Jan. 9, 1923. 1,441,858.

E. JUILLARD.

CARBURETOR.

FILED JAN. 31, 1919. 4 SHEETS—SHEET 1.

Fig. 4.

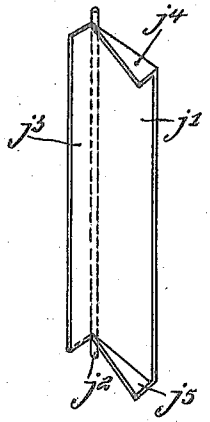


Fig. 1.

Fig. 5.

Fig. 3.

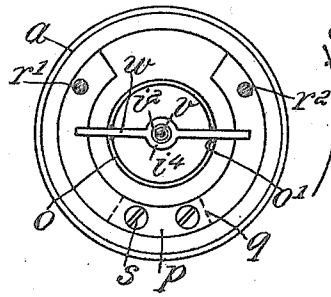
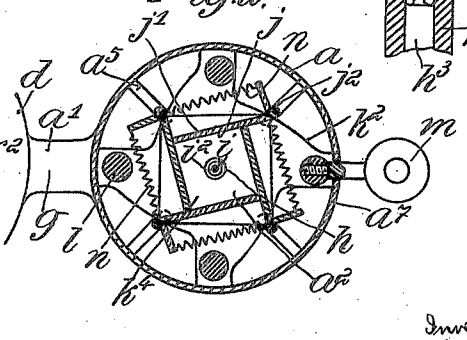


Fig. 2.



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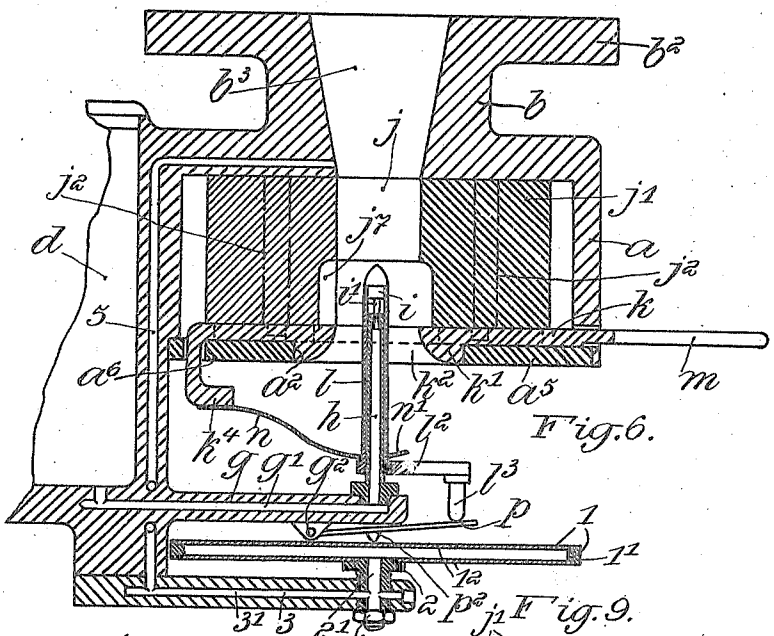


Fig. 6.

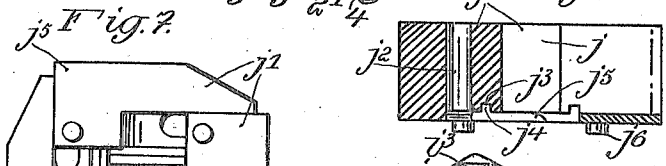


Fig. 9.

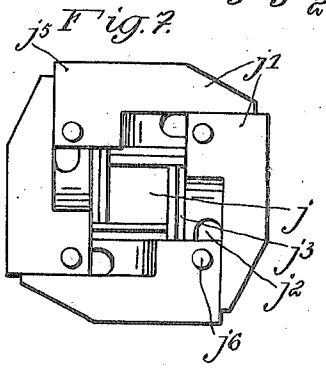


Fig. 7.

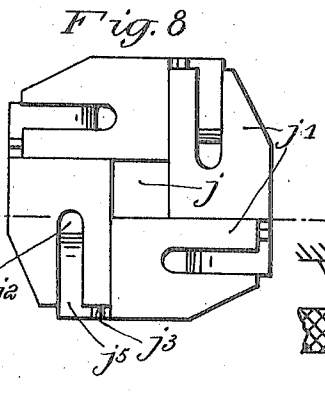


Fig. 8.

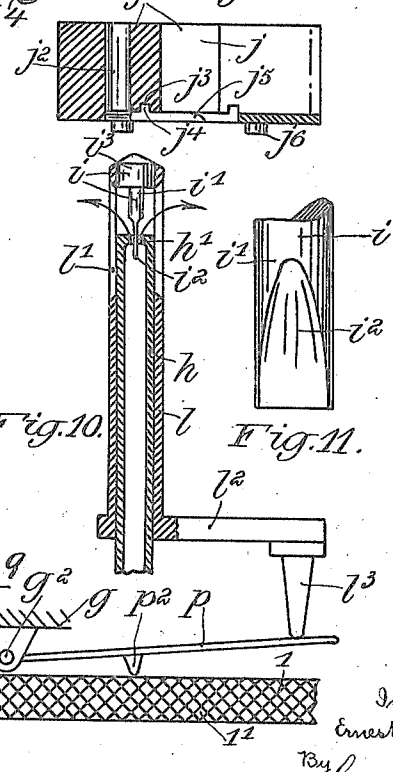


Fig. 10.

Fig. 11.

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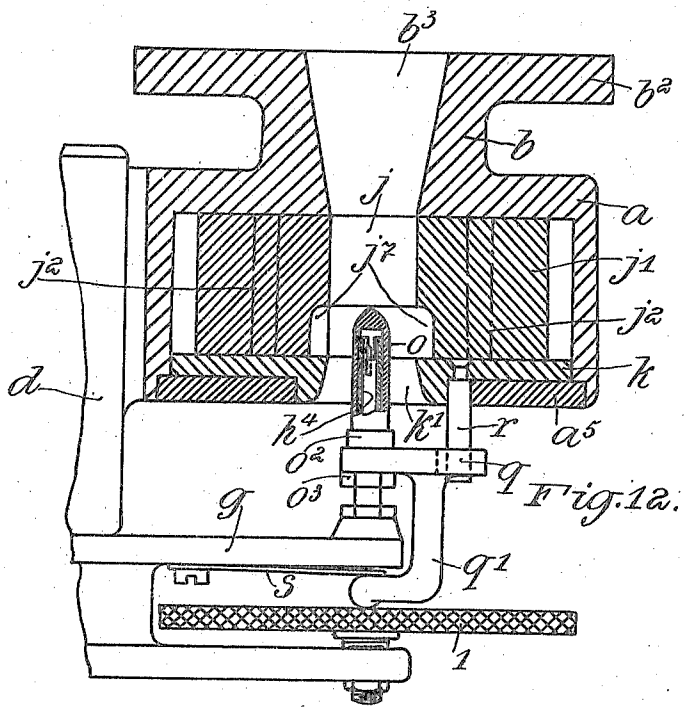
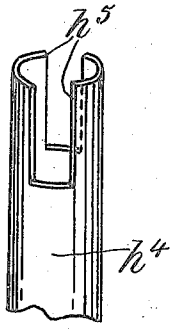


Fig. 12.

Fig. 14.



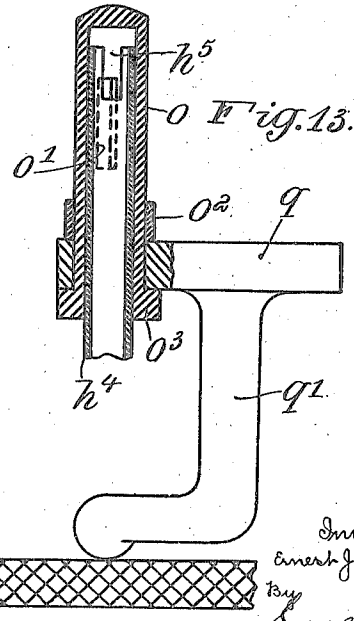


Fig. 13.

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FILED JAN. 31, 1919.

4 SHEETS—SHEET 4.

Fig. 15.

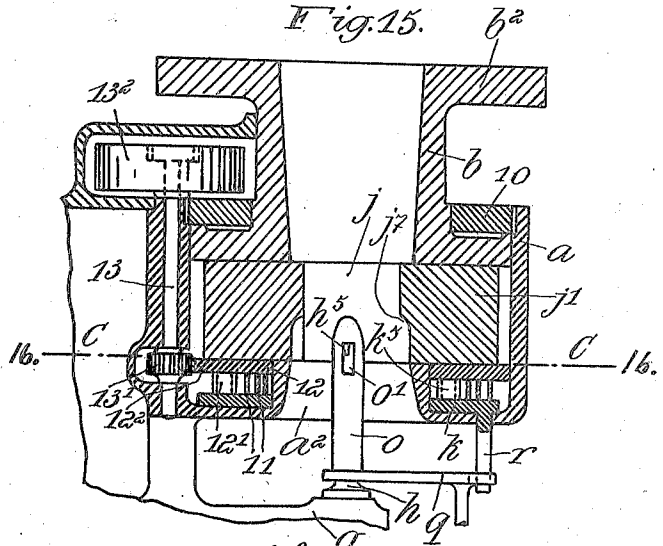
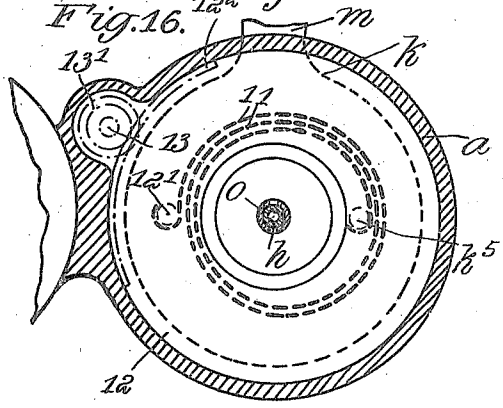


Fig. 16.



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Patented Jan. 9, 1923. 1,441,858

UNITED STATES PATENT OFFICE.

ERNEST JUILLARD, OF GENEVA, SWITZERLAND, ASSIGNOR TO FIRM: ATELIERS H. CUENOD, SOCIETE ANONYME, OF CHATELAINE, NEAR GENEVA, SWITZERLAND.

CARBURETOR.

Application filed January 31, 1919. Serial No. 274,207.

To all whom it may concern:

Be it known that I, ERNEST JUILLARD, engineer, a citizen of Switzerland, residing at Geneva, Canton of Geneva, in the Confederation of Switzerland, have invented certain new and useful Improvements in Carburetors, of which the following is a specification.

The object of the present invention is the provision of a carburetor for internal combustion engines.

It comprises, like other carburetors for internal combustion engines, a spraying nozzle, from the outlet opening or openings of which there is a free passage, the area of which may be varied at will, and which leads into a mixing chamber. But it differs therefrom in the fact that the free opening in the mixing chamber varies throughout the length thereof, depending upon the area of the free opening or openings of the spraying nozzle.

The area of the free passage of the mixing chamber, for instance, may vary proportionally to the area of the free opening or openings of the outlet of the spraying nozzle.

The mixing chamber may be laterally bounded by movable walls of given magnitude forming the side of a polygon, displaceable in such a way that each of them always remains in contact at one extremity with the adjacent wall and subjected in the course of their movement to the action of two guides, to one of which a rotary movement may be communicated, which produces the variation in the cross-sectional area of the chamber. In such a case the guide to which a rotary movement is communicated may control the area of the opening or openings of the spraying nozzle by the use of a valve adapted to close the said opening or openings more or less completely, and participating in the said rotary movement and displaceable at that time along a ramp; the inclination of the latter may be modified during the working of the motor fed by the carburetor.

An adjusting device may be provided for regulating the opening or openings of the spraying nozzle for a given area of the free passage in the mixing chamber. The valve may be subject to the action of a part which participates in the rotation of the rotating guide and which is in contact with two branches of a spring, one of which forms the said ramp and the other of which can be displaced with a view to the adjustment hereinbefore indicated.

In order to facilitate the restarting of the engine fed by the carburetor after it has been running more or less slowly for a time, the construction may be so arranged that the area of the mixing chamber then varies momentarily, in the sense of an increase, more slowly with reference to the area of the opening or openings of the spraying nozzle, than would otherwise be required to meet the requirements. This result may be obtained for instance by the fact that a member controlling the valve also controls the displacement of the movable walls of the mixing chamber, but this by means of a spring which, only at the end of a certain time, can overcome the inertia of the above walls and eventually that of one or more auxiliary members adapted to increase said inertia.

Further it is known that in spraying nozzle carburetors the quantity of liquid fuel leaving the spraying nozzle increases more rapidly than the quantity of air drawn in by suction, in proportion as the vacuum produced in the carburetor by the motor fed thereby becomes higher particularly when it is question of high vacuum. The proportions of liquid fuel and of air in the mixture are not constant and the mixture becomes richer when the vacuum becomes higher.

In order to overcome this disadvantage the carburetor may have a correcting device which comprises a pressure gauge subjected to the action of the pressure prevailing in the neighborhood of the spraying nozzle and controlling a member that acts to regulate the quantity of liquid fuel leaving the said spraying nozzle.

If the regulating member is a member capable of extending more or less deeply into the outlet opening or openings of the spraying nozzle and is connected for that purpose to a part in contact with the said ramp, the pressure gauge may produce a variation in the inclination of said ramp. In the case the said member consists of a hood provided with one or more apertures which can be caused to register more or less completely with the opening or openings, constituted by cut-away parts of the spraying nozzle for the purpose of forming a passage or passages by which the fuel can pass out of the latter, the above pressure

gauge may produce an axial displacement of the hood with respect to the spraying nozzle and in this way modifies the length of the free passage or passages.

I will now describe with reference to the accompanying drawings various constructions in accordance with the present invention, but I do not limit myself to the precise constructions described and illustrated.

In the drawing:

Figure 1 is a central longitudinal cross section and partial elevation of a carburetor made in accordance with this invention.

Fig. 2 is a cross section on line 2—2, Fig. 1.

Fig. 3 is a cross section on line 3—3, Fig. 1.

Fig. 4 is a perspective view of one of the angular members forming the mixing chamber.

Fig. 5 is an enlarged sectional elevation of the construction of the discharge valve for the liquid fuel.

Fig. 6 is a central longitudinal cross section of a modified form of the invention.

Fig. 7 is a plan of the members forming the mixing chamber in the form of the invention shown in Fig. 6.

Fig. 8 is a plan of the parts of the mixing chamber taken at the other end thereof.

Fig. 9 is a cross section on line 9—9, Fig. 8.

Fig. 10 is an enlarged cross section of the supply pipe and the discharge valve for the liquid fuel in the form of the invention shown in Fig. 6.

Fig. 11 is an enlarged elevation of the end of the rod including the valve for admitting the liquid fuel as employed in this form of the invention.

Fig. 12 is a central longitudinal section of another form of the invention.

Fig. 13 is an enlarged central longitudinal section of the form of discharge valve shown in Fig. 12.

Fig. 14 is a perspective view illustrating the bifurcated end of the discharge pipe in the form of the invention shown in Figs. 12 and 13.

Fig. 15 is a central longitudinal cross section of another form of the invention, and

Fig. 16 is a cross section on line 16—16, Fig. 15.

The first form of the invention as shown in Figs. 1 and 2 comprises a vertical cylindrical body a surmounted by a nipple b which is fastened to it by means of a screw thread b^1 and to the inlet passage (not shown) of the motor by means of a flange b^2. The body a is provided at the side with an external arm a^1 supporting a float chamber d. The liquid fuel reaches the chamber d through a pipe e and enters it through an opening controlled by a needle f actuated by a float, not shown. It leaves the fuel chamber through a passage g^1 which is formed in a horizontal lateral arm of the chamber d and which leads to a chamber g^2 into the upper wall of which the spraying nozzle h is screwed. The latter, which is vertical, is located in the axis of the body a, extends to a certain extent into the interior of the body through a circular opening a^2 formed in the bottom a^3 of the body and terminates at the top in a circular chamber h^1 (see Figure 5) leading to a flared bell-mouth h^2. The outflow of the liquid fuel from the spraying nozzle h is controlled by means of a valve i comprising a body i^3 having the shape of a truncated cone, the angle of which corresponds to that of the flared end h^2, into which it fits exactly, but the height of the valve is greater than that of the flared part, in order that the jet of fuel may be deflected towards the walls of the body a. The valve i is provided on one side with a guide i^1 sliding in the axial passage h^3 of the spraying nozzle h and having its cross section cut away in the manner shown in Figure 5 for the purpose of letting the fuel flow freely, and on the other side with a controlling rod i^2 passing through a guiding cross-bar u in the nipple b.

Inside the body a is arranged the mixing chamber j which is practically square in cross section and which is bounded laterally by four plane shutters j^1 (see also Figure 4). Each shutter is provided with a shaft j^2 projecting upwards and downwards and movable in straight radial grooves a^4, a^5 formed crosswise in cover a^6 of the body a and in the bottom a^3 thereof. The shafts j^2 are moreover in contact with rotatable cams k^1, k^2, arranged below and above the cover a^6 and the bottom a^3, and provided with circular openings k^3, k^4 respectively, corresponding to the opening which is formed in each of these two parts and connected to one another by means of struts l. One of the struts or pillars l is provided with a controlling lever m passing through an opening a^7 in the body a and enabling the cage formed by the cams k^1, k^2, and by these struts, to be rotated at will. Springs n each hooked on to the shaft of each shutter j^1 and acting on the lateral ledge j^3 of the adjacent shutter keep these shutters in contact with one another at one end and also press the shafts j^2 on to the periphery of the cams k^1, k^2. It will be found by reference to Figure 2 that if under these conditions the cage is rotated in a clockwise direction the shafts are moved inwards in the grooves a^4, a^5, while the springs n always keep the shutters j in contact with one another, and the cross-sectional area of the chamber j increases. When on the contrary an angular movement in the other direction is communicated to the cage, the

shafts j^2 move outwards in the slots a^4, a^5, and the cross-sectional area of the said chamber j decreases. The form of the cams is such that the said cross-sectional area varies in proportion to the angle through which the cage is rotated. The shutters j^1 are furthermore provided with upper and lower flanges j^4, j^5, triangular in shape, sliding over the cams k^1, k^2 and closing the parts of the circular openings k^3, k^4 which are located outside the square cross section of the said chamber j.

The valve member i of the spraying nozzle h is controlled by the cage. For this purpose the rod i^2 is provided with a ring i^4, kept in contact by means of a spring v with a cross bar w the two extremities of which pass into straight longitudinal slots o^1 formed at diametrically opposite places in a cut-out cylinder o connected to or integral with the upper cam k^1. When the cage is rotated the cross bar w is made to revolve simultaneously, at the same time being free to rise or fall, lowering or raising the valve rod and valve to produce a variation in the free area of the aperture of the spraying nozzle h. To this end the said cross bar w rests outside the cylinder o on a flat horseshoe-shaped spring p, fixed centrally by two screws s to the cover a^6 of the body, a small plate q being interposed between the cover a^6 and the spring p in order that both ends of the latter may be a substantial distance from the cover. These ends, in consequence of the conformation of the spring, both tend to move away from the cover a^6, but are maintained in the desired position by means of screws r^1, r^2 with milled heads, carried by the nipple b. Under normal circumstances the branch p^1 of the spring is kept horizontal by the screw r^1, while the branch p^2 forms a helical ramp the inclination of which is determined by the position of the screw r^2. When the cross bar w is carried along by the upper cam k^1 and by the cylinder o in the rotation of the latter, one of its extremities moves in a horizontal plane on the branch p^1, while the other rises or descends along the branch p^2. The valve i approaches or recedes from the flared opening h^2 of the spraying nozzle h to an extent equal to half the vertical displacement of the extremity of the cross bar w and proportional to the angle of rotation of the cam k^1.

The construction described operates in the following manner:

When the suction of the motor is acting in the nipple b, and consequently in the chamber j, atmospheric air enters through the openings a^2, k^4 while liquid fuel leaves the spraying nozzle h in the form of a sheet of circular cross section, which is met by the air drawn in by suction and which finally strikes against the shutters j^1, upon which it breaks. If the ring lever m is actuated in an anti-clockwise direction, the cross-sectional area of the chamber j is diminished, but at the same time the free cross-sectional area of the aperture of the spraying nozzle h is also diminished, and the parts are so designed that the gas and air are diminished proportionally in order that the composition of the mixture remains substantially constant. The same is the case if the lever is moved in the opposide direction: the cross-sectional area of the chamber and the free cross-sectional area of the aperture of the spraying nozzle h increase with the composition of the mixture being substantially the same.

The variations in the cross-sectional area of the chamber j produce the desired variations in the quantity of explosive mixture drawn in by suction, and consequently the desired variations in the power furnished by the motor.

One advantage of the above construction resides in the fact that carburation always takes place at ample velocities of the air in the mixing chamber, from which there results an energetic carrying along of the fuel and the complete vaporization thereof, without loss of fuel.

The shutters j^1 of the chamber j are kept in contact with one another not only by the springs n but also by the difference between the pressures prevailing inside and outside the chamber j.

As has been said, the branch p^1 of the spring p is normally located in a horizontal plane. In order to bring the carburetor into correct adjustment it is however necessary for the member i to entirely close the aperture of the spraying nozzle h when the cross-sectional area of the chamber j is zero, or at least when it is a minimum. This result is attained by modifying, by means of the screw r^1, the position of the said branch p^1 and by slightly raising or lowering its free extremity.

The screw r^2 may be connected to a controlling member located near the operator of the engine, thus enabling the said operator while traveling to vary the admission of the fuel and modify the composition of the mixture according to circumstances.

It will also be understood that other and equivalent devices may be employed for the accomplishment of the objects of my invention.

The form of the invention shown in Fig. 6 comprises a vertical cylindrical body a made in one piece with the float chamber d on the one hand and with the nipple b^2 on the other hand. The open bottom of the body is fitted with a plate a^5 fixed thereto and provided with a circular opening a^2. On the plate a^5 there rests a disc k provided with a central circular rim k^1, and which

in its turn is provided with a central opening k^2 serving for the passage of air. On the disc k are also placed four symmetrical pieces j^1, see also Figures 7 to 9, movable with respect to one another and enclosing between them a mixing chamber j, of variable square cross section, into which there opens the spraying nozzle h. The said area is varied by simultaneously displacing the four pieces j^1, at the same time keeping them in contact with one another. With this end in view they are each provided with a longitudinal slot j^2, extending the whole of their height and affording a passage for a vertical pin or peg integral with the top of the body a and also a shallow longitudinal groove j^3 that takes a transverse projection j^4 of a small plate j^5, of the adjacent piece j^1. This small plate j^5 is provided with a pin j^6 lodged in a groove in the disc k. If the disc k is rotated by means of a controlling arm m passing through an aperture in the cover a, the parts j^1 are constrained to move all together and relatively to one another in such a way as to increase or to diminish the area of the chamber j. In the internal faces of the said pieces j^1 are formed cavities j^7 in which the spraying nozzle h is lodged when the above mentioned cross-sectional area is small.

In the opening h^1 (Fig. 10) of the spraying nozzle h can enter to a greater or smaller extent a valve i comprising a head i^3 and also a cylindrical lower part i^1 the diameter of which is equal to that of the opening and which is provided with two lateral plain faces i^2 (see also Figure 11), diametrically opposite to one another and forming a beveled end part. In proportion as the member i is raised, starting from the position in which its part i^1 completely closes the opening h^1, the area of the latter left free by the said part i^1 is increased. The head i^3 is connected to a sleeve l which is capable of rotating freely about the spraying nozzle h and which is provided with large openings l^1 to enable the fuel that escapes from the opening h^1 to pass into the chamber j. The sleeve l is integral with an arm l^2, provided with a finger l^3 resting on an inclined plate p jointed at g^2 to the lower part of the arm g. If therefore the sleeve l is rotated, the finger l^3 rises or falls, carrying the sleeve l with it and altering the free area of the opening h^1. This rotary movement is produced by operating the arm m by means of an arm k^4, with which the disc k is provided and which passes through an opening a^6 in the plate a^5 and is provided with a flat spring n terminating in a fork n^1 which embraces the sleeve l above the arm l^2 and causes the disc k to rotate with it.

This second construction is provided with a correcting device comprising a pressure-gauge box 1 (Figs. 6 and 10) having a vertical axis and composed of a ring 1^1 and of two thin plates 1^2. The plate p bears on the centre of the upper plate 1^2 through the medium of a point p^2, while the lower plate 1^2 is carried by a nipple 2 screwed into an arm 3 of the tank d. The position of the box 1 may be adjusted vertically by screwing up or down the nipple 2, which is held in its place by means of a lock nut 4. The interior of the box, 1 is in communication, by means of passages 2^1 in the nipple 2^1 in the arm 3, 5 formed in the wall of the tank d and in the upper part of the body a, with the bottom b of a truncated conical passage b^3 formed in the nipple and forming a continuation of the chamber j.

The second form of the invention operates in the following manner:

According to the power required of the motor, the arm m is rotated in one direction or the other, which has a double result: the area of the chamber j and the area of the opening h^1 are made to vary, in a manner which is approximately proportional to one another in substantially the same manner as that described in the form of the invention shown in Figs. 1 to 5 inclusive.

The two plates 1^2 of the latter yield under the action of the atmospheric pressure in proportion as the vacuum in b^3 increases. So long as the latter is small or moderate, however, the lowering of the box is slight and the ratio between the two areas remains substantially the same. On the contrary when the vacuum becomes high, the upper plate 1^2 descends considerably and causes the valve i to diminish the free area of the opening more rapidly than the area of the chamber j decreases. The two areas cease to be proportional to one another, but the ratio between the air and the fuel in the mixture remains substantially the same as it was before.

When the cross-sectional area of the chamber j is practically zero, it is desirable for the opening h^1 to be completely closed by the part i^1. The desired adjustment is effected by screwing up or down the nipple 2, which raises or lowers the sleeve l and the valve i.

In the form of the invention illustrated in Figures 12 to 14, the spraying nozzle is a tube h^4 screwed into the arm g, pierced from one side to the other with a hole of the same diameter and provided at the top with two rectangular slots h^5 diametrically opposite to one another. On the tube h^4 there is a rotating hood o in which are formed two rectangular apertures o^1 adapted to register with the slots h^5 and in this way determine the area of the passages through which the fuel leaves the spraying nozzle h. The hood o fits frictionally in a circular opening in a split arm q, which is also provided with a slot in which is lodged a pin r of the plate a^5.

When the latter is rotated for the purpose of varying the area of the mixing chamber j, a rotary movement is communicated to the hood o, and the width of the passages formed by the slots h^5 and the apertures o^1 is altered, and thereby the flow of fuel is varied. The arm q is placed between two flanges o^3, o^2 of the hood o, one of which is made in one piece with the latter while the other is fastened to it, in such a way that the hood is caused to rise or fall with it. This arm is provided with a projection q^1, bearing on the centre of the upper plate 1^2 of the pressure-gauge box 1, and kept in contact with the said plate by means of a flat spring s. In proportion as the vacuum produced in the mixing chamber j becomes higher, the two plates i^2 yield, the arm q and the hood o sink; and the height of the free cross section of the passages formed by the slots h^5 and the apertures o^1 diminishes, with the result that for high vacuums the proportion of fuel to the air in the mixture may remain substantially constant.

As indicated in the introduction, in certain cases it may be convenient to have a very rich explosive mixture after restarting the motor when it has been running more or less slowly, while for all other speeds the ratio of the area of the mixing-chamber to the area of the opening or openings of the spraying nozzle is maintained constant. This result is obtained by the fourth construction of the invention. In this construction (Figs. 15 and 16) the body a is provided at its bottom part with a circular trough having the central opening a^2 for the inlet of the air, and, its top is closed by a neck b fitted into it and held in position by a washer 10. The trough encloses the rotatable disk 12 supporting the four mixing chamber members j^1 similar to those hereinbefore described.

The hood o of the spraying-nozzle h is fitted frictionally within a circular hole of a split arm q which embraces a pin r of a rotatable disk k, said disk being lodged within the bottom of the trough of the body a and being provided with a handle m. On a pin k^5 fast on disk k is attached a spiral spring 11 the other end whereof is attached to a pin 12^1 fast on the disk 12. The latter is provided on a part of its circumference with teeth 12^2 engaging with a pinion 13^1 keyed onto a vertical spindle 13 fitted at its top with the fly-wheel 13^2 intended to increase the inertia opposed to a rotation of disk 12 and to the displacing of the pieces j^1.

The operation of this fourth construction is as follows:

When slowly moving the arm m in order to vary the quantity of fuel delivered by the spraying-nozzle the spring 11 will transmit almost instantaneously the movement to the disk 12 which moves the pieces j^1 so as to increase or to decrease the area of the chamber j. It will also slowly rotate the fly-wheel 13^2, but its inertia under these conditions will be of no account.

If it is desired to decrease suddenly the output of the motor the arm m has to be rapidly moved in the desired direction. The apertures o^1 will at once register in a less degree than before with the slots h^5 and the delivery of fuel will be decreased. Owing to the inertia of disk 12 of the members j^1, and of the fly wheel 13^2 the disk 12 can not closely follow the rotating movement, the spring 11 will be extended but the area of the chamber j will for a while remain as it was before; much air will enter and but a small amount of fuel and the mixing will be very poor. The spring 11 however will soon start the disk 12, the pieces j^1 and the fly wheel 13^2 and will displace the members j^1 so as to diminish the said area, until it will have attained the same ratio as before with regard to the area of the apertures of the spraying nozzle.

If it is desired to increase the engine speed rapidly, the arm m will have to be swung rapidly in the opposite direction. Again the area of the apertures of the spraying-nozzle will at once be changed, but this time in the sense of an increase of the fuel delivered. While the disk 12 cannot follow at once the pull of spring 11, the area of the chamber j continues for a moment the same as it was before and the air enters to a small amount. From these two facts will result a very rich mixture facilitating the starting of the motor. After a certain time the spring 11 will overcome the inertia of the disk 12, of members j^1 and of the fly wheel 13^2 and will bring the members j^1 into the position corresponding with the adjusted area of the apertures of the spraying-nozzle h.

It has been stated in the foregoing that the area of the chamber j and the area of the opening or openings of the spraying nozzle vary in the same proportion in such a way that the composition of the mixture remains substantially constant. The relationship existing between these two areas might of course be different, and it might be such that the first area increased or diminished more rapidly than the second, in order to obtain a variation in the composition of the mixture instead of substantial constancy in the composition.

Having now fully described and ascertained the nature of my invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a carburetor and in combination, a casing, a plurality of walls, the combined walls forming an elongated mixing chamber, the area of which is variable but con-

stant throughout its entire length for any adjustment thereof, means for maintaining a part of each wall in contact with a part of the next adjacent wall, means for shifting the positions of the said walls to vary the cross sectional area of the mixing chamber, and a spraying nozzle extending into the said mixing chamber.

2. In a carburetor and in combination, a plurality of rectangular walls forming an elongated mixing chamber, an extension placed at an angle to each of the said rectangular walls, pivot pins connected to each of the rectangular walls and the extensions thereof and upon which each rectangular wall and its extension is shiftable, yielding means for maintaining an edge of each of the rectangular walls in contact with a face of the next adjacent rectangular wall, means cooperating with the said pivot pins and yielding means for shifting the positions of the rectangular walls to vary the cross sectional area of the mixing chamber, and a spraying nozzle.

3. In a carburetor and in combination, a casing, a cage comprising disks, and spacer rods revolubly mounted in the casing, a plurality of rectangular walls forming an elongated mixing chamber mounted in the said cage, means for maintaining the edge of each rectangular wall in position against the face of the next adjacent rectangular wall to form a continuous and closed mixing chamber, pivot pins upon which the said rectangular walls are mounted in the said cage, cam members by which the said rectangular walls are shifted in turning the cage to vary the positions of the rectangular walls against the action of the aforesaid means to vary the cross sectional area of the mixing chamber, a spraying nozzle, and means for actuating the said cage to shift the positions of the said rectangular walls to vary the cross sectional area of the said mixing chamber.

In testimony whereof I have affixed my signature in presence of two witnesses.

ERNEST JUILLARD

Witnesses:

LOUIS H. MUNIER,

DR. ROD. DE WURTEMBERG.