Oct. 27, 1931. C. E. MONOSMITH ET AL 1,828,902

CARBURETOR

Filed April 13, 1928 2 Sheets-Sheet 1

FIG. 11.

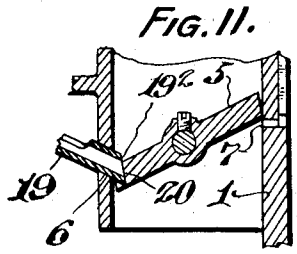






FIG. 1.

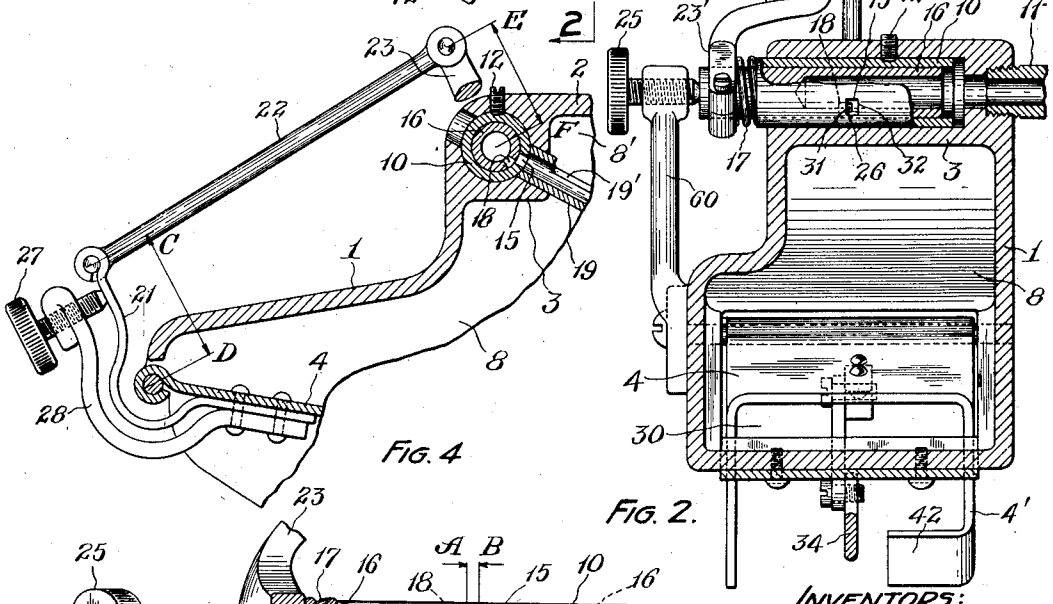



FIG. 4.

FIG. 2.

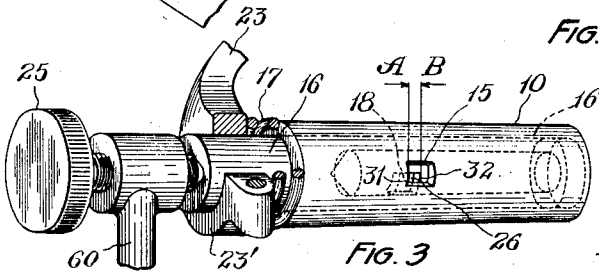



FIG. 3.

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Oct. 27, 1931. C. E. MONOSMITH ET AL 1,828,902

CARBURETOR

Filed April 13, 1928 2 Sheets-Sheet 2

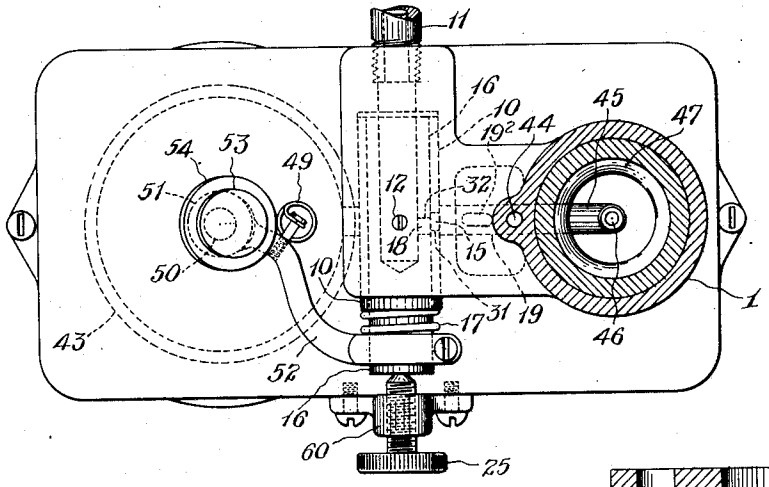



FIG. 6.

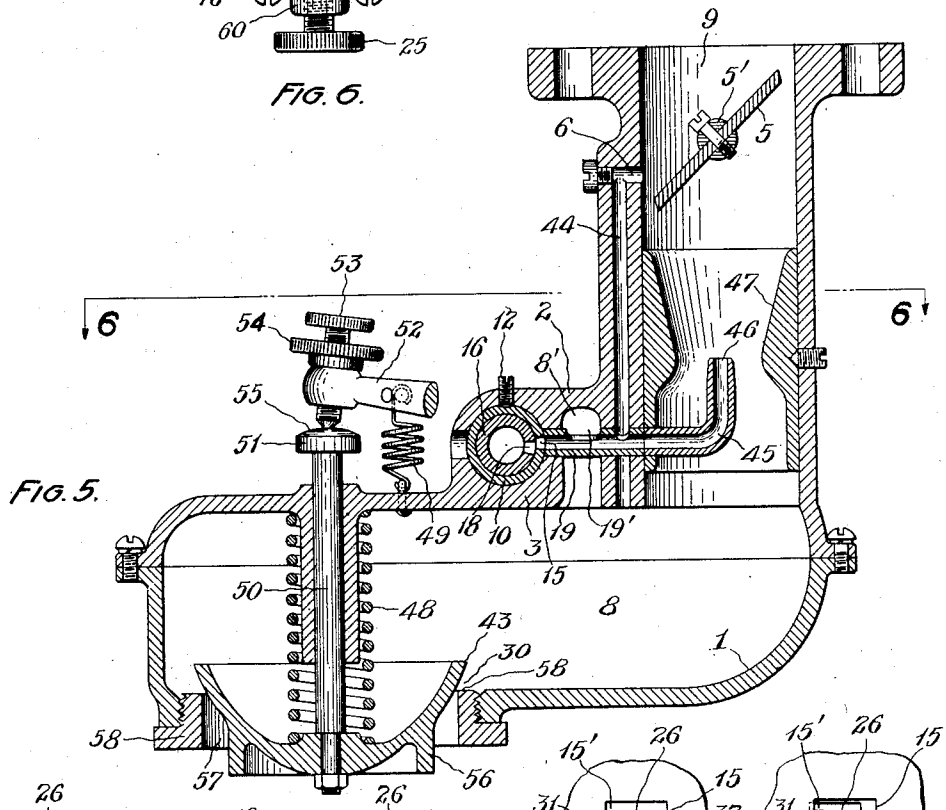



FIG. 5.

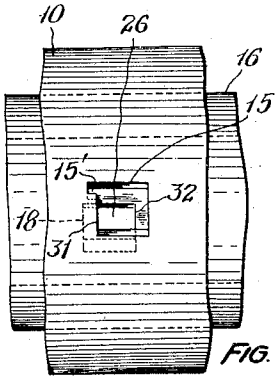



FIG. 9.

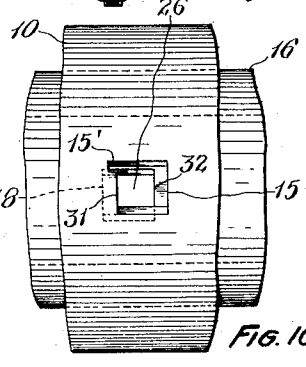



FIG. 10.

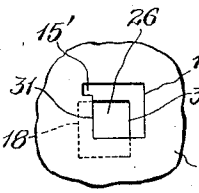



FIG. 7.

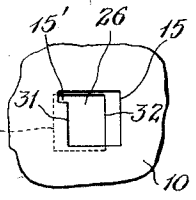



FIG. 8.

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Patented Oct. 27, 1931 1,828,902

# UNITED STATES PATENT OFFICE

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## CARBURETOR

Application filed April 13, 1928. Serial No. 269,624.

Our invention relates to carburetors for internal combustion engines, and particularly to the type wherein the fuel valve is controlled by a suction-actuated air valve. Certain principles of this improved carburetor are shown in an application of ourselves and Olney B. Monosmith, Ser. No. 602,032, which issued into U. S. Patent No. 1,666,296, granted April 17, 1928, and will be herein briefly described, by reference to the accompanying drawings, in order to make clear the construction and operation of the particular improvements claimed in this application and to show their specific application to the carburetor described in said patent. These features of said patent relate to a two-movement fuel valve, this movement being in different directions; a fuel valve and an air valve having proportional valve areas, the movements of the fuel valve in one direction being produced by and proportionate to the movements of the automatic air valve, the opening of the fuel valve during its movements in this direction being, throughout the entire range of movement, in an amount having a constant ratio to the opening of the air valve, the movement of the fuel valve in the other direction being adapted continuously to change the value of the constant ratio; and means providing a common vacuum into which the fuel and air valves feed. The means controlling the air supply are held closed, preferably spring-loaded, so as to permit the admission of air only above a certain predetermined minimum vacuum in the forward part of the casing immediately within the air opening, thereby obviating undesirable effects because of fluctuating fuel levels and because of the surface tension of the liquid fuel: also, obviating the change of the fuel flow from the turbulent to the streamline flow. On the other hand, in order that the power of the engine may not be limited at full load, the restraint by which the air opening cover is held closed does not exceed a predetermined maximum. Therefore, the vacuum chosen for the casing chamber into which the air and fuel both primarily feed lies between certain upper and lower limits.

The prevailing opinion of those skilled in the art seems to favor a relatively lean mixture for economy and smooth and cool motor conditions up to substantially the point of maximum power requirements, where a richer power mixture is desirable. Our construction meets these conditions within the limits of economical and maximum power mixtures. It is the design of the improvements shown in this application to modify the constant ratio of areas of the fuel and air valve openings to meet practical conditions, and at the same time use the main principles of the invention shown in said Patent No. 1,666,296. This modification consists in providing means for furnishing a comparatively richer mixture for maximum power and speed at full open position of the air valve. This purpose is effected in a manner that will permit of a substantially constant fuel-to-air ratio up to any predetermined amount of opening of the fuel and air valves, in combination with supplemental means which will provide a richer or maximum power mixture for full opening. Further modifications of this invention consists in the elimination of the atomizing lug shown in said Patent No. 1,666,296, and the provision of means whereby some of the fuel passes the throttle instead of all of the fuel by-passing the throttle as is true of the device shown in said patent.

Other incidental modifications and improvements of the device of said Patent No. 1,666,296, will be mentioned hereinafter and fully described in the accompanying description and shown in the accompanying drawings.

The annexed drawings and the following description set forth in detail certain means embodying our invention, such means disclosing, however, but two of the various forms in which the principle of the invention may be applied.

In said annexed drawings:

Figure 1 represents a longitudinal section of the preferred form of our improved carburetor;

Figure 2 is a transverse section, taken in the planes indicated by the line 2—2, Figure 1;

Figure 3 is a perspective view of the automatically-operable fuel valve and a broken view of certain connected parts, the view being upon an enlarged scale and also showing manually-operable means for adjusting the valve in one direction;

Figure 4 is a fragmentary view of certain elements shown in Figure 1 modified to the extent of varying somewhat the means connecting the air and fuel valves for the purpose of gradually enriching the mixture, this modification being hereinafter fully described;

Figure 5 is a longitudinal section of a second form of our improved carburetor;

Figure 6 is a plan section taken in the plane indicated by the line 6—6, Figure 5;

Figures 7 and 8 are diagrammatic views indicating a certain construction of fuel valve adapted to effect the feeding of larger amounts of fuel compared to the amount of air fed, at the full open air valve position;

Figures 9 and 10 are enlarged fragmentary views of the valve parts effecting the result shown in Figures 7 and 8; and

Figure 11 is a fragmentary sectional view showing the throttle valve of Figure 1 in its closed position.

Referring to the annexed drawings in which the several elements are indicated in the different views by the same respective ordinals, a main carburetor casing 1 of a general L-shape formation is provided with a thickened wall section 3 within which is mounted a fuel valve hereinafter fully described, this section 3 being connected to the main casing wall by a web member 2, the members 2 and 3 together with the adjacent portion of main casing 1 constituting an auxiliary casing and forming an auxiliary chamber 8′ whose purpose will be hereinafter fully described.

Referring particularly to Figures 1 to 4, a rectangular air valve 4 is pivotally mounted at one end and suction-actuated so as to open inwardly of the casing 1 and permit air to enter through the opening or inlet 30 whose size is determined by the amount of opening movement of the valve 4. A throttle valve 5 is also mounted in the casing 1, being secured to the shaft 5′ actuated from any convenient point upon the machine to which the carburetor is adapted. The several features described divide the main casing 1 into chambers 8, 8′ and 9, the chamber 9 being hereinafter designated as a high vacuum chamber, the chamber 8 being a low vacuum chamber, and the chamber 8′, which is a continuation of chamber 8 and is located aside from the main line of travel of air from the opening 30 to the chamber 9, being subject to the same vacuum as the chamber 8. The throttle valve 5 thus divides main casing 1 into a forward low vacuum portion comprising chambers 8 and 8′ and a rearward high vacuum chamber, the mixture outlet being at the rear end of casing 1.

Secured by a set screw 12 in the wall 3 of the auxiliary chamber 8′ is a fuel valving means comprising a cylindrical sleeve 10 and a rotatable member 16. This sleeve 10 has a port 15 communicating with a conduit 19 extended through an opening or port 6 in the casing 1 and terminating in an inwardly-projected portion 20 disposed adjacent the throttle valve 5 in the closed position of the latter, this conduit member 19 providing a passage $19^2$ for fuel from the port 15 to the high vacuum chamber 9, the further construction and operation of all of which parts will be hereinafter given in detail. Within the sleeve 10 is the rotatable valve member 16 having a port 18 adapted to register more or less with the port 15, according to the extent to which the valve member 16 is automatically rotated, as hereinafter described, and according to the extent of the original manual longitudinal setting of the valve member 16, as will also hereinafter be fully described. The interior of this valve member 16 communicates with a conduit member 11, Figure 2, which in turn communicates with any suitable desired type of fuel float chamber, none of which is it considered necessary to show in the accompanying drawings. The valve member 16 is mounted to be longitudinally movable within the sleeve 10 by means of an adjusting screw 25 threaded through a bracket 60 secured to the casing 1 and acting upon the sleeve 16 to move the same against the tension of a spring 17 which encircles the valve 16 and abuts at one end the sleeve 10 and at the other end the inner face of a hub portion 23′ of an angular arm 23 hereinafter fully described. We indicate the fuel port formed by the registering areas of the openings 15 and 18 by the ordinal 26, Figure 3, and we indicate the port edge of the opening 18 by the ordinal 32 and the port edge of the opening 15 by the ordinal 31.

Secured to the air valve 4 is a spring-arm 21 and secured to the fuel valve 16 is the arm 23, these two arms being pivotally connected to the two respective ends of a rod 22. The distance C—D, Figure 1, represents the distance between the pivotal axes of the two ends of the arm 22 and the pivotal axis of the air valve 4 and the fuel valve 16, respectively, and the lines representing the shortest distances between these respective points are parallel and of the same length. It is thus seen that the movements of the air valve 4 will effect corresponding movements of the fuel valve 16 and proportionately change the amount of the registering area of the fuel ports 15 and 18, whereby coordinated proportionate valving of air and fuel is obtained. For idling adjustment, the position of the fuel valve 16 relative to the air valve 4 can be adjusted by a thumb screw 27 threaded

through a bracket 28 and bearing at its outer end against the spring arm 21 which latter bears against the screw 27 with considerable pressure.

The air valve 4 is set or controlled by a spring 24 whose tension determines the amount of vacuum in the low vacuum chamber 8. This spring 24 is contained in a dashpot casing 29 within which is a plunger 13 mounted upon the spring 24 forming a chamber 40. The chamber 40 is connected to the float chamber through a small opening 41. The casing 1 is formed with a port 7 communicating with the interior of the casing 29, this port 7 being located so that it is adjacently forward of the throttle valve 5 when in its closed position. The plunger 13 is connected by a link 36 with a lever 34 pivoted intermediate its ends upon a pin 35 and connected by means of an open link 33 with the air valve 4. The purpose of the open link construction 33 is to prevent injury in case of back-fire. This last-described construction thus controls the opening of the air valve 4 and determines the vacuum of the chamber 8. This construction also acts as an accelerator upon acceleration of the motor and furthermore prevents the air valve 4 from fluttering. The spring 24 also serves to take the slack out of the connecting linkage. The acculerator operation is as follows: When the air valve 4 is opened by the suction in the chamber 8, the movement of the valve 4 causes the plunger 13 to descend and momentarily raises the fuel level 37 high enough to permit fuel to be drawn into the chamber 8 through the small opening 7 whence it is carried into the engine manifold by the air current passing the throttle valve 5. The height of the fuel in the chamber 40 is gradually equalized with the height in the source of supply through the medium of the restricted opening 41. In order to obviate the possibility of the fuel being drawn through the opening 7, when the plunger 13 is not depressed, we provide an annular groove 38 and a vertical groove 39 in the wall of casing 29 immediately adjacent and above the level of the opening 7. The annular groove 38 also obviates the possibility of the plunger 13 closing the opening 7 and interfering with the fuel feed through said opening, when the plunger 13 is depressed.

It is evident from the aforegoing description that, the spring 24 being placed under suitable tension to provide the desired differential of pressure between atmospheric pressure and that of the chamber 8, the movements of the air valve 4, induced by the movements of the throttle valve 5 and the speed of the motor, will maintain this differential within the required limits, and this vacuum of the chamber 8 produced by this differential has been termed the "low vacuum". By the term "low vacuum", as applied to chamber 8, we refer to a vacuum that is, preferably, kept to about one pound or less; whereas, in practice, the vacuum in chamber 9 may be at times as high as eight pounds. Spring 24 connected to air valve 4 will maintain the vacuum in chamber 8 within sufficiently close limits to prevent any material change in the flow of air relative to the flow of liquid fuel, due to variations of vacuum in said chamber 8. This same low vacuum will also be maintained in the chamber 8'. During the manufacture of the carburetor a suitable tension is determined for the spring 24, according to the charatcer of the carburetor, the service for which the same is designed, and the stresses to which springs are subjected according to standard published works on springs.

The conduit member 19 is provided with an opening 19' on the upper side which admits air from the chamber 8' and thus prevents the high vacuum in chamber 9 affecting the fuel valve ports 15 and 18. The throttle 5 is made relatively thick so that when the throttle is in its closed position, the opening $19^2$ of the conduit member 19 is nearly closed. By such a construction we can make the conduit member 19 and the openings 19' and $19^2$ of ample dimensions for full load and also provide for slow idling of the engine.

It is evident that the fuel port 26 discharges into the low vacuum of the chamber 8'. Therefore, the air and the fuel will each discharge into a low vacuum and this vacuum will be the same. Now, further, the opening and closing of the fuel nozzle of the fuel port 26, due to the mechanical assembling hereinbefore described and shown in the accompanying drawings, will be proportional to the opening and the closing of the air valve 4. The aperture 30 through which the air enters the chamber 8 is rectangular, as plainly shown in Figure 2, and, as before mentioned, the openings 15 and 18 forming the fuel nozzle 26 are rectangular so that any increment of air valve and fuel valve openings will admit a corresponding increment of air and fuel.

The ratio between the openings of the air and fuel valves being once determined, this ratio remains constant throughout the whole range of operation of the air valve, insofar as apparatus thus far described is concerned, some modification thereof occurring at a predetermined amount of fuel valve and air valve openings, in the manner and by the mechanism hereinafter fully described. In order that the turbulent flow of the fuel may be preserved throughout the entire range of operation, despite the fluctuations in vacuum encountered in practice, we load the air valve 4 by the spring 24 between certain lower and upper limits of vacuum, preferably a lower limit of about 2 ounces and an

upper limit of about 1 pound below atmosphere, i. e., between the inside of chamber 8 and the atmosphere. The reasons for these practical limits are: If the suction in chamber 8 is much more than 1 pound the power of the engine is limited at full load. If the suction is much less than 2 ounces, there is an undesired effect from fluctuating fuel levels and from the surface tension of the liquid fuel; also, the fuel flow may change from the turbulent to the streamline flow, which causes variations in the fuel flow disproportionate to the variations in the air flow. Although, as above stated, practical operation presents certain fluctuations of the vacuum, still the tension of the spring 24 is determined for any one carburetor so as to provide a vacuum in the chamber 8 between two ounces and one pound, as deemed desirable, and in theory this vacuum is considered to be maintained constant, although in practice it actually varies, this variation being well within the above limits under usual operating conditions and not affecting the constant ratio between the effective areas of the fuel and air openings, and therefore not affecting the relative flow of fuel to air. In this type of carburetor, a considerable friction in the air and fuel valve mechanism, or a wider fluctuation in the differential pressure between chamber 8 and the atmosphere, has no material effect on the relative flow of air-to-fuel either in theory or practice. The conduit portion 19 by means of which the fuel enters the chamber 9 is made just large enough to pass the fuel at the maximum opening of the throttle valve 5 without any restrictive or choking effect. This determination of the size of the part 19 is obtained by experience and tests of the type of carburetor for the particular service required.

It will be noted that the air and fuel normally used are mixed upon the high vacuum side of the throttle valve 5 and that, therefore, all of the fuel is by-passed from the low vacuum of the chamber 8′ to the high vacuum of the mixing chamber 9, with the exception of the fuel introduced through port 7 upon acceleration of the motor. The advantages of this particular operation reside in the facts that the proportional feeding of the fuel is easier to accomplish in the low vacuum chamber; whereas, the mixing of the fuel with the air in the high vacuum chamber provides an unobstructed passage for the mixture into the engine manifold. Inasmuch as in carburetor practice it is desirable to atomize and vaporize the fuel to as great an extent as possible, this effect is partially nullified if the mixing takes place on the low vacuum side of the throttle because the spray condenses on the throttle and feeds off in relatively large drops. Also, our mixing upon the high vacuum side of the throttle results in the flow of a homogeneous mixture to the engine manifold; whereas, the feeding of the fuel off the throttle in relatively large drops, when the mixing has taken place on the atmospheric or low vacuum side of the throttle, results in a more or less irregular mixture flowing to the engine manifold. Also, the atomization is best accomplished at the point of highest velocity. This point is on the high vacuum side and close to the throttle margin, and our construction permits by-passing to this point the fuel used in normal uniform running of the motor.

It is evident that the operation thus far described relates only to the automatic operation occasioned by the suction-actuated air valve. Now, by means of an adjusting screw 25, the sleeve 16 can be moved longitudinally to provide different-sized longitudinal openings therein for the fuel port 26. It is evident, therefore, that any desirable range of fuel feed for motor operation, from idling to full throttle, may be chosen through the medium of proper setting of the adjusting screw 25 and then, under the action of the throttle and the pull of the engine, the fuel valve through the medium of the air valve will move through this chosen range of openings. Inasmuch as the fuel port 26 is rectangular, the area of said port 26 will vary in direct proportion as the distance between the port edges 31 and 32 varies, illustrated by the distance A—B, Figure 3. Therefore, any adjustment effected by the screw 25 will be proportional for all automatic movements of the fuel valve and hence for all openings of the throttle and all the speeds of the motor. We have provided, then, two movements of the fuel valve, at an angle to each other, one movement feeding the fuel proportionately to the flow of air and the other movement varying this proportion. It will be noted that the automatic control of the fuel and air valves maintains a constant ratio between the effective areas of the fuel valve and air valve openings for all automatic movements; further, that the manual control of the fuel valve provides for changing this ratio of effective areas of the fuel valve and air valve openings from one constant ratio value to another constant ratio value.

The parts 20 and 20′ of the tube 19 project through the wall passage 6 at the edge of the throttle which is the point of the highest velocity of the main air stream at small throttle openings, and is a point of high velocity at all times, since as the throttle is opened and its restrictive action is reduced, the velocity of the air through the passage 8—9 increases. The projection 20—20′ of the tube 19 which functions as a spray nozzle, being located at a point of high velocity at all times, insures fine spraying or atomization of the fuel. The restrictive action of the throttle causes a differential of pressure between the high vac-

uum chamber 9 and the vacuum chamber 8—8′ into which the fuel and air feed, which differential serves to draw the fuel through the tube 19 into the mixing chamber 9. Furthermore, the outlet of conduit or tube 19 has a downwardly and outwardly bevelled portion; thus it projects further into the air stream at the point 20 than it does at the point 20′, which construction prevents the possibility of the air blowing into the tube 19 through the opening $19^2$. In fact, the opposite effect results, viz., the tendency is to exhaust the air at $19^2$ and thus aid in drawing the fuel into the air stream.

Referring now particularly to the special air-to-fuel ratio modification shown and claimed in this application, we refer particularly, in so far as Figures 1 to 4 are concerned, to a small baffle 42 attached to the side plate 4′ of the air valve 4. In the construction shown in the accompanying drawings, this baffle 42 is rectangular but it could be triangular, curved or of any other shape, or any other suitable size than that shown, to give the desired variation in the ratio of fuel-to-air mixture. The operation is as follows: Assuming the engine running and the carburetor functioning, as the throttle valve 5 is opened and more air enters the intake manifold, the air valve 4 is lifted and the fuel valve 16 is proportionately opened, giving a constant ratio of fuel-to-air, until valve 4 approaches its full opening, when the baffle 42 will partially close the opening 30, thus restricting the increase in the flow of air, compared to the increase in the flow of fuel, resulting in the richer or maximum power mixture at full air valve opening. Our particular baffle member 42 provides the same relative or percentage increase of fuel, irrespective of the adjustment of the ratio-changing screw 25.

A particular form of apparatus for the purpose last described is suggested in Figure 4. This construction produces, however, a progressively proportionate fuel valve actuation as the air valve is opened and thus a progressive increase in richness of mixture as the air and fuel valves are opened in coordination, the increasing ratio of fuel to air being small at first and becoming relatively greater as the valves approach full open position, the particular construction consisting in shortening the distance E—F, on the fuel valve end of the rod 22, as compared to the length of the normal line C—D, hereinbefore described.

Referring particularly to the construction shown in Figures 5 and 6, we modify the construction described with reference to Figures 1 and 4, in the following particulars. The chamber of the carburetor casing 1 is of nonrectangular cross-section and the air valve 43 is of the poppet type, formed by means well known in the art to give the area of the annular air opening 30 a direct proportion to the lift of the valve 43 from its seat 58. The degree of vacuum in the low vacuum chamber 8 is determined by the tension of springs 48 and 49, the latter being connected at one end to the casing 1 and at the other end to an arm 52 secured at one end to the rotatable valve member 16. The spring 48, as shown, is disposed between the upper wall of the chamber 8 and the inner face of the valve 43. The movement of the air valve 43 is communicated to the fuel valve member 16 through a valve stem 50 having a cap member 51 provided with a slightly curved surface 55 to insure the proportionate angular movement of the arm 52 which is supported upon the surface 55 by means of a thumb screw 53, idling adjustment being effected by adjusting the thumb-screw 53 and the member 54 serving as a lock nut. As thus far described, this form of carburetor functions similarly to that described with reference to Figures 1 to 4, the particular means for obtaining the richer fuel-to-air ratio at full open throttle consisting of a circular flange or baffle 56 projected downwardly from the valve 43 whereby when valve 4 lifts high enough to cause the area of the air opening 30 to approach the area of the opening 57 between the flange 56 and the seat 58 of the valve 43, the mixture fed to the engine is enriched because there is a slight relative choking effect on the air caused at about full air valve opening by the flange 56 in the air opening 30, as is true of the device shown in Figures 1 to 4. This permits the carburetor to be adjusted for economical operation for normal driving and automatically gives a more powerful mixture for a full air valve opening or higher speeds.

We show a further modification in Figures 5 and 6 in that when the throttle valve opens for engine loads higher than idling or very light loads, not all the fuel by-passes the throttle 5 through the conduits 19 and 44 and port 6, but some of it is fed into the air stream forwardly of the throttle 5 through the medium of a tube 45 communicating with the tube 19 and formed with a nozzle member 46 located within and centrally of a venturi 47. This form dispenses with the use of the atomizing and vaporizing lug and permits handling of the fuel, after it has been measured by the fuel valve members 10 and 16, in a manner well known to those skilled in the art. It will be seen that in this modification, just as in that of Figures 1 to 4, the fuel is measured while subject to the low vacuum prevailing at opening 19′.

Referring particularly to Figures 7, 8, 9 and 10, we show means for increasing the richness of the mixture at full air valve opening by means of a certain construction of fuel valve instead of a restrictive construction of air valve. This fuel valve construction may be employed to enrichen the mixture when it

is desired not to restrict the air opening or inlet 30. Figures 7 and 8 show diagrammatically the fuel valve openings; whereas, Figures 9 and 10 show the actual shape of the openings in the cylindrical valve members. We form a notch 15′ in the wall of the valve member 10 so as to increase the size of the opening 15 at that end which comes into play when the valve is substantially at full open position, so that as the fuel valve approaches maximum opening, this notch is uncovered, thus relatively increasing the supply of fuel and consequently enriching the mixture. This notched portion of the opening 15 may be of any desired size or shape to produce the necessary results, and can be provided in the movable valve member 16 instead of in the stationary valve member 10, as shown. It is obvious that this notch 15′ constitutes, in fact, an additional fuel port supplementing the fuel port formed by opening 15, when opening 18 is in registration therewith.

With particular reference to the construction of the fuel valve, we point out that in said Patent No. 1,666,296, the automatically-movable member 16 of the valve is the external member; whereas, in the form of valve shown in this application the automatically movable valve member 16 is the inner member.

Referring briefly to the different means of obtaining an increase in the ratio of fuel to air for the large power demands on the carburetor, we wish to point out that in that type wherein the increase in richness of mixture is accomplished by modifying the air-valve opening, as illustrated in Figures 1 to 3, the increase is always in the same ratio, irrespective of the position of the ratio changing member. For example: Assuming first that the carburetor is not so modified, the opening of the air-valve varies with the demands of the motor, always opening sufficiently to maintain a certain or predetermined degree of vacuum in chamber 8. Now, if the modifying means or baffle is positioned in the air-valve opening, the air-valve will open enough further to maintain the same degree of vacuum in the chamber 8 as before. This greater movement of the air-valve is in proportion to the size of the baffle. Now, since the fuel valve opening is at all times in proportion to the movement of the air-valve, the relative increase of fuel to air caused by the air-valve modification is always in the same ratio irrespective of the position of the ratio-changing means. Also, it will be noted that the baffle does not restrict the air intake of the motor, but in effect only increases the relative flow of fuel to air; hence, does not reduce the volumetric efficiency of the motor. Attaching the baffle to the air-valve is one form of this preferred type of construction, but it need not necessarily be so attached but, as will be readily understood, might be attached to the casing 1 so as to extend into or cover a portion of the air-valve opening at or near the full open position of the air-valve.

When the notched fuel port illustrated in Figures 7 to 10 is utilized, the increase in the fuel flow relative to the air flow is a constant quantity for all positions over the range of the field within which the notched fuel port operates, the amount of the increase being controlled by the area of the notch 15′, which area is constant. In the various forms of the invention mentioned above, it will be seen that the fuel and air are valved in constant ratio through the greater part of the valving range of the fuel and air valves and that the ratio of fuel and air is changed for the remainder thereof, that is, at full valve opening. When some of the connections between the air-valve and fuel valve are shortened, as has been described relative to Figure 4, the increase in effective area of the fuel valve opening relative to the area of the air-valve opening is progressive, slow at the start and increasing as the valves open, the change in the ratio of the area of the fuel valve and air-valve openings being capable of being mathematically plotted by a curve.

In the foregoing description and in the following claims, the term tension is employed, not in the specific sense of a stretched condition, but in its broad meanings of any condition or state of strain, or of the force of property in the spring or other element causing or tending to cause such strained state. Thus springs 24 and 48, in a compressed condition, and spring 49, in a stretched condition, are each referred to as being under tension.

What we claim is:

1. In carburetors, the combination of a main casing formed with a mixture outlet and with an air-opening; a suction-actuated air valve for said opening, said valve being loaded to maintain a vacuum between predetermined minimum and maximum vacuum limits; a throttle valve between said mixture outlet and said air valve and dividing said casing into a high vacuum chamber and a low vacuum chamber; a port formed in the casing adjacently rearward of the edge of said throttle valve when the latter is in its closed position; an auxiliary casing forming an auxiliary chamber commuicating with the main casing through the said port and also communcating with the main casing between said throttle valve and said air valve; means forming a conduit adapted to communicate with a source of fuel supply and having a fuel port and a movable valve member controlling said fuel port; means forming a conduit subject to the vacuum of said auxiliary chamber and adapted to convey fuel from said fuel port to said first-mentioned port; means connecting said air valve and said fuel valve to move the latter proportionately to the movements of the former;

and means for increasing the amount of fuel at substantially full air-valve opening relative to the amount of air.

2. In carburetors, the combination of a main casing formed with a mixture outlet and with an air-opening; a suction-actuated air valve for said opening, said valve being loaded to maintain a vacuum between predetermined minimum and maximum vacuum limits; a throttle valve between said mixture outlet and said air valve and dividing said casing into a high vacuum chamber and a low vacuum chamber; a port formed in the casing adjacently rearward of the edge of said throttle valve when the latter is in its closed position; an auxiliary casing forming an auxiliary chamber communicating with the main casing through the said port and also communicating with the main casing between said throttle valve and said air valve; means forming a conduit adapted to communicate with a source of fuel supply and having a fuel port and a movable valve member controlling said fuel port; means forming a conduit subject to the vacuum of said auxiliary chamber and adapted to convey fuel from said fuel port to said casing port; means connecting said air valve and said fuel valve to move the latter proportionately to the movements of the former; and a baffle member actuated by the movements of said air valve to reduce said air opening relative to the effective size of the fuel valve opening at full air-valve opening.

3. In carburetors, the combination of a main casing formed with a mixture outlet and with an air-opening; a suction-actuated air valve for said opening, said valve being loaded to maintain a vacuum between predetermined minimum and maximum vacuum limits; a throttle valve between said mixture outlet and said air valve and dividing said casing into a high vacuum chamber and a low vacuum chamber; a port formed in the casing adjacently rearward of the edge of said throttle valve when the latter is in its closed position; an auxiliary casing forming an auxiliary chamber communicating with the main casing through the said port and also communicating with the main casing between said throttle valve and said air valve; means forming a conduit adapted to communicate with a source of fuel and having a fuel port and a movable valve member controlling said fuel port; means forming a conduit subject to the vacuum of said auxiliary chamber and adapted to convey fuel from said fuel port to said casing port; means connecting said air valve and said fuel valve to move the latter proportionately to the movements of the former; a second port formed in the main casing adjacently forwardly of the edge of said throttle valve when the latter is in its closed position; a source of fuel adapted to have fuel supplying communication with said second port; and means for effecting said communication when the motor is accelerated and for interrupting the same when the motor is pulling steadily or is retarded.

4. In carburetors, the combination of a main casing formed with a mixture outlet and with an air-opening; a suction-actuated air valve for said opening, said valve being loaded to maintain a vacuum between predetermined minimum and maximum vacuum limits; a throttle valve between said mixture outlet and said air valve and dividing said casing into a high vacuum chamber and a low vacuum chamber; a port formed in the casing adjacently rearward of the edge of said throttle valve when the latter is in its closed position; an auxiliary casing forming an auxiliary chamber communicating with the main casing through the said port and also communicating with the main casing between said throttle valve and said air valve; means forming a conduit adapted to communicate with a source of fuel supply and having a fuel port and a movable valve member controlling said fuel port; means forming a conduit subject to the vacuum of said auxiliary chamber and adapted to convey fuel from said fuel port to said first-mentioned port; means connecting said air valve and said fuel valve to move the latter proportionately to the movements of the former; a second port formed in the main casing adjacently forwardly of the edge of said throttle valve when the latter is in its closed position; a dash-pot casing forming a chamber communicating with the main casing through said second port; a source of fuel supply in communication with said last-mentioned chamber; and a spring-mounted plunger disposed in said last-mentioned chamber, said plunger being connected to said air valve and the tension of the spring of said plunger-mounting constituting the loading upon said air valve, the normal fuel level in said last-mentioned chamber being below said second casing port.

5. In carburetors, the combination of a main casing formed with a mixture outlet and with an air-opening; a suction-actuated valve for said opening, said air valve being loaded to maintain a vacuum between predetermined minimum and maximum vacuum limits; a throttle valve between said mixture outlet and said air valve and dividing said casing into a high vacuum chamber and a low vacuum chamber; a port formed in the casing adjacently rearward of the edge of said throttle valve when the latter is in its closed position; an auxiliary casing forming an auxiliary chamber communicating with the main casing through the said port and also communicating with the main casing between said throttle valve and said air valve; means forming a conduit adapted to communicate with a source of fuel supply and

having a fuel port and a movable valve member controlling said fuel port; means forming a conduit subject to the vacuum of said auxiliary chamber and adapted to convey fuel from said fuel port to said casing port; means connecting said air valve and said fuel valve so as to vary the area of the fuel valve opening, throughout the entire range of movement, in an amount having a constant ratio to the area of the opening of the air valve; means for adjusting said fuel valve so as to change the constant ratio from one value to another; and means for increasing the amount of fuel.

6. In carburetors, the combination of a main casing formed with a mixture outlet and with an air-opening; a suction-actuated air valve for said opening, said valve being loaded to maintain a vacuum between predetermined minimum and maximum vacuum limits; a throttle valve between said mixture outlet and said air valve and dividing said casing into a high vacuum chamber and a low vacuum chamber; a port formed in the casing adjacently rearward of the edge of said throttle valve when the latter is in its closed position, said throttle valve being formed with a notched portion adjacent said port; an auxiliary casing forming an auxiliary chamber communicating with the main casing through the said port and also communicating with the main casing between said throttle valve and said air valve; means forming a conduit adapted to communicate with a source of fuel supply and having a fuel port and a movable member controlling said fuel port; means forming a conduit subject to the vacuum of said auxiliary chamber and adapted to convey fuel from said fuel port through said first-mentioned port, said last-named conduit being formed with a portion extending into said throttle notch; means connecting said air valve and said fuel valve to move the latter proportionately to the movements of the former; and means for increasing the amount of fuel at substantially full air-valve opening relative to the amount of air.

7. In a carburetor, the combination of a main casing formed with a mixture outlet and with an air-opening; a suction-actuated air valve for said opening, said valve being loaded to maintain a vacuum between predetermined minimum and maximum limits; a throttle valve between said mixture outlet and said air valve and dividing said casing into a high vacuum chamber and a low vacuum chamber; an auxiliary casing forming an auxiliary chamber communicating with the main casing between said throttle valve and said air valve; fuel valving means adapted for communication with a source of fuel supply and comprising a fuel port and a movable valve member controlling said fuel port; a conduit subject to the vacuum of said auxiliary chamber and adapted to convey fuel from said fuel port to said high vacuum chamber; means connecting said air valve and said fuel valve member to move the latter proportionately to the movements of the former; and means for increasing the amount of fuel at substantially full air-valve opening relative to the amount of air.

8. In carburetors, the combination of a main casing formed with a mixture outlet and with an air-opening; a suction-actuated air valve for said opening, said valve being loaded to maintain a vacuum between predetermined minimum and maximum vacuum limits; a throttle valve between said mixture outlet and said air valve and dividing said casing into a high vacuum chamber and a low vacuum chamber; an auxiliary casing forming an auxiliary chamber communicating with the main casing between said throttle valve and said air valve; a fuel valving means comprising a fuel port and a movable fuel valve member controlling said fuel port; a conduit subject to the vacuum of said auxiliary chamber and extending from said fuel port to said high vacuum chamber; means connecting said air valve and said fuel valving means so as to vary the effective area of said fuel port proportionately to the area of the opening of the air valve; and means for increasing the ratio of fuel to air when the area of the air valve opening approaches its maximum.

9. In a carburetor comprising a casing having an air inlet and a mixture outlet a suction-operated air valve controlling said inlet, a throttle valve between said inlet and said mixture outlet and dividing said casing into a high vacuum chamber and a low vacuum portion, fuel valving means adapted for communication with a source of fuel, and a conduit leading from said fuel valving means to said high vacuum chamber and open to said low vacuum portion; the combination of means for proportionately valving air and fuel through the greater part of the valving range of said air valve and of said fuel valving means, and means for changing the ratio of fuel to air through the remainder of the valving range.

10. In a carburetor, the combination of a casing having an air inlet and a mixture outlet; a suction-operated air valve operatively associated with said inlet; a throttle valve between said inlet and said mixture outlet and dividing said casing into a high vacuum chamber and a low vacuum portion; fuel valving means adapted for communication with a source of fuel; a conduit leading from said fuel valving means to said high vacuum chamber, an intermediate part of said conduit being open to said low vacuum portion; means connecting said air valve and said fuel valving means for proportionate valving of air and fuel through the greater part

of the valving range of said air valve and of said fuel valving means; and means for increasing the ratio of fuel to air at substantially full air valve opening.

11. In a carburetor, the combination of a casing having an air inlet and a mixture outlet; a suction-operated air valve for said inlet; a throttle valve between said inlet and said mixture outlet and dividing said casing into a high vacuum chamber and a low vacuum portion; fuel valving means adapted for communication with a source of fuel; means connecting said air valve and said fuel valving means for valving air and fuel in coordination; and a conduit leading downwardly from said fuel valving means into said high vacuum chamber near the closed position of said throttle valve, said conduit having an intermediate part passing through and open to said low vacuum portion and an outlet formed with a downwardly and outwardly bevelled portion.

12. In a carburetor, the combination of a casing having an air inlet and a mixture outlet; a suction-operated valve for said inlet; a throttle valve between said air inlet and said mixture outlet and dividing said casing into a high vacuum chamber and a low vacuum chamber; an auxiliary chamber open to said low vacuum chamber; fuel valving means adapted for communication with a source of fuel; means connecting said air valve and said fuel valving means for actuating the latter; and a conduit adapted to convey fuel from said fuel valving means to said high vacuum chamber, the intermediate part of said conduit passing through said auxiliary chamber and being open thereto, the outlet of said conduit having a downwardly and outwardly bevelled portion extending into said high vacuum chamber immediately adjacent the closed position of said throttle valve, and said throttle valve in its closed position nearly closing said outlet.

13. In a carburetor adapted for use with an internal combustion motor and comprising a main casing having an air inlet and a mixture outlet, a suction-operated valve for said air inlet, a throttle valve between said air inlet and said mixture outlet, fuel valving means adapted for communication with a source of fuel, means connecting said air valve and said fuel valving means for actuating the latter, and a conduit leading from said fuel valving means into said main casing; loading means for said air valve comprising a dash-pot casing adapted to have communication with a source of fuel, a plunger in said dash-pot casing, a spring under tension tending to move said plunger in said dash-pot casing, and means connecting said air valve and said plunger so that opening of said valve causes movement of said plunger against the tension of said spring, said main casing having a fuel port communicating with said dash-pot casing above the normal level of fuel in said casing so that fuel is caused to pass from said dash-pot casing into said main casing when said air valve is quickly opened on acceleration of the motor.

14. In a carburetor having a main casing provided with an air valve, a dash-pot casing adjoining said main casing and having a closed bottom, a spring seated on said bottom, a plunger mounted upon said spring, means connecting said plunger and said air valve so that said spring is maintained under tension by said plunger in the closed position of said air valve and resists opening of said air valve, a peripheral groove in the inner side of the dash-pot casing side walls adjacent said plunger, and a fuel port in said main casing communicating with said groove, said dash-pot casing being adapted to have communication with a source of fuel such that the normal level of fuel in said dash-pot casing is below said groove.

15. In a carburetor, the combination of a main casing having an air inlet and a mixture outlet; a suction-actuated air valve for said inlet; a throttle valve between said inlet and said outlet and dividing said casing into a high vacuum chamber and a low vacuum portion; fuel valving means adapted for communication with a source of fuel and subject to the vacuum of said low vacuum portion; a conduit leading from said fuel valving means to said high vacuum chamber; means connecting said air valve and said fuel valving means for actuating the latter; a fuel port opening into said low vacuum portion of said main casing; a dash-pot casing communicating with said main casing through said fuel port and adapted for communication with a source of fuel so that the normal level of fuel in said dash-pot casing is below said fuel port; and a spring-mounted plunger disposed in said dash-pot casing and connected to said air valve, the spring of the plunger mounting being under tension to provide a loading for said air valve, quick movement of said plunger on quick actuation of said air valve causing fuel to pass from said dash-pot casing into said fuel port.

16. In a carburetor, the combination of a casing having a mixture outlet and an air-opening; a suction-actuated air valve for said opening, said valve being loaded to maintain a vacuum between predetermined minimum and maximum vacuum limits; a throttle valve between said mixture outlet and said air valve and dividing said casing into a high vacuum chamber and a low vacuum portion; fuel valving means adapted for communication with a source of fuel and comprising a fuel port and a movable valve member controlling said fuel port; a conduit subject to the vacuum of said low vacuum portion and leading from said fuel port to said high vacuum chamber; said conduit having a branch

communicating with said main casing forwardly of said throttle valve; means connecting said air valve and said fuel valve member to move the latter proportionately to the movements of the former; and means for increasing the ratio of fuel to air at substantially full air valve opening.

17. In carburetors, the combination of a main casing formed with a mixture outlet and with an air-opening; a suction-actuated air valve for said opening, said valve being loaded to maintain a vacuum between predetermined minimum and maximum vacuum limits; a throttle valve between said mixture outlet and said air valve and dividing said casing into a high vacuum chamber and a low vacuum chamber; a port formed in the casing adjacently rearward of the edge of said throttle valve when the latter is in its closed position; an auxiliary casing forming an auxiliary chamber communicating with the main casing between said throttle valve and said air valve; means forming a conduit adapted to communicate with a source of fuel and having a fuel port and a movable valve member controlling said fuel port; means forming a conduit subject to the vacuum of said auxiliary chamber and adapted to convey fuel from said fuel port to said first-mentioned port, a branch of said second-mentioned conduit communicating with said main casing forwardly of said throttle valve; a venturi secured in said casing adjacent the outlet of said branch conduit and surrounding said outlet; means connecting said air valve and said movable valve member to move the latter proportionately to the movements of the former; and means for increasing the amount of fuel at substantially full air-valve opening relative to the amount of air.

18. In a carburetor, the combination of a casing having an air inlet and a mixture outlet; a suction-actuated air valve operatively associated with said air inlet, said valve being loaded to maintain a vacuum between predetermined minimum and maximum limits; a throttle valve between said mixture outlet and said air inlet and dividing said casing into a high vacuum chamber and a low vacuum portion; fuel valving means adapted for communication with a source of fuel and comprising relatively fixed and movable valve members, one of said members having a fuel port; a conduit leading from said fuel valving means to said high vacuum chamber, said conduit being open to said low vacuum portion; means connecting said air valve and said movable valve member to actuate the latter proportionately to the actuation of the former; and an additional fuel port communicating with said conduit and supplementing said first-mentioned fuel port at substantially full air-valve opening whereby the ratio of fuel to air is increased.

19. In a carburetor, the combination of a casing having an air inlet and a mixture outlet; a suction-operated air valve controlling said air inlet; a throttle valve between said air inlet and said mixture outlet and dividing said casing into a high vacuum chamber and a low vacuum portion; fuel valving means adapted for communication with a source of fuel and comprising a fixed valve member formed with a fuel port and a movable valve member controlling said fuel port; a conduit leading from said fuel port to said high vacuum chamber, an intermediate portion of said conduit being open to said low vacuum portion, and means connecting said air valve and said movable valve member to actuate the latter proportionately to the actuation of the former, said fuel port being of constant section through that part of the range of movement of said movable valve member corresponding to less than substantially full air-valve opening and being of relatively greater section at that part of the range of movement of said movable valve member corresponding to substantially full air-valve opening.

20. In a carburetor comprising a casing having an air inlet and a mixture outlet, a suction-operated valve for said air inlet, a throttle valve between said air inlet and said mixture outlet and dividing said casing into a high vacuum chamber and a low vacuum portion, and fuel valving means adapted for communication with a source of fuel; the combination of a conduit leading from said fuel valving means to said high vacuum chamber and open to said low vacuum portion, means for proportionately valving air and fuel through the greater part of the valving range of said suction-operated valve and of said fuel valving means, means for changing the ratio of fuel to air through the remainder of the valving range, and means for temporarily increasing the ratio of fuel to air when said suction-operated valve is opened.

Signed by us this 10th day of April, 1928.

CLAYTON E. MONOSMITH.
DAVID J. MONOSMITH.

# CERTIFICATE OF CORRECTION.

Patent No. 1,828,902. Granted October 27, 1931, to

CLAYTON E. MONOSMITH ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 16, after the word "forward" insert the words of the edge; lines 30 and 31, for the misspelled word "acculerator" read accelerator, and line 80, for "charatcer" read character; page 6, line 97, for "of" read or; line 117, claim 1, for "communicating" read communicating, and line 119, for "cummuncating" read communicating; page 7, line 115, claim 5, strike out the word "air" and insert the same after the compound word "suction-actuated" in line 114, of same claim; page 8, line 36, claim 6, before the word "member" insert the word valve, and line 86, claim 8, strike out the article "a"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 15th day of December, A. D. 1931.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)