Sept. 19, 1933. H. W. HESS 1,927,090

CARBURETOR

Filed April 26, 1928 2 Sheets-Sheet 1

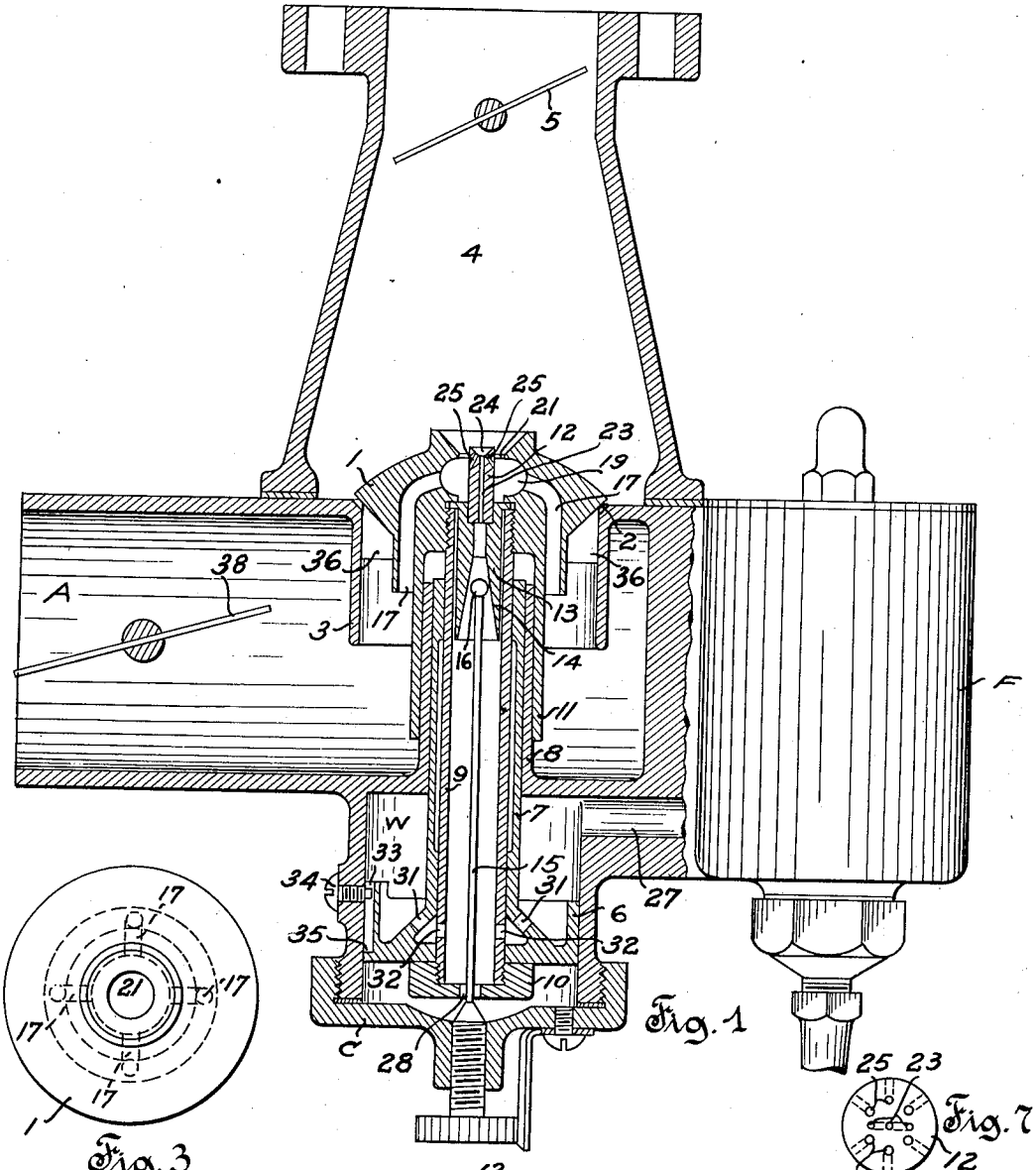


Fig. 1

Fig. 3

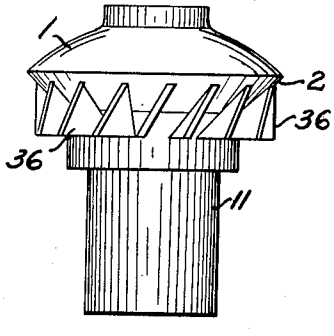


Fig. 2

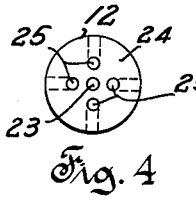


Fig. 4

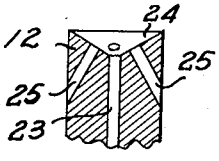


Fig. 5

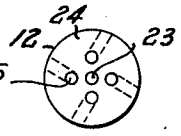


Fig. 6

Fig. 7

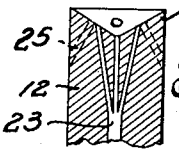


Fig. 8

Inventor

H. W. Hess

by John J. Kane

Attorney

Sept. 19, 1933. H. W. HESS 1,927,090

CARBURETOR

Filed April 26, 1928 2 Sheets-Sheet 2

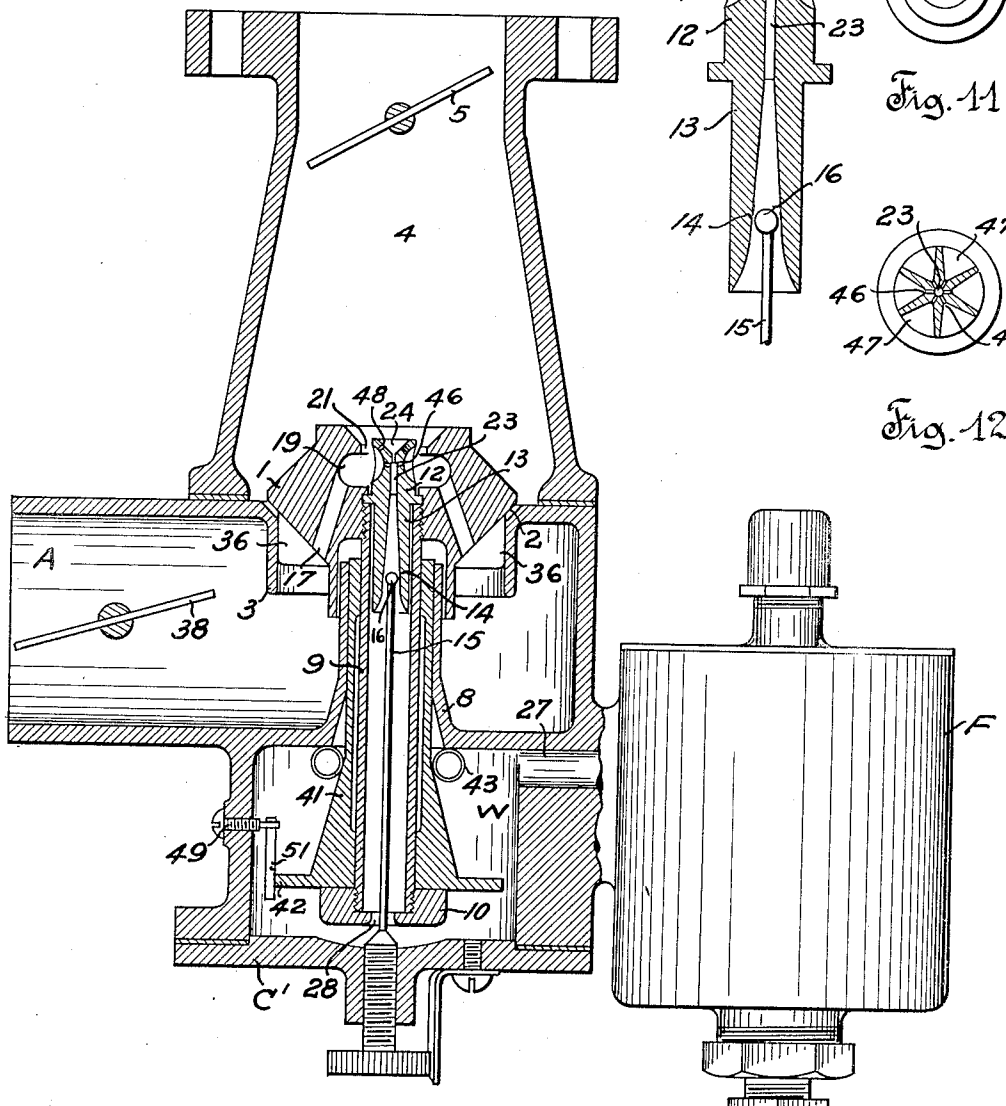


Fig. 9

Fig. 10

Fig. 11

Fig. 12

Inventor
H. W. Hess
by John J. Kane
Attorney

Patented Sept. 19, 1933 1,927,090

UNITED STATES PATENT OFFICE

1,927,090

CARBURETOR

Harry W. Hess, Kansas City, Mo., assignor to Carburetor Control Company, Los Angeles, Calif., a corporation of California

Application April 26, 1928. Serial No. 272,978

8 Claims. (Cl. 261—44)

This invention relates in general to the carburetion or vaporization and conditioning of fuel for internal combustion engines, and it is more particularly concerned with the use of apparatus of the type wherein the admission of a supply of a liquid fuel and air to an expansion or mixing chamber connecting with the inlet to the engine is of a more or less automatic character.

Considerable difficulty has been experienced in connection with carburetion devices of the prior art in attaining that desired degree of uniformity of mixture of air and thoroughly vaporized liquid fuel throughout the full range of ordinarily desired speeds of operation of an internal combustion engine of the liquid fuel type, particularly such as is ordinarily used for driving automobiles, which will result in a satisfactorily high degree of general efficiency and economy of operation of the engine. These difficulties result particularly from improper vaporization of liquid fuel and insufficient mingling or mixture of the liquid fuel and air components, and failure of the air and fuel supply valves to respond with desired or required alacrity or to a uniform degree throughout the full range, in response to operation of the throttle valve which controls the supply of fuel mixture to the engine and the speed and power of the latter.

I have in accordance with the present invention provided a method whereby there may be presented or available at the intake manifold of an internal combustion engine a mixture of thoroughly commingled air and properly vaporized or gasified fuel in proportion which serves to secure the desired or contemplated speed or power of the engine with a great degree of efficiency and economy in the operation of the latter; and I have likewise introduced refinements in the design and construction of carburetors for internal combustion engines which contribute to or facilitate in securing the desired end in the matter of thoroughly commingling the liquid fuel and air fed to the engine, and insuring a desirably quickened response in the supply of such mixture of vaporized fuel and air proportioned to the needs of the engine, as indicated in the operation of the inlet controlling throttle; and I have attained these results with a design and construction which is efficient in operation and of great simplicity and economy in the matter of production.

Among features which contribute particularly to the attainment of desired results sought through the present invention are the provision of means for imparting to the air, at or prior to its entrance to the expansion or mixing chamber of the carburetor, a whirling motion which has the effect of rotating the air valve and the movable element of the liquid fuel valve, insuring the passage to the engine manifold of a satisfactory volume of swirling air and fuel, and this rotation of these parts contributes to maintain the same suspended and free of static friction and hence most readily responsive to variations in the degree of rarefaction or vacuum in the expansion chamber, such as are incident to the operation of the engine throttle. And this increased readiness of response of the valves to the throttle and the consequent variation in the thoroughly mixed and available supply of air and fuel is facilitated by a special design of the controlling means therefor and of the liquid fuel supply parts, the fuel controlling valve being of such design and so related to the fuel supply source as to facilitate the ready drawing of an active stream or body of fuel through the metering opening of the valve, and the fuel discharge nozzle being of such design and so related to the air supply ducts as to assist in securing effective commingling of the liquid fuel and air.

It is a definite object of the present invention to provide an improved design and construction of carburetor for an internal combustion engine wherein provisions are made for insuring an ample and readily available supply of thoroughly commingled air and vaporized liquid fuel at the engine inlet throughout the range of speed and power requirements of the engine.

It is a further object of the present invention to provide a carburetor of improved design and construction for insuring the supply of thoroughly commingled air and vaporized liquid fuel to the inlet of an internal combustion engine and wherein provision is made for projecting or injecting one or more components of fuel mixture into the expansion or mixing chamber in the form of a rotating stream or streams which contribute in a substantial degree toward securing the desired final mixture supplied to the engine.

It is a further object of the present invention to provide an improved method of preparing and presenting a mixture of vaporized liquid fuel and air at the inlet of an internal combustion engine.

Further objects of the present invention include the provision of an improved design of carburetor of the general character referred to hereinabove, wherein a movable part of one or both of the valves for controlling the passage of air and liquid fuel to the fuel-mixing or expansion chamber is rotatable under conditions of normal oper-

ation of the engine, and wherein these valves are so controlled as to be definitely and readily responsive, as to both opening and closing movements, to the engine throttle, and wherein the parts of the liquid fuel controlling valves are of such design and so related to the readily available supply of fuel in the storage source as to insure an exceptionally quickened supply of such fuel to the mixing chamber.

These and other objects and advantages are attained by the present invention, various novel features of which will be apparent from the description and drawings herein, disclosing embodiments of features of such invention, and will be more particularly pointed out in the claims.

In the accompanying drawings:

Fig. 1 is a partly sectional elevation of a carburetor embodying features of the present invention.

Fig. 2 is a view in elevation of a portion of the valve structure disclosed in Fig. 1.

Fig. 3 is an enlarged plan view of the valve structure shown in Fig. 2.

Figs. 4 and 5 are enlarged plan and vertical sectional views, respectively, of a detail of Fig. 1.

Figs. 6 and 7 are views similar to Fig. 4 of modifications.

Fig. 8 is a broken vertical sectional view of the modification shown in Fig. 7.

Fig. 9 is a view similar to Fig. 1 of a carburetor embodying modifications of certain features of the invention.

Figs. 10, 11 and 12 are enlarged vertical sectional, plan and horizontal sectional views, respectively, of a detail of Fig. 9.

In accordance with the disclosure of Fig. 1 of the drawings, F designates a reservoir or chamber provided with a float and an inlet-controlling valve, usually of the needle type, actuated by the float, for regulating the inlet feed of liquid fuel, such as gasoline, to the reservoir and carburetor proper, the reservoir and the inlet-controlling devices therein being of conventional character. The float chamber may be integral with or otherwise supported by and secured in fluid communication with the carburetor proper, the latter including a hollow or cored body portion A open at one side and constituting an air supply chamber, and having a tubular extension at the lower side thereof constituting a chamber or well W which is provided with a closure at its lower end, this closure, indicated at C, being preferably in the form of a removable screw cap.

The body portion or casing A constituting the air chamber is provided at its upper side with a circular opening with the edge of which an air valve in the form of a generally mushroom-shaped head 1, cooperates along a beveled seating portion 2. A depending sleeve or annular flange 3 formed on the upper wall of the casing part A projects downwardly a substantial distance into the body of the air chamber. An expansion or mixing chamber 4 is provided above the air chamber A, and communicating with the valve opening in the upper wall of the air chamber, the air valve 1 opening into this expansion chamber, and the latter being preferably formed by a tubular wall or nipple of larger diameter at its lower side and having a valve 5, usually of the butterfly type, controlling the discharge from the mixing chamber to the inlet manifold of an internal combustion engine, this valve being actuated by the usual throttle-actuating devices.

A dash-pot plunger 6 is fitted in the well W at the lower side of the body portion of the air chamber, the well constituting the cylinder of the dash-pot, and the dash-pot plunger being of conventional type, if desired, with a valve-controlled passage therethrough and an upwardly projecting sleeve extension 7 which fits fairly closely, but still with a sliding fit, within an upwardly projecting sleeve or annular collar 8 formed on the lower side or wall of the air chamber A. A sleeve 9, preferably in the form of a tube and threaded into an aperture formed in the underside of the valve head 1, projects downwardly from the latter and, with a fairly close sliding fit, through the upwardly extending sleeve 7 attached to the dash-pot plunger 6. The lower end of the sleeve or tube 9 is extended below the plunger 6 and there is provided on such sleeve, preferably by threading and definitely affixing thereto, a bearing element 10 whose upper surface is rotatable in thrust engagement with the underside of the dash-pot plunger 6, one or both of the cooperative thrust bearing surfaces of these parts being preferably suitably formed for facilitating lubrication of these surfaces by the liquid fuel in the well. The relation between the dash-pot plunger 6 and the depending sleeve 9 attached to the valve 1 is such that the plunger is moved upwardly by the valve head, the latter being retarded in such movement by the plunger, and the valve head may be movable downwardly independently of the dash-pot plunger. The arrangement is preferably such that the plunger 5 is guided so as to have only a reciprocating movement, the sleeve preferably having a close rotating fit on spaced bearing portions of the sleeve 7.

It will be apparent that the valve head 1 is guided to a considerable extent in its movement upwardly off its valve seat 2, through the cooperation of the sleeve 9 attached to the valve head and the sleeve 7 attached to the plunger 5, the latter sleeve being itself guided through engagement with the inner wall of the annular collar or sleeve 6 secured to the casing A. The underside of the valve head may be provided with a further depending annular extension or sleeve 11 which may have a fairly close sliding fit upon the outer surface of the annular collar or sleeve 8 on the wall of the air chamber A, this engagement between the sleeve 11 and the collar 8 further facilitating the guided reciprocating movement of the valve head and associated parts, and the extended surface engagement between the reciprocating parts serving to prevent leakage of air or liquid fuel along the cooperative surfaces.

Attached to the valve head 1 in alinement with the axis thereof is a supply conduit for liquid fuel, the same including a nozzle 12 preferably removably attached to the upper end of a bored nipple 13, preferably fitting closely within the upper portion of the tube 9 attached to the valve head and held in place preferably by engagement of the upper end of the tube 9 with a flange at the upper end of the nipple, this flange abutting against the under side of a shoulder formed on the valve head. The lower end of the nipple 13 is provided with a downwardly and outwardly tapered valve seat, indicated at 14. A rod 15 having at its upper end a valve or metering head of cylindrical or other suitable shape, but preferably with a valve seating surface of convex curvature, such as is provided by the substantially spherical valve head illustrated in Fig. 1, is adjustably fixed in position with its axis in alinement with the axis of the nipple 13 and its seat 14, as by means of an adjustable screw portion at its lower end cooperative with a threaded bore in the closure

cap C of the dash-pot cylinder or well W. By adjustment of the screw portion at its lower end, the valve rod 15 may be adjusted to closed position or any desired degree of minimum opening between the valve head 16 at the upper end of the valve rod and the cooperative surface of the tapered seat 14 at the lower end of the nipple 13, when the air valve 1 is in closed position or such position wherein a minimum amount of air passes across the seating portion 2, so as to thus insure the supply of a proper amount of liquid fuel when the valve parts are in position corresponding to an idling condition of the engine. A conventional type of detent may be provided, as indicated, for holding the valve rod in desired adjusted position.

The valve head is provided with a plurality of curved or angularly shaped ports 17, providing communication between the lower side of the valve head within the air chamber A and an annular chamber 19 near the upper end of the valve head and surrounding the nozzle 12, this chamber 19 communicating through an outlet 21, about the nozzle 12 and outwardly flared therefrom, with the mixing or expansion chamber 4.

As indicated, the nozzle 12 is preferably formed with an axial bore 23 communicating with the axial bore through the nipple 13, the upper end of the nozzle being provided with a tapered recess 24 communicating at its lower side with the axial bore of the nozzle. A plurality of spaced inwardly directed and upwardly inclined ports 25 are provided so as to receive air from the chamber 19 and discharge the same about and generally toward a stream of liquid fuel discharged through the axial port 23.

The level of liquid fuel in the float chamber F is preferably maintained, as by suitable adjustment of its float-actuated inlet valve, so as to insure the presence of liquid fuel within the tapered lower portion of the bore of the nipple 13, at a point very closely adjacent the controlled port provided between the upper end of the fixed valve part 16 and its cooperative tapered seat 14, the liquid fuel being fed from the float chamber through a port, indicated at 27, into the cylinder or well W and thence, through ports in the plunger 6 to the space beneath the same, whence it may pass upwardly through an axial opening 28 in the bearing collar 10 into the sleeve 9 attached to the air valve 1, or through ports 31 in the tubular extension of the plunger and thence through ports 32 directly into the space within the sleeve 9. However, it is preferable that the fuel enter the tube 9 through the lower axial port 28, since centrifugal force thereby offers least impedance to the feeding of the fuel.

A desirable method of guiding the plunger 5 in its movement is through the provision of a guiding recess 33 which receives the inner end of a guiding screw 34 passing through the wall of the cylinder W, the engagement of the screw with the wall of recess 33 preventing rotation of the plunger. Likewise, this screw may be so positioned that engagement thereof by the lower end wall 35 of the recess will limit the upward movement of the plunger and air and liquid fuel valves.

The outer periphery of that portion of the valve head 1 which cooperates with the seating portion of the casing to control the passage of air to the expansion or mixing chamber 4, is preferably formed with a plurality of suitably spaced fins 36 whose outer edges may cooperate with the inner wall of the annular collar or sleeve 3 to assist in guiding the air valve in its movement off its seat. Through the provision of these spaced fins 36, there is produced an additional effect of dividing or breaking up the air passing across the valve seat into a large number of separate streams. And by providing a skewed formation of these fins 36, as more particularly indicated in Fig. 2, the fins serve as fan vanes which, due to the effect of the streams of air thereupon as they are drawn into the expansion chamber, cause a lively rotation of valve head and parts carried thereby, and provide a very definite effect of swirling the several streams of air against the inner wall of the mixing chamber and thoroughly agitating the air in such chamber, and the liquid fuel, because of the rotation of the nozzle 12, partakes of this rotation and is thereby thrown outwardly toward and into the whirling streams of air entering the chamber, and there is thus secured a very desirable degree of commingling of this air and the liquid fuel fed to this chamber.

An air controlling valve 38 of conventional butterfly type is provided in the air chamber A adjacent the inlet thereof, this air-controlling valve being ordinarily adjusted to a definite setting, and the discharge-controlling or throttle valve 5 being adjusted as desired in accordance with requirements for or to secure variation in the speed and power of the engine.

When the engine is not in operation, the fuel valve 16 is preferably held slightly off its seat, and the air valve is also preferably slightly off or closely adjacent its seat, the degree of opening of fuel and air valves corresponding to that required or desirable for an idling condition of the engine. After the engine is placed in operation and the throttle is adjusted to an idling condition of the engine, the slight vacuum or rarefaction in the expansion chamber 4 may be just sufficient to cause the air valve, with the same raised slightly off its seat, to draw in a limited supply of air through the ports 17 and 21 and the passages between the skewed vanes 36 formed at the edge of the valve head 1 adjacent its seat 2, and, with the seat 14 of the fuel valve likewise raised slightly from its spherical seat 16, the required limited amount of liquid fuel is drawn across the seating portion adjacent the upper edge of the metering valve 16, and through the nozzle 12. As the desire for increased power occurs, the throttle valve 5 is adjusted to appropriate position, the effect of such adjustment being to cause the air valve and liquid fuel valve to automatically open to the required extent to permit the supply to the mixing chamber of the proper ingredients of a fuel mixture required by the engine.

Any appreciable amount of air passing through the vaned ports at the edge of the valve head 1, when the latter is raised from its seat, due to the difference in pressure between the upper and lower sides thereof, causes rotation of the valve head and parts carried thereby, and the streams of air issuing through these vaned ports are angularly projected or swirled about and in contact with walls of the mixing chamber. Also, a certain amount of air passes through the ports 17, a portion of such air passing through angular ports 25 at the upper end of nozzle 12, and these latter jets of air impinge upon and whirl about with the issuing stream of fuel, the effect of centrifugal force on the central fuel jet, due to rotation of the nozzle 12 with the valve head, also causing particles of such fuel to be thrown outwardly into the body of moving air. The general result of this feeding of air and fuel in the form of rotating bodies is a thorough breaking-up or vaporization of the stream of fuel and the projection of

particles thereof toward the outer walls of the expansion chamber where they are more readily mixed or mingled with the air admitted across the valve seat 2; and thus a very desirable mixture of vaporized fuel and air is available at the throttle for admission to the engine manifold.

As will be apparent, to secure any further desired increase in speed of the engine, the throttle is actuated to the appropriate position and the resulting increased rarefaction or vacuum in the expansion chamber results in an increased difference in pressure between the upper and lower sides of the valve head 1, the result being that the valve head is forced upwardly toward full-open position to an extent corresponding to the setting of the throttle valve and at a speed or degree of response determined by characteristics of the dash-pot and its plunger 6. Due to the fact that the valve head 1 and associated parts are maintained in rotation by the air passing through the skewed ports between the vanes 36 at the outer periphery of the valve head adjacent the seat 2, there is no appreciable static friction to be overcome in raising of the valve head; and the response of the valves to a very slight difference in pressure between the upper and lower sides of the valve head, corresponding to a slight adjustment of the throttle, is definite. It will be apparent that as the air valve 1 is raised, the tapered valve seat 14 is raised to a corresponding extent, the degree of taper of the seat being definitely proportioned in accordance with the variable cross-sectional area through which air is admitted to the expansion chamber 4 through a valve part adjacent the seat 2. In this manner, it is possible to very closely control the proportion of air and liquid fuel passed into the expansion chamber for the several settings of the throttle valve, so as to secure a constant proportion of the liquid fuel and air for the several positions or settings of the throttle valve, or any desired degree of variation in the proportion of air and fuel admitted to the mixing chamber for the settings of the throttle.

In case the throttle is adjusted to decrease the speed of the engine, or the amount of fuel mixture admitted thereto, the response of these parts in the matter of closing of the air and liquid fuel admission openings is immediate and definite even for slight variations in the adjustment of the throttle, for the reason that the valve head and associated parts are in rotation and thus relieved of static friction and inertia. It is understood, however, that the actual rate or speed of adjustment of the valve parts may be subject to the design and proportioning of details of the dash-pot and its plunger, one of these details also serving to limit the maximum opening movement of the valves. While not essential to ordinarily satisfactory operating results, nevertheless, if desired, the responsiveness of the plunger of the dash-pot in the matter of its upward movement and that of the valves associated therewith, may be further modified through the addition of a spring pressing against the upper side of the plunger and biasing the same downwardly.

Any suitable means may be provided for maintaining the movable parts of the air and gas valves off their seats to a slight extent to accommodate for an idling condition of the engine. This means may be in the form of a stop limiting the downward movement of the valves and associated parts, and it may be disposed in the dash-pot cylinder, or in the form of a collar or other member associated with the stationary sleeve 8 and the valve head 1 or the sleeve or skirt 11 thereon.

With a valve or metering device of the character described hereinabove provided for the liquid fuel, an increase in flow through the opening past the valve 16 at the upper end of the valve rod 15 is practically immediate or greatly quickened, because of the venturi effect due to the suitably tapering passage in which the spherical or rounded valve head 16 is disposed and through which the liquid fuel is conducted to the nozzle 12; and these desirable effects are contributed to or heightened by reason of the fact that the level of liquid fuel is normally maintained and there is a large body of the same immediately adjacent the inlet portion of the valved passage through the metering device 14, 16.

The increased degree of response of the air and liquid fuel valves to actuation of the throttle, contributed to by the rotation of these valve parts with resultant reduction of static friction, and aside from the consequently increased thoroughness of vaporization of the liquid fuel and mingling of the latter and an ample volume of air so as to insure efficient operation of the engine, removes or considerably reduces the amplitude and duration of any pulsations in the pressure of the fuel mixture supplied from the mixing chamber to the engine; and this contributes toward the production of a more nearly equalized or uniform acceleration and deceleration of the engine in response to actuation of the throttle. And this same increased responsiveness of the air and fuel valves to the pressure or rarefaction in the mixing chamber and the proper vaporization of liquid fuel and mingling of the latter with an ample supply of air insures the efficient and economical operation of the engine, with the different settings of the throttle, under any atmospheric or altitude conditions.

Fig. 6 discloses a modified design of nozzle 12 wherein the air ports 25, instead of being disposed in substantially radial planes, extend in a direction making a substantial angle to a radius, thus causing the projection of jets of air through these ports in directions having substantial angular or rotative components. Through this effect, there may be produced an intensified breaking-up of the stream of liquid fuel discharged from the port 23 and mixing or mingling of the particles of such fuel with the more definitely or positively rotated air streams emerging from the ports 25.

In the modified form of nozzle 12 disclosed in Figs. 7 and 8, the liquid fuel discharge port 23 is divided adjacent its discharge end into a plurality of separated branches, the same being shown herein as being three in number. This division of the liquid fuel path with its several streams further insures a more thorough breaking-up of the liquid fuel and its complete vaporization and mingling with the swirling air in the mixing chamber.

In the modified form of carburetor shown in Figs. 9, 10, 11 and 12, the movable element, forming a part of or attached to the valve head 1 through the sleeve or tube 10, which operates in the fuel well W, may be in the form of a hollow plunger or drag 41 having its outer surface of tapering or generally cone shape. This plunger element 41 extends throughout almost the full depth of the fuel well and is provided adjacent its lower end with a retarding or stop ledge or plate 42, and the upper bearing surface of the thrust plate or collar 10 attached to the lower

end of the tube or sleeve 9, attached to and rotating with the valve head 1, has a bearing engagement on the lower face of the cone 41, as will be apparent from the description hereinabove as to Fig. 1, the lower side of the thrust member 10 being substantially spaced from the bottom of the well when the air and liquid fuel valves are in substantially closed position, thus permitting the ready supply of fuel beneath the plunger 41 and upwardly through the central opening 28 in the member 10 and the sleeve 9. An annular helical spring 43 of the garter type and biased to contracted position is disposed in the upper portion of the fuel well, with its convolutions bearing against a suitable normal seat formed adjacent the lower end of the sleeve 8 and pressing against the outer cone-shaped surface of the plunger 41, this spring exerting a retarding effect upon the upward movement of the plunger and valve parts and assisting or facilitating the downward movement of these parts upon decrease in the vacuum in the mixing chamber. The outer cone-shaped surface of the plunger 41 may, if desired, be provided with roughened or serrated surface portions affording a greater frictional grip of the spring 43 upon the surface of the plunger. The plunger 42 may be held against rotation in any suitable manner, as through a set screw 49 fitting in a recess or slot 51 formed in an upwardly extending projection formed on the part 42, the lower wall of the slot serving as a positive limiting stop, in cooperation with the screw 49, to limit the upward or opening movement of the plunger or valves; and the upper wall of the slot, in the absence of other means, serving with the screw 49 to limit the closing movement of the valve parts to that desired.

With suitably related dimensions of the biasing or retarding spring 43 and the plunger 41 as to its taper, a very finely and definitely adjusted control of the degree of opening of the air and liquid fuel valves may be secured; and the response of these valves to adjustment of the throttle may be of an exceptionally quickened character. Likewise, the cooperation of the ledge or plate 42 on the lower end of the cone-shaped plunger 41 with the garter spring 43 as the plunger and valves approach their upper or open limit, serves as a resilient stop or cushion to this movement.

The essential parts of the air and liquid fuel valves of the device of Fig. 9 may be substantially the same as in the form of carburetor shown in Fig. 1. However, in Fig. 9, nipple 13, with its tapered valve seat 14, has its nozzle portion 12 provided with not only a through axial port 23, preferably of reduced size at its discharge end, but also a plurality of spaced, substantially radially extending ports 46 branching from the axial port and opening into slotted or milled recesses 47 of smooth wall curvature, thus permitting air streams passing upwardly through these recesses to sweep or carry along therewith the particles of liquid fuel discharged from the ports 46. Adjacent the upper ends of the recesses 47, are provided inclined ports opening into the central recess 24 at the upper end of the nozzle and carrying small air streams into or closely adjacent the stream of fuel particles discharging through the central port of the nozzle. As in Fig. 1, the nipple 13 may be held in position by means of the tube 9 whose upper end is caused to bear against an external annular flange on the nipple, forcing and holding the flange against a shoulder formed on the valve head 1.

With skewed fins or vanes 36 formed on the valve head 1 of Fig. 9, as described hereinabove in connection with Figs. 1 and 2, the valve head is rotated during normal operation of the carburetor, and the streams of air and fuel passing through the valves are given a rotating or whirling motion with the result, as will be apparent from the description hereinabove as to the operation of the device of Fig. 1, that the liquid fuel is thoroughly vaporized and there is a consequent thorough mixture of such vaporized fuel and air available for use in the engine. And this, coupled with suitable dimensions of the cone-shaped retarding plunger 41 and its biasing spring results in completely responsive carburetor control and economical operation of the engine.

It will be obvious that, through the provision of the radial fuel discharge ports 46, a considerable body of fuel with air mixed therewith is discharged into the mixing chamber 4 at points appreciably removed from the axis of the rotatable valves; and hence these particles of fuel so discharged are subjected to a lively rotation and are more thoroughly mixed with the surrounding air in the mixing chamber.

It will be apparent that commercially desirable carbureting devices including features of the present invention may be provided which include less than all of the structural and operating details of the several embodiments of the invention described hereinabove. And it should be understood that the invention claimed is not limited to the exact details of construction and operation described herein, for obvious modifications within the scope of the invention may be apparent to those skilled in the art; and it is desired that the invention generally be considered as covering any such modifications included within the scope of the claims.

It is claimed and desired to secure by Letters Patent:

1. In a carburetor for an internal combustion engine, the combination with a fuel-mixing chamber, of a movable valve member provided with seating portions for controlling the supply of air and liquid fuel to said mixing chamber, means for guiding said valve member to permit both reciprocation and rotation thereof, said guiding means comprising a sleeve element associated with said valve member and disposed radially outside of the active part of said fuel-controlling portion thereof, and a relatively fixed guiding portion cooperative with said sleeve, and fan means associated with the seating portion controlling the passage of air to said mixing chamber and operative to cause the rotation of said valve member during the passage of air across said seating portion.

2. In a carburetor for an internal combustion engine, the combination with a fuel-mixing chamber, a valve controlling the passage of air to said mixing chamber, means for controlling the supply of liquid fuel to said mixing chamber, said fuel-controlling means comprising an element movable with said air controlling valve, means for controlling the operation of said air valve and said fuel-controlling means to permit rotation thereof and to insure a retarded rectilinear motion thereof, said means including a movable sleeve element associated with said valve, and means for preventing rotation of said sleeve, and fan means associated with said air valve and operative to rotate said valve and to cause the air passing through said valve and into said mixing chamber to be discharged therein with a whirling motion.

3. In a carburetor for an internal combustion engine, the combination with an air chamber, a mixing chamber at the discharge side thereof, an air valve controlling the passage of air from said air chamber to said mixing chamber, a liquid fuel supply nozzle for discharging fuel to said mixing chamber, and a controlling valve communicating with the inlet side of said nozzle, said nozzle and said fuel-controlling valve being disposed with their axes coincident with that of said air valve, the movable part of said air valve being formed with fan vanes in the path of air entering said mixing chamber and effective to cause the air passing through said valve to be discharged into said mixing chamber as a whirling mass and to maintain the movable parts of said air and fuel valves in rotation during normal operation of said carburetor and means for guiding said air and fuel valves in their movement, said guiding means comprising a sleeve member movable with said valves and surrounding said fuel-controlling valve and telescopically co-operative with a tubular extension of the wall of said air chamber.

4. In a carburetor for an internal combustion engine, the combination with a main casing, a mixing chamber at the discharge side thereof, a rotatable air valve controlling the passage of air from said main casing to said mixing chamber, a fuel supply well, a liquid fuel controlling valve for controlling the discharge of fuel from said well to said mixing chamber and having a portion carried by said air valve, a retarding plunger disposed in said well, and means for impositively connecting said air valve to said plunger whereby said plunger is movable in conjunction with said air valve during opening movement thereof and is movable independently of said plunger during closing movement thereof.

5. In a carburetor for an internal combustion engine, the combination with a main casing, a fuel-mixing chamber at the discharge side thereof, a rotatably mounted air valve controlling the passage of air from said main casing to said mixing chamber, instrumentalities associated with said air valve and upon which air discharged past said valve impinges and is effective to cause rotation of said valve, a fuel supply well, a liquid fuel controlling valve for controlling the discharge of fuel from said well to said mixing chamber and having a part mounted on said air valve, and means for exerting a retarding effect upon the opening movement of said valves and facilitating the closing movement thereof, said means comprising a plunger disposed in said well and connected to said valves through a sleeve passing downwardly through said main casing.

6. In a carburetor for an internal combustion engine, the combination with a main casing, a fuel-mixing chamber at the discharge side thereof, a rotatable air valve controlling the passage of air from said main casing to said mixing chamber, a fuel supply well, a liquid fuel controlling valve for controlling the discharge of fuel to said mixing chamber and having a movable part carried by said air valve, a plunger disposed in said well, a sleeve connected to said air valve and passing downwardly through said main casing, means for impositively connecting said sleeve to said plunger and for preventing rotation of said plunger while permitting rotation of said air valve, and a spring disposed in said oil well and cooperative with said plunger for retarding the opening movement of said valves and facilitating closing movement thereof.

7. In a carburetor for an internal combustion engine, the combination with a main casing, a fuel-mixing chamber at the discharge side thereof, an air valve controlling the passage of air from said main casing to said mixing chamber, a fuel supply well, a liquid fuel controlling valve for controlling the discharge of fuel to said mixing chamber and having a movable part carried by said air valve, a plunger disposed in said oil well and connected to said valves and having a cone-shaped surface with its smaller diameter at the top, and an annular spring cooperative with the cone-shaped surface of said plunger for retarding the opening movement of said valves and facilitating closing movement thereof.

8. In a carburetor for an internal combustion engine, the combination with a main casing, a fuel-mixing chamber at the discharge side thereof, a rotatably mounted air valve controlling the passage of air from said main casing to said mixing chamber, a liquid fuel controlling valve, a discharge nozzle communicating with the discharge side of said fuel valve, said nozzle having a central port, laterally directed ports branching from said central port and opening into longitudinally extending pockets in the outer wall of said nozzle.

HARRY W. HESS.