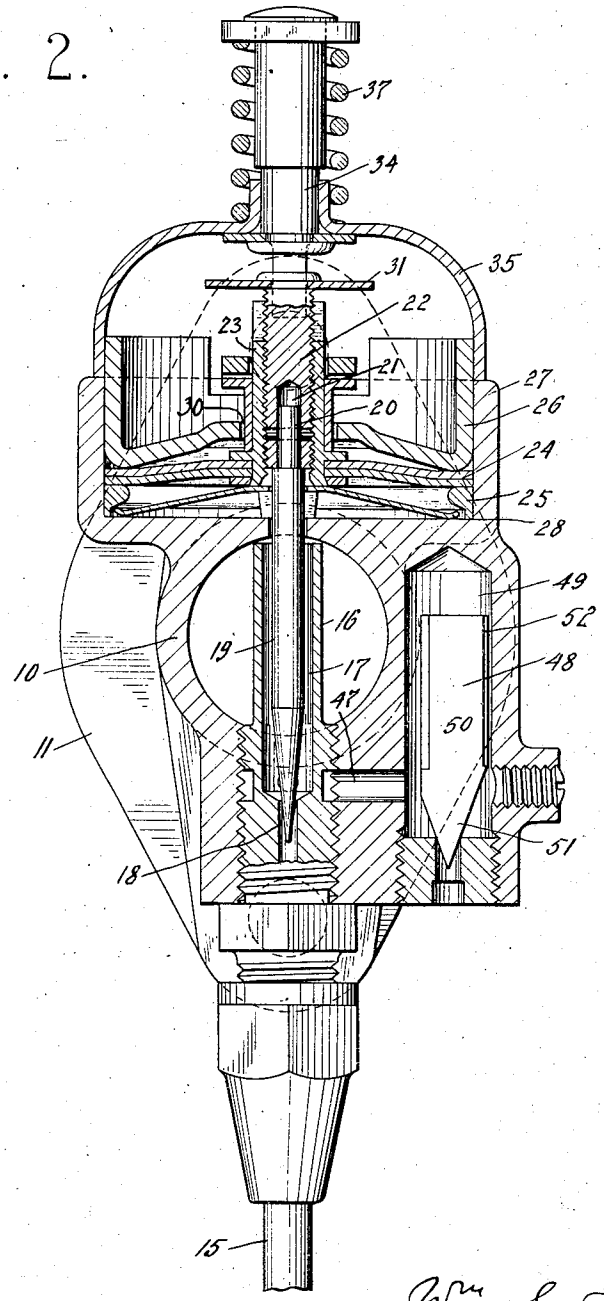
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Fig. 2.



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Fig. 3.

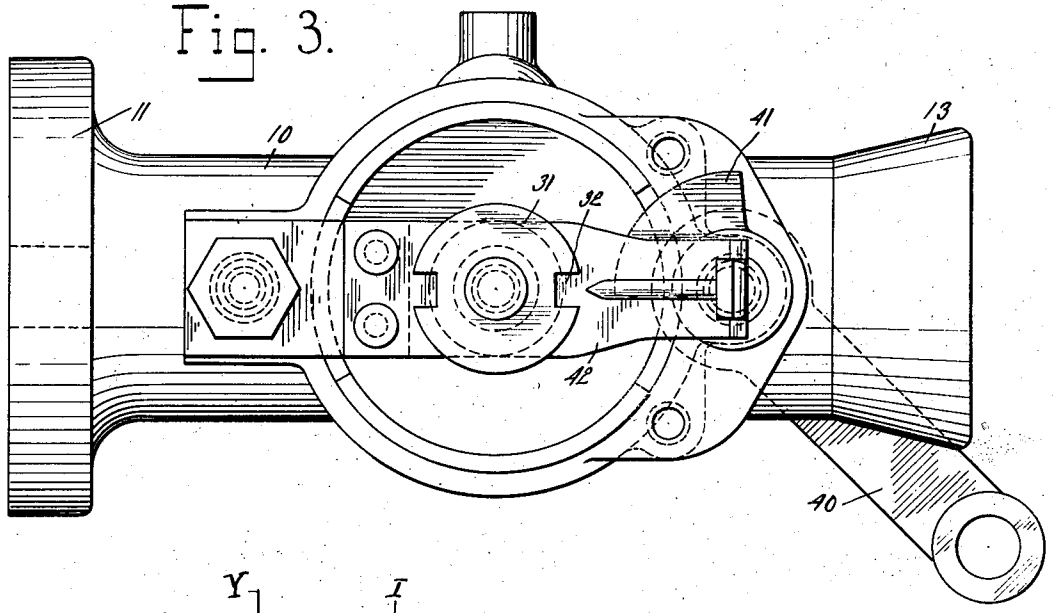


Fig. 4.

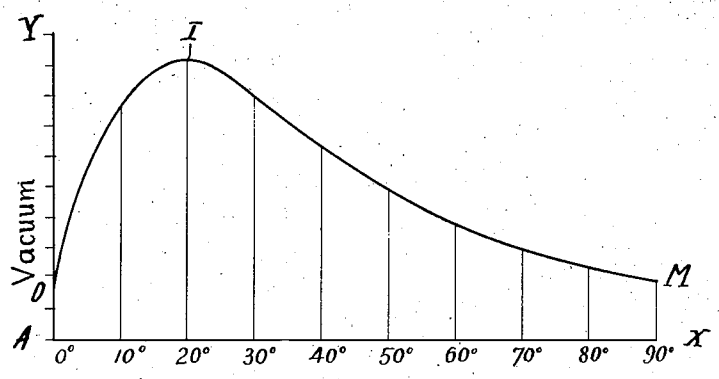
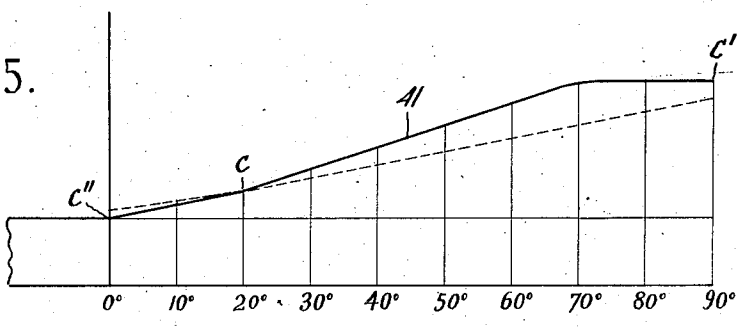


Fig. 5.



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Patented Nov. 3, 1925. 1,559,756

UNITED STATES PATENT OFFICE.

WILLIAM E. KEMP, OF NEW YORK, N. Y.

CARBURETOR.

Application filed July 1, 1922. Serial No. 572,235.

To all whom it may concern:

Be it known that I, WILLIAM E. KEMP, a citizen of the United States, and resident of the city of New York, in the county of New York 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 improvements in carburetors and more particularly to that class in which the liquid fuel is lifted from a "low level" tank to the carburetor nozzle by the suction of the engine without the intermediary of an auxiliary tank.

In one class of carburetors of this type, the supply nozzle in the carbureting chamber is controlled by a freely movable valve, which is connected with means controlled by the suction of the engine for automatically adjusting the outlet of the nozzle in inverse proportion to the vacuum produced in the carbureting chamber. In front of the nozzle is disposed a throttle, as usual in constructions of this type. The means connected to the valve consists of a diaphragm, one face of which is exposed to atmospheric pressure, while its other face is subjected to the vacuum in the carbureting chamber, the arrangement being such that the valve opening is in inverse proportion to the vacuum produced in the carbureting chamber. In other words, the higher the vacuum, the smaller the nozzle opening, and the lower the vacuum, the larger the nozzle opening. In practice it has been found however, that these constructions are impracticable for variable speed engines, the reason being that, as the throttle is shifted to its closing position and approaches the end of its closing stroke, the vacuum in the carbureting chamber gradually decreases instead of increasing, as theoretically should be the case. The result of this is that the valve controlling the nozzle automatically increases the nozzle opening, whereby a too rich mixture is produced.

The main object of the present invention is to overcome this defect, or in other words produce a carburetor wherein the proper proportion of air and liquid hydrocarbon is obtained during the entire range of the throttle movement thereof.

A further object of the invention is to provide a carburetor in the nozzle of which constantly a vacuum of predetermined degree is produced, irrespective of the changes of the vacuum in the carbureting chamber.

With these and other objects in view, which will more fully appear as the nature of the invention is better understood, the same consists in the combination, arrangement and construction of parts hereinafter described, pointed out in the appended claims and illustrated in the accompanying drawings, it being understood that many changes may be made in the size and proportion of the several parts and details of construction within the scope of the appended claims, without departing from the spirit or sacrificing any of the advantages of the invention.

One of the many possible embodiments of the invention is illustrated in the accompanying drawings. in which:—

Figure 1 is a central vertical section taken through a carburetor constructed in accordance with the present invention; Fig. 2 is a section taken on line 2—2 of Fig. 1; Fig. 3 is a top plan view of the carburetor; Fig. 4 is a diagram illustrating the relation between the throttle openings and vacuum in the carbureting chamber; and Fig. 5 is a diagram of a cam controlling the nozzle opening of the carburetor.

Referring now to the drawings, the carburetor comprises a carbureting chamber 10, in the form of a tubular body, provided with a flange 11, which abuts against the engine intake. The outer end of the carbureting chamber is, preferably, flared, as shown at 13 to permit of an unrestricted flow of air into the carbureting chamber. The chamber 10 is provided intermediate its ends with a nipple 14, to which is joined, by a suitable coupling, a pipe 15, the latter leading to a fuel tank below the carburetor. Into the nipple fits a nozzle 16, extending diametrically across the carbureting chamber. This nozzle is provided with longitudinal slots 17, disposed on that side of the nozzle which faces the outlet of the carbureting chamber. The purpose of this arrangement will be hereinafter explained. The nozzle is provided below its slots with a restricted opening 18, with which co-operates a needle valve 19, which is disposed within the nozzle, its diameter being smaller than the inner diameter of said nozzle.

Outside of the carbureting chamber, the needle valve is reduced in diameter, as shown at 20, this reduced end being tightly fitted into a bore 21 in an exteriorly screw-threaded stem 22. With the threads of this stem mesh those of a sleeve 23, on the lower end of which is mounted a diaphragm 24 of any suitable construction, the peripheral portion of the said diaphragm being held between clamping members 25 and 26, which are tightly fitted into a cylindrical extension 27 of the carbureting chamber. Against the lower end of the sleeve 23 bears a star-shaped spring 28 in the cylindrical extension 27, the tendency of this spring being to lift the needle valve. The underface of the diaphragm is subjected to the vacuum in the carbureting chamber, the latter communicating through an opening 29 with that portion of the cylindrical extension 27 which is disposed below the diaphragm. The upper face of the diaphragm, on the other hand, is exposed to atmospheric pressure, atmospheric air finding its way to the said upper face through an opening 30 in the member 26.

To permit of an adjustment of the fuel valve there is fixed to the stem 22 a disk 31, having notches 32 in diametrically opposite portions thereof. In these notches are seated prongs 33, fixed to a spindle 34, the latter being rotatably mounted upon a cover 35, which closes the cylindrical extension 27 of the carbureting chamber. The free end of the spindle 34 carries an arm 36 for connection with an operating rod, which permits the needle valve to be adjusted from a distant point. A spring 37, coiled around the spindle 34, is interposed between the cover 35 and arm 36, its purpose being to hold the needle valve in any adjusted position in relation to the sleeve 23.

In front of the needle valve is located a butterfly throttle 38, the spindle 39 of which extends in parallel relation to the needle valve, a lever 40, fixed to the lower end of the spindle 39 and having its other end connected with an actuating rod, not shown, being provided for operating the throttle.

To the upper end of the spindle 39 is rigidly attached a cam 41, co-operating with an arm 42, which is riveted or otherwise attached to a blade spring 43, the latter being clamped to the cylindrical extension 27. This arm is provided with an opening 44, through which the sleeve 23 projects, the arm resting on a sleeve 45, which is slidably mounted upon the sleeve 23 and abuts against the diaphragm 24. The free end of the arm 42 is bent upwards as shown at 42′, this upwardly bent portion projecting through an opening 46 in the cover 35 and being adapted to be connected to an actuating rod, for a purpose hereinafter to be described. The spring 43 is strong enough to overcome the pressure exerted by the spring 28, for a purpose hereinafter to be explained.

From an inspection of the drawings it appears that the only restriction or obstruction to the flow of air through the carbureting chamber is by the throttle. It also appears that there is no restriction in the carbureting chamber between the nozzle and the engine, or in other words there is no obstruction placed in the path of the fuel. Due to this construction, the highest vacuum or lowest pressure point in the carbureting chamber is immediately in rear of the throttle. The nozzle, on the other hand, is within the range of the highest vacuum or lowest pressure point.

In order to understand the operation of the elements so far described, reference is first made to the diagram shown in Fig. 4 of the drawings. In this figure the line A—X represents the axis of abscissæ, and the line A—Y the axis of ordinates, the abscissæ representing the throttle openings in degrees and the ordinates the vacuum in the carbureting chamber. The throttle in constructions of this type turns 90° from its fully closed position to its fully open position, the fully closed position being represented by the point A, that is to say the vertex of the co-ordinates. The line M—O represents the vacuum curve of the carbureting chamber, it appearing that, when the throttle is fully open, there exists a certain vacuum in the carbureting chamber, said vacuum increasing gradually to the point I, at which the throttle is about 20° from its closing position. Then there is a turn in this curve, the vacuum gradually decreasing when the throttle is fully closed. Theoretically there should be no turn in the vacuum curve, as the vacuum should be the highest in the carbureting chamber when the throttle is fully closed. If, therefore, the needle valve were controlled by the vacuum in the carbureting chamber, it would gradually close the discharge opening of the fuel conduit as the vacuum in the carbureting chamber increases up to a point in the closing movement of the throttle corresponding to the point I in the vacuum curve A—O. At this point the valve would then gradually increase the discharge opening of the fuel conduit and would thus, during a turn of 20° at the end of the closing movement of the throttle, produce an over-rich mixture. In order to prevent this, a connection is made between the throttle and needle valve, as above described, the cam 41, shown diagrammatically in Fig. 5 of the drawings, being so constructed that the spring-pressed arm 42 cannot act on the sleeve 45 until it reaches the point C (Fig. 5) of the cam, the cam face between the points C′ and C being so constructed that it holds the spring-

pressed arm 42 in an elevated position. From the point C to the point C'' the cam face gradually slants, permitting the spring-pressed arm 42 to act on the sleeve 45, and thus on the diaphragm 24, the result being that during the last 20° of the closing movement of the throttle the needle valve 19 gradually obstructs the discharge opening of the liquid fuel conduit, whereby a proper mixture is provided.

Bearing these facts in mind, it will be found that the operation of the carburetor is as follows: The suction of the engine lifts liquid fuel from the tank against the force of gravity into the nozzle, and the air, which is caused to flow in a confined stream through the carbureting chamber past the discharge end of the nozzle, entrains and vaporizes the liquid fuel, the resulting combustible mixture being drawn into the cylinder. A lifting of the fuel is made possible by the fact that the nozzle is subject to the highest vacuum created by the suction of the piston, irrespective of the speed of and load to the engine. The slots 17 are disposed in that side of the nozzle 16 which faces the outlet opening of the carbureting chamber, to produce a homogeneous mixture of air and combustible gas, the liquid fuel being discharged at right angles to the flow of the air through the carbureting chamber and the air not striking directly the liquid within the nozzle. By reason of this construction, the sensibility of the needle valve is eliminated to a great extent. Another purpose of disposing the slots in the manner above stated is to produce a higher vacuum within the nozzle. By reason of this higher vacuum a faster nozzle discharge is induced, thereby causing finer atomization. The high vacuum created by this construction also permits higher lift of fuel from the fuel tank.

The purpose of the throttle in this construction is only to control the volume of air admitted to the carbureting chamber. Inasmuch as this throttle is disposed in front of the nozzle and constitutes the only obstruction in the carbureting chamber, the combustible mixture is carried to the engine at any speed of the latter and has thus less chance to condense and stagnate in said chamber. Each charge is therefore of the same quality with a given throttle opening, resulting in an even running of the engine.

In a single cylinder engine, when the throttle is shifted, during the suction stroke of the piston in the cylinder, within a range of between 20° and 90° toward closing position, the needle valve is lowered, because the vacuum in the carbureting chamber acts upon the underface of the diaphragm 24. The opening 18 in the nozzle is thus restricted, the degree of restriction depending upon the vacuum in the said chamber. Immediately after the suction stroke, the needle valve returns to its normal position under the action of the spring 28. The lowering of the needle valve is due to the difference of pressure on the underface and the upperface of the diaphragm 24. The purpose of this arrangement is as follows: It provides automatic means, within the range mentioned, for regulating the discharge opening 18 of the fuel conduit, the valve restricting during the suction stroke of the piston the said discharge opening in proportion to the speed of the engine. Within this range the spring 43 does not act upon the diaphragm, the arm 42 being held by the cam 41 in positions so as not to act upon the needle valve. During the movement of the throttle from the zero to the 20° position, the cam permits the spring 43 to act upon the needle valve regardless of whether the movement of the throttle is in the opening or closing direction. The needle valve restricts thereby the discharge end of the fuel conduit according to the position of the throttle, or in other words in proportion to the vacuum in the carbureting chamber. From the foregoing it appears that the needle valve opens in inverse proportion to the vacuum throughout the entire range of the movement of the throttle, part of the movement of the needle valve being automatic and part positive. In multi-cylinder engines the moving parts of the device, due to inertia, do not follow the pulsations of the vacuum, but assume a mean position.

From the foregoing it will be seen that the liquid fuel is drawn into the carbureting chamber, instead of being forced in. Possibility of flooding the apparatus is thus removed, as no liquid fuel can be introduced into the same except by the suction of the engine, which at once vaporizes the liquid fuel. In case of accident or stopping of the engine, the liquid fuel in the supply pipe 15 immediately returns by gravity into the tank.

The point I of the curve shown in Fig. 4 of the drawings depends on the condition of the internal combustion engine with reference to valves, piston and piston ring fits. In engines in which these parts are in excellent mechanical condition the point I of the curve is nearer the axis A—Y of ordinates than in motors which are only in average mechanical condition. In some cases the point I has been found to be very near the ordinate marked 10° in Fig. 4 of the drawings. In others it is at 15° and still in others at 20°, as shown in the said figure.

In the construction so far described, the vacuum in the nozzle 16 is somewhat greater than the vacuum in the carbureting chamber at approximately wide open throttle.

As this vacuum in the carbureting chamber varies during the operation of the engine, obviously an uneven flow of liquid fuel into the nozzle results. In order to prevent this, an air passage 47 leads to the nozzle, said passage being controlled by a weighted valve 48 within a valve casing 49. The valve may be of any suitable construction. In the case illustrated it includes a stem 50, having a pointed end 51, controlling the inlet to the passage 47. On the stem are provided guides 52, bearing against the inner face of the valve casing. The weight of the valve is overcome by the suction in the nozzle 16, it being lifted from its seat whenever the suction exceeds a predetermined degree. With this arrangement, the nozzle 16 acts as an unvented nozzle until a sufficient vacuum is reached to unseat the valve 48. After this, even though the vacuum in the mixing chamber may materially increase, the vacuum in the nozzle will remain substantially constant, being that required to unseat the valve. The result of this is that an even flow of liquid fuel is induced into the nozzle.

When starting an engine, the throttle 38 is shifted to closing position and the arm 42 lifted by the actuating rod, connected to the upwardly bent portion 42′, whereby the spring 28 lifts the needle valve, thereby permitting of a priming of the carburetor. As soon as the engine is running, the arm 42 is released and the throttle actuated according to the requirements.

What I claim is:—

1. A carburetor comprising a carbureting chamber, a supply nozzle therein, a valve controlling said nozzle freely movable in relation thereto, a throttle in said carbureting chamber, means connected with said valve for automatically adjusting said nozzle in proportion to the vacuum produced in said carbureting chamber during a predetermined portion of the stroke of said throttle, and means controlled by said throttle for mechanically actuating said valve during the remainder of the stroke of said throttle.

2. A carburetor comprising a carbureting chamber, a supply nozzle therein, a valve controlling said nozzle freely movable in relation thereto, a throttle in said carbureting chamber, a diaphragm connected with said valve under the action of the vacuum in said carbureting chamber for automatically adjusting said nozzle in proportion to the vacuum produced in said carbureting chamber during a predetermined portion of the stroke of said throttle, and means controlled by said throttle for mechanically actuating said valve during the remainder of the stroke of said throttle.

3. A carburetor comprising a carbureting chamber having an air inlet and a mixture outlet, a fuel nozzle discharging in said chamber, a valve controlling said nozzle, means constantly acting to open said valve, means responsive to the depression in said carbureting chamber acting to close said valve, a throttle valve for said carbureting chamber, and a second means to close said fuel valve, held out of operation by said throttle valve during a portion of the movement thereof, and free to operate during the remainder of the movement of said throttle valve.

Signed at New York, in the county of New York, and State of New York, this 21st day of June, A. D. 1922.

WILLIAM E. KEMP.