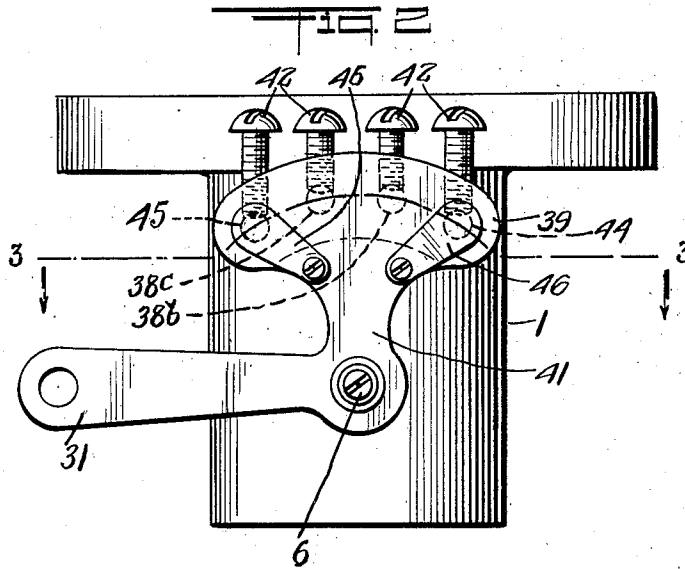


2,014,000

Original Filed Aug. 13, 1925 2 Sheets-Sheet 1



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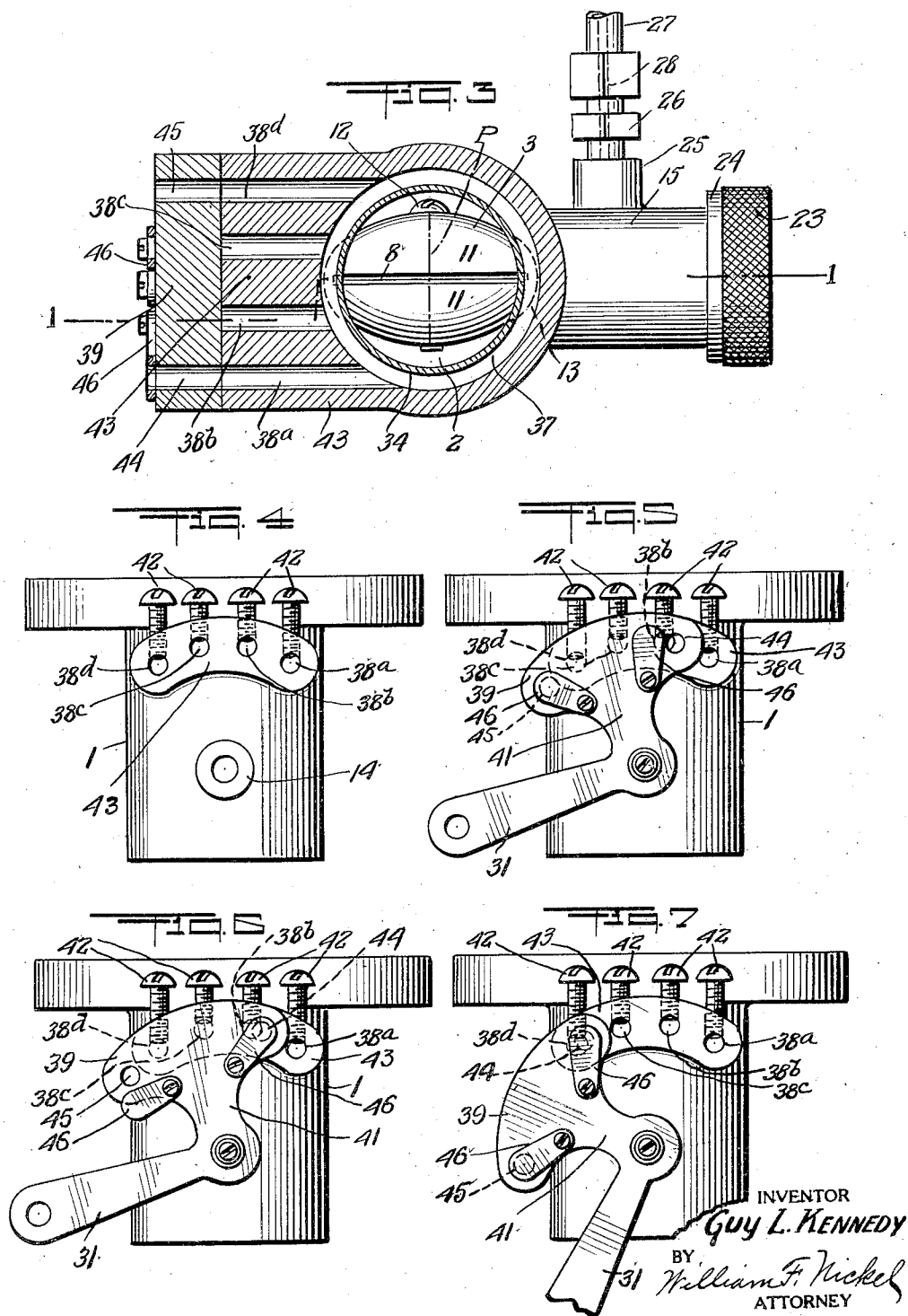
Sept. 10, 1935.

G. L. KENNEDY

2,014,000

CARBURETOR

Original Filed Aug. 13, 1925 2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,014,000

CARBURETOR

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Application August 13, 1925, Serial No. 49,967
Renewed January 24, 1935

5 Claims. (Cl. 277—1)

I have invented certain improvements in carburetors for supplying inflammable motive agent to internal combustion engines; and particularly, a carburetor wherein the ratio between the quantities of air and liquid fuel admitted to the carburetor to be vaporized, is kept substantially constant.

In my copending application, Serial No. 687, for a patent on Carburetors, filed January 5th, 1925, I disclose a carburetor having air-controlling means and a valve for regulating the entrance of gasoline or the like to the carburetor; said parts being connected to move in unison and being so shaped that, while the amount of air and gasoline passing through the carburetor can be changed, the relative quantity of each is unaltered; and thus an agent of uniform composition is always obtained, no matter what may be the positions of the parts or the conditions of operation. This result flows from the fact that both the air-controlling means and the gasoline or fuel valve are designed to have a special shape, and purpose; but I have found in practice, that the relation or ratio between the quantities of air and gasoline taken into the carburetor must be so accurately maintained, that, if variations and imperfections are present in the structure of the carburetor, this relation or ratio will be so disturbed that exact functioning cannot be had. Thus a serious difficulty arises when production in large numbers must be undertaken, because under such circumstances, structural variations are necessarily frequent and many carburetors will prove to be very faulty when tested.

The main object of my invention is to compensate for such structural variations and defects, and I attain the desired end by providing for a precise regulation and adjustment of the air supply in a manner that is independent of and supplemental to the effect produced by the regular actuation of the principal air controlling means. The amount of gasoline supplied to the carburetor is not additionally regulated; but as the quantity of gasoline or other liquid fuel is always far smaller than the quantity of air used to vaporize it, the method actually followed,—that of further controlling the volume of air,—is more desirable and efficient and much more easily practiced.

Other objects and advantages of the invention will be made clear in the following description and the novel features of my improved carburetor will be defined in the appended claims. But this disclosure is, of course, illustrative only, and I may alter the details of construction actually shown herein to a considerable extent, as indicated by the broad meanings of the terms in which the claims are expressed.

On the drawings,

Figure 1 is a view of a carburetor according to

my invention, presented in longitudinal section; on line 1—1 of Figure 3;

Figure 2 is a side view thereof;

Figure 3 is a horizontal section on line 3—3 of Figure 2, looking downward;

Figure 4 is a view similar to Figure 2, of such a carburetor, with some of the outside parts removed; and

Figures 5, 6 and 7 illustrate somewhat diagrammatically such a carburetor, with its principal external parts in different operative positions.

The same numerals identify the same parts throughout.

As in my aforesaid copending case, the numeral 1 indicates a tubular casing which has a bore 2 extending longitudinally through it, and is open at both ends. The bore 2 is indicated as a cylinder in cross-section, but may have any other desired shape, and mounted in the casing 1, so as to control the bore 2, is a valve 3. I mount the valve 3 so that it can turn about an axis transverse with respect to the bore 2 to open or closing position, this valve being supported upon a rotatable shaft or spindle 6, turning in bearings in the side of the casing 1. The valve 3 is hollow and encloses an interior chamber 7, and this valve is also provided with an outlet 8 in the form of a slot, as indicated particularly in Figures 1 and 3. On the inside of the valve 3, the spindle 6 is bored to provide a pair of ports 9 which communicate with a duct 10 through which gasoline and air pass by way of the ports or nozzles 9, to the chamber 7, and the gasoline thus admitted to the chamber 7 intermingles with the air in this chamber and flows out through the slot 8 into the bore 2. Therefore, the valve 3 serves as an air regulating valve and spray nozzle combined.

This valve 3 should preferably have the shape of an oblate sphere consisting of two halves 11, each half being hemispherical in shape, but not truly hemispherical; and being somewhat flattened, and also held together rim to rim by a screw 12 which passes directly through the spindle 6, the rims of each half 11 being recessed to enable them to be clamped upon the shaft or spindle 6 with their edges in contact, except over the portions where the opposed edges of the two halves are cut away to provide the slot 8. This slot is entirely at one side of the valve and is somewhat less than a semicircle in length. As shown clearly in the drawings, the diameter of this valve measured in the plane of the contacting edges or rims of the substantially hemispherical halves 11, is greater than the diameter coinciding with the axis of the screw 12, the valve 3 thus being oblate in form or in the form of a sphere flattened at the poles and bulging at the equator. The equatorial diameter is indicated by the dotted line E in Figure 1, 60

and the polar diameter by the line indicated by the letter P in Figure 3.

When the valve is turned on its shaft 6 so as to carry it into the position shown in Figures 1 and 3, that is, with the polar diameter P transverse to the axis of the bore 2, it will open the bore 2 and permit air to flow through same as fully as the shape of this valve will permit; but when it is revolved into such a position that the polar diameter is brought into line with the axis of the bore 2, thus placing the equatorial plane of the valve across the bore, the valve 3 will then close or nearly close the bore, and reduce the flow of air through the carburetor to a minimum. As indicated by the numeral 13, the valve 3 even when it occupies the position of closing the bore 2, will be separated from the inside surface of the bore 2 around its periphery by a small annular space 13, and this space will be considerably larger when the valve is turned to its fullest open position as shown in Figures 1 and 3. At one side of the casing the spindle 6 is engaged by an external bearing 14 and at the opposite side of the spindle, it turns in another outside bearing 15.

As I shall describe more fully below, the shape of the combined air regulating valve and spray nozzle 3 is such that the bore 2 can be opened to permit more and more air to flow therethrough in direct proportion to the degree of angular displacement of this valve from the position of full closing to that of Figure 1; that is, when the valve is turned from the position of full closing through 45 degrees towards full open position, it will permit twice as much air to flow past it, as when it is turned through only $22\frac{1}{2}$ degrees, and when it is turned through 90 degrees to full open position, it allows twice as much air to flow past it, as when it is turned through only 45 degrees; thus the quantity of air which flows through the casing 1 is increased or decreased in the same ratio as the angular distance of the valve from the position of full closing is increased or decreased.

No claim is made herein to the valve 3, as this valve is the subject of the description and claims of my copending application, Patent No. 1,971,527, dated Aug. 28, 1934.

The extremity of the shaft 6 which is supported in the bearing 14 may be solid and integral, but the opposite extremity which turns in the hollow external projection or bearing 15, is hollow and comprises at least two parts or members constituting a valve for the convenient admission and regulation of gasoline and air to the carburetor. No claim is made herein to this valve for admitting the fuel; therefore the same need not be more fully shown than in Figure 1; as this valve is illustrated in detail in my copending application above mentioned; and claims therefor are presented in my copending application, Serial No. 49,964 filed of even date herewith. It is sufficient to state that the portion of the shaft 6 having the axial duct 10 delivering through the two ports or nozzles 9 to the chamber 7, is expanded on the outside of the casing 1 to provide a disc or head 16, provided with a rim 17; making in effect a cup-shaped member which forms one section of the valve for regulating the gasoline supplied to the carburetor. The other section of this valve is provided by a similar disc 16', rigid with a journal 6A to be in axial alinement with the main portion of the shaft 6, and this section also has the form of a cylinder cup with a rim 17'. These rims are

so shaped, as described in my copending cases aforesaid, that they have shoulders 20, which when the two sections of this valve are assembled by bringing them together as indicated in Figure 1, rim to rim, abut and engage; so that the cups 16 must obviously rotate in unison when the valve 3 is rotated. In the rim 17', on the disc 16', attached to the journal 6A, is cut a notch or recess 21, this notch beginning at the point a, Figure 1, and extending along a straight diagonal line b, to a shoulder c, the recess being about 90 degrees in extent. Hence, when the two sections of this valve are assembled rim to rim, the recess will permit communication with the interior of the valve, so that gasoline can flow through this recess, which will serve as an inlet for the gasoline to pass into the rotary valve to the duct 10. At its outer extremity, the projection 15 has internal threads 22, to engage external threads upon a perforated element or nut 23, between which and the extremity of the bearing 15, is clamped a washer or packing 24. This nut is perforated and serves as a bearing for the journal 6A.

The projection 15 has an extension 25 receiving 25 in its outer extremity a gland 26 to secure therein a gasoline supply conduit 27 having a bore 28. See Figure 3. This bore 28 leads to an inlet opening 29 in the side of the projection 15 and when the port formed by the triangular recess 30 21 in the hollow rotary valve disposed within the bearing 15, uncovers this inlet 29, gasoline can, of course, flow freely into the valve for regulating the gasoline in the projection 15, and thence by way of the duct 10, through the nozzles 9 to 35 the chamber 7 in the valve 3. In practice, the rims of the two sections of this valve do not quite make contact with each other, but are separated to a slight extent, as indicated in Figure 1; and for this purpose, I place inside of the valve 40 a compression spring 39, which seats against the two opposing discs 16 and normally tends to move the two sections of the rotary gasoline valve apart. The axis of the extension 25 is at right angles to the axis of the bore 2, so that 45 when the casing 1 is vertical, both the projection 15 and extension 25 will lie in a horizontal plane, and, therefore, the conduit 27 will communicate with the interior of the valve for controlling the gasoline through the inlet 29, through the side of 50 the projection 15. When the valve 3 is in such position that it closes as much as possible, the bore 2, the valve for controlling the entrance of gasoline to the carburetor, will be in such position that the point a of the notch or port 21 will be substantially in line with the bore 28 through 55 the conduit 27. No gasoline at all, or only enough for idling, will now be enabled to flow into the carburetor. As, however, the valve 3 is turned to bring its polar axis more and more transverse 60 to the axis of the bore 2, the diagonal edge b of the port or recess 21, will pass across the inlet 29 and expose a larger and larger portion of the area of the bore 28, and thus admit more and more gasoline to the inside of the valve and the 65 duct 10. When the valve 3 has come to such position that it opens the bore 2 as much as possible, the sections of the valve for controlling the gasoline will occupy the position shown in Figure 1, with the shoulder c adjacent the inlet 70 29 and with the area of the bore 28 in the conduit 29 uncovered to the maximum extent. By turning the nut 23, the position of the diagonal edge of the notch or port 21 can be so adjusted that the extent to which the inlet 29 will be uncovered, 75

as the valve for admitting the gasoline is rotated, can be adjusted and increased or decreased at will.

As the edge *b* of the notch 21 is diagonal with reference to the spindle 6, it is clear that more and more gasoline will be admitted in direct proportion to the angular degree of rotation of the valve for controlling the gasoline in the same manner as the supply of air is regulated by the oblate spherical valve 3. That is, in the positions of the parts shown in Figure 1, twice as much air and twice as much gasoline will be admitted to the carburetor, as when the parts occupy positions 45 degrees distant; and so for all other positions, so that while the quantities of air and gasoline may be varied, the amounts of the two ingredients are always present in the same ratio, and the composition of the fuel which results from the action of the air upon the gasoline, is rendered constant. At the same time, precise and complete regulation as to the amount of air and gasoline admitted can always be secured, and the quantity of each will be increased in exact proportion to the extent of angular movement of the valve 3, and the valve for controlling the gasoline supply which must always move with the air valve.

With the parts in the positions occupied in Figure 1, the direction of rotation of the shaft 6 to move the valves towards closing position is indicated by the arrow A.

On the interior of the casing 1, above or beyond the valve 3 is a tubular member 34, presenting a relatively large end 35 to the valve 3, and secured around its periphery at this end to the inside surface of the bore 2. The opposite end of this member is smaller, and separated from the inside of the bore 2 by an annular space 36. Between its ends the member 34 is contracted, as shown at 37, somewhat like a Venturi tube. Opposite the contraction 37, the casing 1 has air inlet ports 38*a*, 38*b*, 38*c* and 38*d*, controlled by a shutter plate 39. To the plate 39 is affixed an arm 41, having a hub affixed to the shaft 6. Associated with each port is an element such as a screw 42, to control the area of the ports.

An arm 31 perforated to be united to a link connected to an actuating lever, is rigid with the arm 41, and the valves 3 and 39 of course, move together. As the valve 3 and the valve for the gasoline in the projection 15 are opened further, and further, more air and more gas are admitted to flow through the casing in exact proportion to the degree of movement of these valves from fully closed to fully open position; but the ratio of the quantity of gasoline to the quantity of air is always the same and is, of course, selected according to the known capacity of air to absorb the gasoline as the latter is admitted to the carburetor. The vaporization begins in the chamber 7 of the valve 3, and the gasoline issues from the nozzles 9 in the form of bubbles; because as the gasoline flows into the duct 10, enough air is entrained from the inside of the gasoline valve in the projection 15, to cause bubbles to appear; the air entering the inside of the gasoline valve through a channel 6' in the journal 6*A*; this channel or port opening through the outer end of the journal and the disk 16' attached thereto. From the chamber 7 the air and the gasoline taken up by it are sprayed through the slot 8, and drawn into the member 34 by air flowing around the valve 3 through the bore 2, the slot 8 being turned towards the member 34, as the valve 3 moves to

fully open position. Upon passing the contraction 37, the air and vaporized gasoline tend to expand, but this tendency is overcome by air entering ports 38*a*, etc., and flowing through the annular space 36, where it tends to expand toward the axis of the bore 2. Thus air coming in by way of inlets 38*a*, etc., blows through the space 36 toward the axis of the bore 2, all around the member 34, forcing the spray of air and gasoline inward, and further dividing and vaporizing the gasoline; so that when the intake manifold is reached, a perfectly dry and uniform gaseous fuel has been produced. Hence the member 34 facilitates vaporization with the annular space 36 and inlets 38*a*, 38*b*, 38*c* and 38*d*, through which air flows and escapes as a thin annular stream, to envelop and surround the spray of air and gasoline proceeding from the air regulating valve and spray nozzle 3. This annular stream of air surrounds the spray and drives any unvaporized particles of the mixture that may reach this point, away from the surrounding wall of the casing to the axis of the bore 2, and greatly increases vaporizing action.

The purpose and function of the fuel valve, and the valve 3, and particularly, the mode of operation by which the ratio between the quantities of air and fuel is kept from changing, are fully set forth in other applications referred to above.

In a carburetor according to this invention, wherein the supply of gasoline is governed by mechanical means, not by air velocity, it is imperative that mechanical means shall measure both the air volume and the fuel volume with such accuracy as to produce and maintain a constant air-fuel ratio at all positions of the throttle. By the construction and operation of my carburetor, this result is achieved.

However, the relation between the quantities of air and gasoline is so precise that, due to mechanical variations, it appears impossible to produce my carburetors in great numbers, and have them all test out up to standard requirements. Such variations may even occur within the usual tolerance limits. Air and gasoline may both be supplied in substantially constant ratio, if the curvature of the air regulating valve 3, and the angle of the edge *b* of the inlet of the fuel regulating valve are absolutely correct and exact in design. If the curvature of the valve 3, or if the inlet of the fuel valve departs from perfect shape and size in the slightest degree, the air-gasoline ratio will be altered to a material degree.

The difficulty is entirely obviated by the multiple air inlets 38*a*, 38*b*, 38*c* and 38*d*, with the adjusting screws 42 and shutter 39. Thus I provide means for increasing or decreasing the air volume at a multiplicity of points in the arc of movement of shutter 39, so as to compensate and allow for mechanical variations in the construction of the valve 3 and the fuel regulating valve, and I thereby maintain the air-gasoline ratio substantially constant at all throttle positions regardless of slight structural defects. This end is gained by altering the relative air volume, and not the fuel volume, to harmonize with the gasoline volume; and I thus avoid the troubles inherent in the usual procedure of attempting to vary the relative gasoline volume instead, to harmonize it with a fixed and predetermined amount of air.

The desirability of regulating or adjusting the relative air volume at a multiplicity of points to maintain a constant air-gasoline ratio, instead of regulating or adjusting the fuel, will be apparent

when it is remembered that a good explosive mixture of gasoline and air consists always of several thousand volumes of air, to one volume of gasoline. It is of course very plain that it is much harder to increase or decrease, within practical working limits, the smaller amount of gasoline, than the much larger amount of air.

The inlets 38a, etc., are shown as four, but the number may, of course, be larger or smaller. They are in a wide boss 43, shown uncovered in Figure 4. The shutter 39 may have in its ends ports 44 and 45, each of which can be covered and uncovered by a small closure 46 riveted to the shutter and held not too tight for movement, but tight enough to remain in any given position.

It is now evident that if one turns throttle lever counterclockwise, he will rotate shutter 41, and shaft 6 in perfect synchronism and successively uncover air inlets 38a, 38b, 38c, and 38d. As shown in Figure 2, all the parts are in idling position with all air inlets closed. One may now open port 44 or 45, as timing conditions may demand and admit air for idling purposes. Suppose that inlets 38a, 38b, 38c and 38d are now uncovered in succession and air admitted in volume determined by position of screws 42.

The thing of prime importance is the timing of the admission of air. The fuel or gasoline regulating valve turns the shaft 6. Hence when shaft 6 and valve 3, and the fuel regulating valve are turned to admit fuel and air, the air regulating means should be such as to time the admission of air to coincide with the time of the admission of gasoline; for both should be admitted in the right ratio at the same instant. Let us suppose the engine is now started and port 44 is open, and that the engine is idling in a satisfactory manner. The parts are then as in Figure 5.

In this view the throttle is advanced and shutter 39 opened enough to allow air to enter both inlet 38a, and by way of opening 44, the inlet 38b also; and thus additional air may be delivered a fraction ahead of or in advance of the fuel supply.

If the throttle lever attached to arm 31 and the shutter 39 are moved enough, each port 38a, etc., is opened in turn. Figure 7 shows the ports 44 and 45 in the plate 39 shut. Suppose as in Figure 5, the port 44 is uncovered, port 45 remaining closed. Now, if one advances the throttle lever as shown in Figure 5, one finds that port 44 uncovers inlet 38b as the shutter 39 uncovers the inlet 38a. Thus in Figure 5, with the throttle in the same position as in Figure 6, we admit air through two inlets, whereas in Figure 6, we admit air through only one.

This ability to advance or retard the time of the admission of air on beginning the turning movement of the valve 3 and the gasoline valve, is found to be of great value in adjusting the carburetor to meet varying conditions encountered on different makes of engines.

The second feature of importance is the screws 42, to increase or decrease the volume of air flowing through inlets 38a, etc., and thereby enrich or impoverish the mixture at various points on turning the valves from closed to full open position; thus obviating the necessity of regulating the fuel supply.

Assume that idling conditions have been satisfactorily established and closures 46, singly or together are set so that the timing is perfect. Now turn parts to more open position as shown in Figure 7. Here inlets 38a, 38b and 38c are

fully open. If in this position the mixture is found to be "lean", the port 38a can be partly closed by its screw 42, as may be required, and if closing 38a does not sufficiently enrich the mixture, one can similarly restrict port 38b; and thus further diminish the volume of inflowing air until it has the necessary ratio to the volume of gasoline drawn into the device when the parts are in this half open position.

The same procedure is followed, and the same results obtained when the parts are in full open position or in any other position, and it is this capacity for regulating and modifying the air volume in reference to the fuel supply at all throttle positions to produce a constant air-gasoline composition without additional regulation of the fuel, that constitutes the chief feature of my invention. I am enabled to regulate and adjust the relatively greater volume of air in a manner independent of and supplemental to the action of the principal means for governing the admission of the air comprising the valve 3 and shutter valve 39; and especially by the presence of the screws 42, the operation of the carburetor is made perfect; since for any position, the screws 42 can be set to admit the exact quantity of air needed to the space 35, while the entrance of the fuel is left entirely to the valve in the projection 15. Any slight structural fault can be compensated and all the carburetors can be adjusted on test before leaving the factory, to work in an entirely satisfactory way.

Having described my invention, what I believe to be new and desire to secure and protect by Letters Patent of the United States is:—

1. A valve mounted on the outside of a casing having a plurality of inlets, the valve being movable to uncover said inlets successively, said valve having one or more ports to cooperate with said inlets, closures for said ports to cover same, and separate means adjacent each inlet disposed on the casing to regulate independently the size of said inlets.

2. A valve to be mounted on the outside of a casing having a plurality of inlets, the valve being movable to uncover the inlets successively, said inlets leading to the inside of the casing, elements on the valve for controlling said inlets, and separate means adjacent each inlet disposed on the casing to regulate independently the size of the inlets.

3. A valve to be mounted on a casing having inlets leading to the inside thereof, said valve having openings with closures for controlling said inlets, and means on the outside of the casing adjacent each inlet for independently regulating the size of the latter.

4. A valve to be mounted on the outside of a casing having a plurality of inlets, the valve being movable to uncover the inlets successively, said inlets leading to the inside of the casing, movable elements on the valve for controlling said inlets, and separate means adjacent each inlet disposed on the casing to regulate independently the size of the inlets.

5. A valve to be mounted on a casing having inlets leading to the inside thereof, said valve having openings with closures for controlling said inlets, and means on the outside of the casing adjacent each inlet for independently regulating the size of the latter, said means comprising screw elements mounted in operative position with respect to said inlets.

GUY L. KENNEDY.