May 11, 1965 R. R. HILL 3,182,974

CARBURETOR

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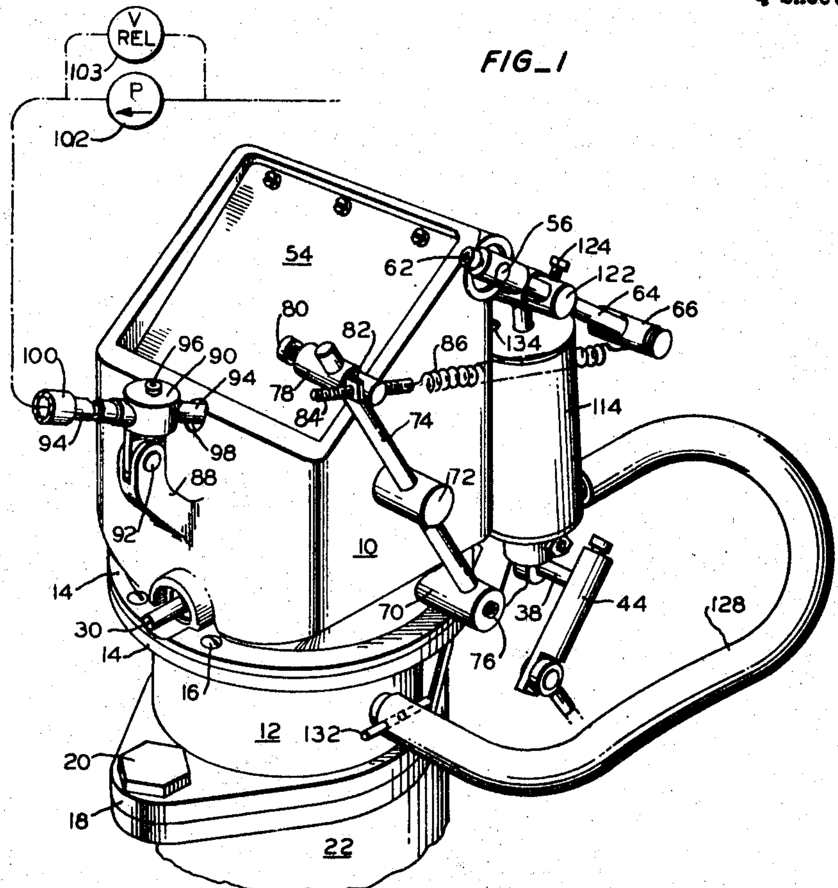
FIG_1



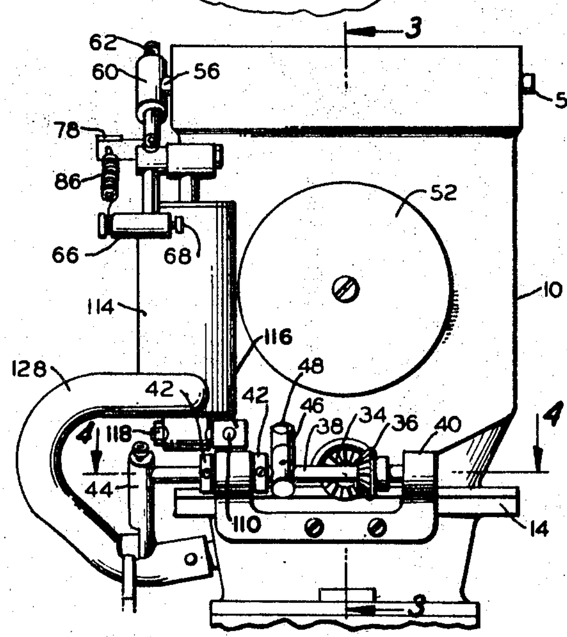




FIG_2

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CARBURETOR

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FIG_3

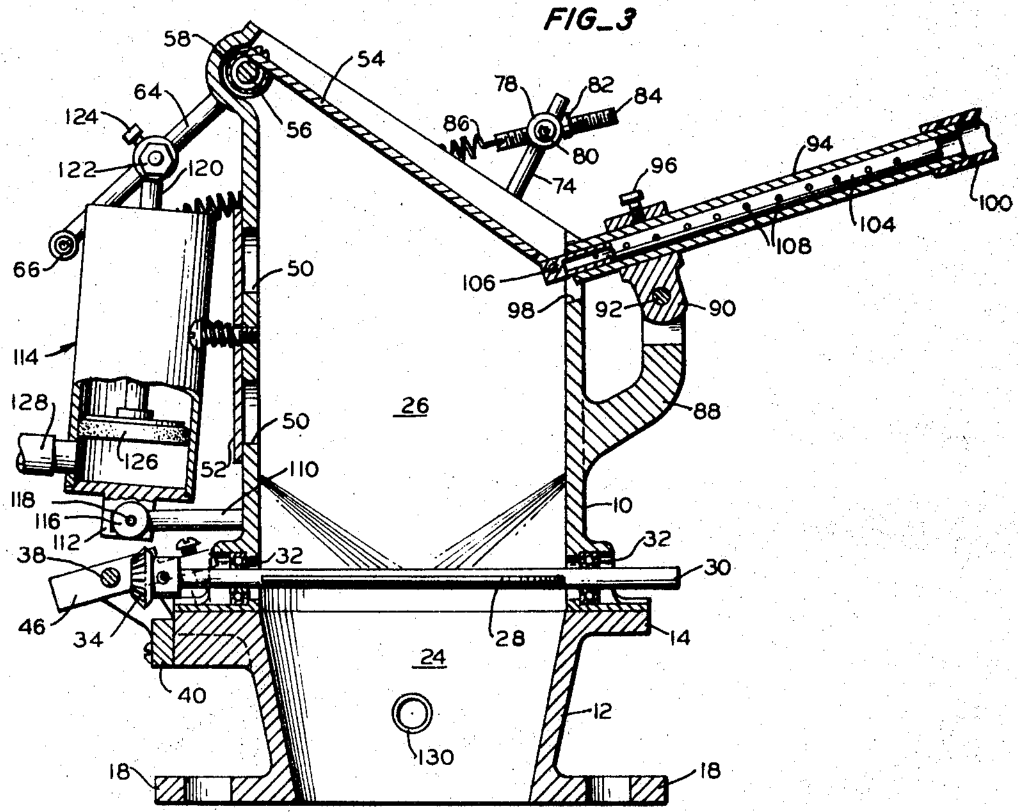


FIG_4

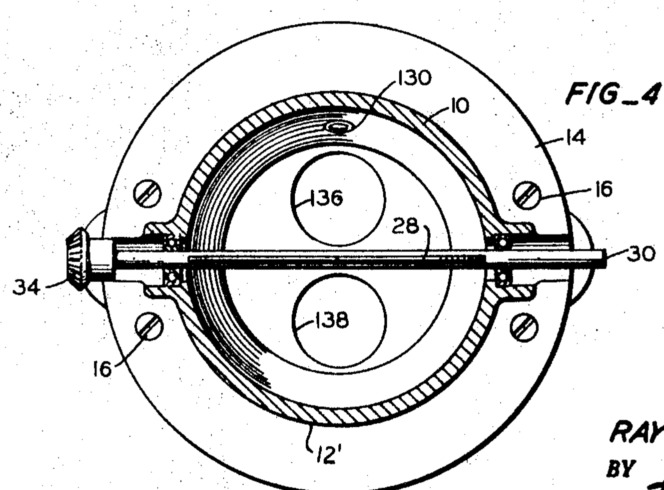


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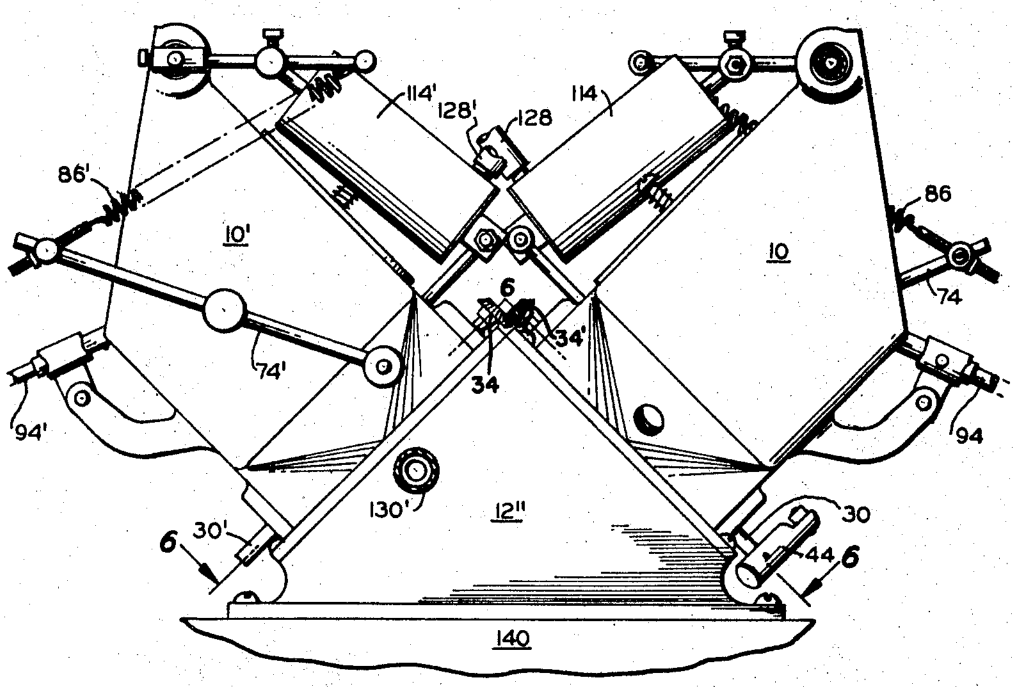
FIG_5



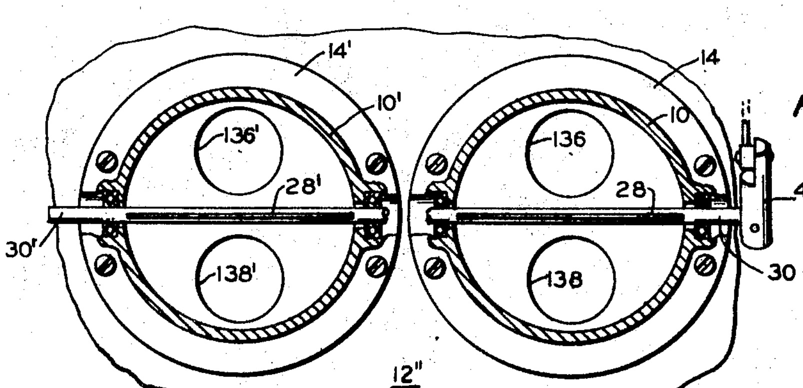




FIG_6

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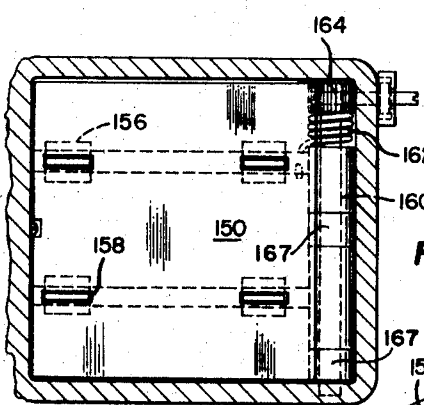


FIG. 8

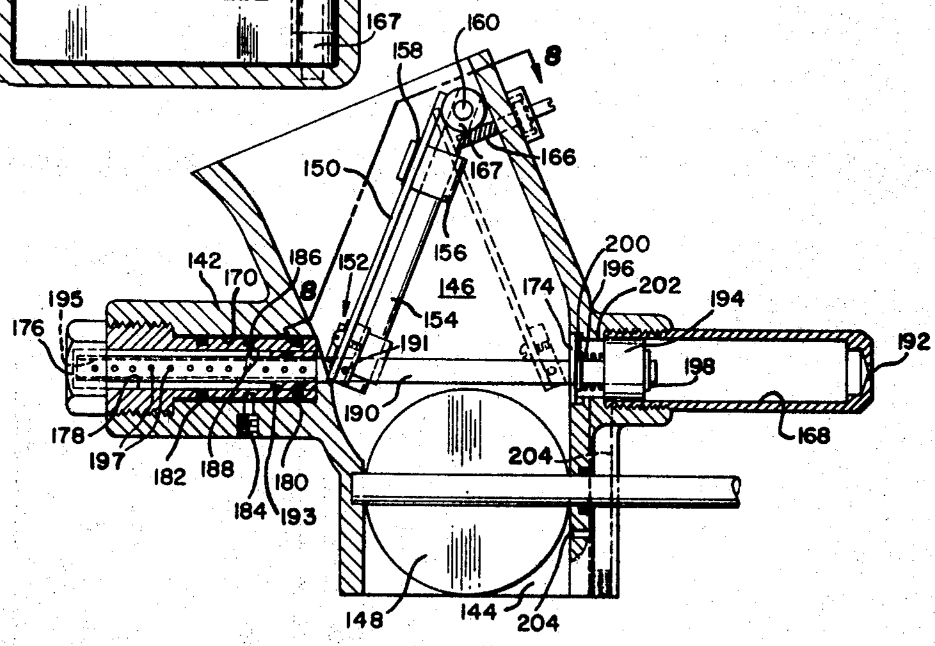


FIG. 7

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# United States Patent Office

3,182,974
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3,182,974


## CARBURETOR


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Filed Sept. 5, 1963, Ser. No. 306,960
22 Claims. (Cl. 261—20)


This application is a continuation-in-part of applicant's copending application Serial Number 66,871, filed November 14, 1960, which is abandoned in favor of this application.

This invention relates to carburetors for internal combustion engines and more particularly to a very efficient arrangement for producing uniform mixtures of air and liquid fuels in such carburetors.

Accordingly, it is the principal object of this invention to provide a carburetor for an internal combustion engine which will result in more efficient operation of the engine than has been possible heretofore.

It is a further object of this invention to provide such a carburetor which will effect more efficient operation of internal combustion engines for automobiles by permitting more rapid acceleration of said automobiles, without sacrificing fuel economy when the automobile is operated at constant speed.

It is a further object of this invention to provide such a carburetor which will result in more rapid response of said engine when the throttle adjustment of said carburetor is changed.

It is another object of this invention to provide such a carburetor which may be manufactured easily and inexpensively and which is not subject to fouling by carbonaceous materials blown back from the engine.

It is another object of this invention to provide such a carburetor which may be easily adjusted to compensate for changes in the environment in which said engine is used.

It is a further object of this invention to provide a carburetor which may be installed universally on all automobiles popular in the United States.

It is a more specific object of this invention to provide a carburetor which will vaporize a liquid fuel into air more efficiently and produce a more uniform fuel-air mixture than has been possible heretofore.

It is another object of the invention to provide such a carburetor which will produce the same quality and uniformity of the fuel-air mixture regardless of the quantity of the mixture which the carburetor is delivering to the engine.

It is another object of this invention to provide such a carburetor having efficient and easily operable means for choking said carburetor when the engine associated with the carburetor is used under colder than normal operating condition and for providing a leaner fuel-air mixture for cruising conditions than for acceleration conditions.

It is another object of the invention to provide such a carburetor having no external moving parts.

Other objects and advantages of the invention will become apparent from the following description read in conjunction with the attached drawings in which:

FIG. 1 is a perspective view of a carburetor constructed in accordance with the principles of this invention;

FIG. 2 is a rear elevational view of the carburetor of FIG. 1;

FIG. 3 is a vertical sectional view of the carburetor of FIGS. 1 and 2 taken on the plane and in the direction indicated by the line in the arrows at 3—3 in FIG. 2;

FIG. 4 is a horizontal sectional view of an alternative form of the carburetor of this invention, illustrating a different base portion of the carburetor and taken through



the device along a plane in the direction indicated by the line and the arrows at 4—4 in FIG. 2;

FIG. 5 is a side elevational view of another alternative form of the carburetor of this invention illustrating a twin-carburetor combination adapted for use as a four barrel carburetor;

FIG. 6 is a composite cross sectional view of the apparatus of FIG. 5 taken along the planes indicated by the lines and the arrows at 6—6—6 in FIG. 5;

FIG. 7 is a view in vertical section similar to FIG. 3 illustrating an improved structure for the carburetor of the invention, and

FIG. 8 is a sectional view of the carburetor of FIG. 7 taken along the plane indicated at 8—8 in FIG. 7.

Referring now in detail to the drawings and particularly to FIGS. 1–3 the carburetor illustrated therein is made up of upper and lower body portions **10** and **12** carrying flanges **14** at their adjacent edges which are secured together by means of screws **16**. The lower body portion **12** is designed specifically for use with a particular automobile and carries lower ears **18** thereon adapted to be bolted by bolts **20** to the intake manifold **22** of the engine of the automobile.

As thus mounted on an automobile the lower body portion **12** defines a chamber **24** therein (FIG. 3) which is in communication with the interior of the intake manifold of the engine. The upper body portion **10** defines a generally rectangular chamber **26** therein tapered at its lower end, and a butterfly valve **28** forms a common wall between chambers **24** and **26**.

Butterfly valve **28** is mounted on an axle **30** which is journaled by means of bearings **32** for rotation in the upper body member **10**. As illustrated in FIGS. 2 and 3 the back end of axle **30** is provided with a bevel gear **34**, and a second bevel gear **36** on a shaft **38** is held in mesh with gear **34** by means of a bracket **40** (see FIG. 2). Suitable spacing rings **42** maintain the axial position of shaft **38**, and an operating finger **44** is mounted on the end of shaft **38** and is adapted to be connected to the accelerator pedal of an automobile.

A second finger **46** is mounted on shaft **38** and is provided with an adjusting screw **48** by means of which the idling speed of the engine employing the carburetor may be adjusted.

A plurality of backfire ports **50** are provided in the back of upper body portion **10** and are covered by a spring loaded cap **52**.

The top wall of the upper chamber **26** is formed by a valve door **54** which is pivotally mounted to body member **10** by means of a shaft **56** mounted in bearings **58**. A shaft head **60** is provided on the end of shaft **56**, pivotally adjustable with respect to shaft **56** by means of a set screw **62**, and an arm **64** is rigidly attached to the shaft head **60**. A spring retaining lug **66** is adjustably mounted on the arm **64** by means of set screw **68**.

A pair of bosses **70** and **72** are provided on the side of body member **10**, and an arm **74** is slidably mounted in apertures in bosses **70** and **72** and adapted to be clamped in a fixed position by means of set screw **76**. A spring retaining lug **78** is adjustably mounted on arm **74** by means of set screw **80** and a spring tension adjusting nut and screw **82** and **84**, respectively, are mounted on lug **78**. A helical tension spring **86** is stretched between screw **84** and spring retaining lug **66** on arm **64**, thereby spring biasing valve door **54** toward its closed position illustrated in FIGS. 1 and 3.

As illustrated in FIGS. 1 and 3, a boss **88** is provided on the front of body member **10** and carries a bracket **90** pivotally mounted thereon by means of pivot pin **92**. A sleeve **94** is adjustably mounted in bracket **90** by means of set screw **96**, and sleeve **94** extends through an enlarged aperture **98** in the front wall of body member **10**.

The outer end of sleeve 94 carries a flexible fuel supply conduit 100 which is adapted to be connected to a fuel pump 102 which is preferably a constant pressure output pump. Pump 102 may be a constant volume output pump provided with an adjustable pressure relief valve bypass 103, or other means which permit adjusting the pressure of the fuel supplied to the carburetor.

Telescopically mounted in sleeve 94 is a metering rod 104 which is movable axially with respect to sleeve 94. Metering rod 104 extends through the open end of sleeve 94 and is pivotally connected to the free swinging end of valve door 54 by means of a pivot pin 106. Metering rod 104 is provided with a series of fuel supply ports 108 extending laterally therefrom, with the ports 108 arranged in two diametrically opposed groups with one port of each group being horizontally aligned with a similar port of the other group.

As illustrated in FIGS. 2 and 3 a boss 110 is provided on the back of body member 10, and the base 112 of a piston-cylinder combination, indicated generally at 114, is adjustably secured thereto by means of a link 116 and a set screw 118. The upper end, or piston rod 120 of piston-cylinder combination 114, is pivotally connected to a link 122 which in turn is adjustably mounted on arm 64 by means of set screw 124. A piston 126 is mounted on the lower end of piston rod 120 in piston-cylinder combination 114, and a flexible conduit 128 extends from piston-cylinder combination 114 from below the lowest position of piston 126 as viewed in FIG. 3. Flexible conduit 128 is connected to a port 130 (see FIG. 3) in lower chamber 24, and a manually operable slide valve 132 is provided in conduit 128. The upper end of piston-cylinder combination 114 is provided with an atmospheric vent 134.

In operation of the device illustrated in FIGS. 1 to 3, butterfly valve 28 is normally in a horizontal position as illustrated in FIG. 3 when the engine associated with the carburetor is in its idling condition; in this condition a relatively strong vacuum is created in chamber 24 by the fluid demand of the engine, and a very small minimum clearance is provided between the periphery of butterfly valve 28 and the adjacent walls of body member 10 to permit just sufficient fuel-air mixture to pass therethrough to supply the idling requirements of the engine. Adjustment of adjusting screw 48 effects adjustment of this idling clearance.

Under this idling condition, air enters the carburetor through port 98 and a small amount of fuel enters chambers 26 through the central bore in metering rod 104 and the end fluid delivery port 108 therein. The quantity of fuel supplied under idling condition can be adjusted by moving sleeve 94 in bracket 90 by means of adjusting screw 96 thereby adjusting the number of fuel supply ports 108 which are not covered by sleeve 94.

When it is desirable to accelerate the engine on which the carburetor is employed, butterfly valve 28 is opened by manipulating operating finger 44 (see FIG. 2), thereby drawing fluid from chamber 26 into chamber 24 responsive to the pressure gradient across butterfly valve 28. This flow of fluid out of chamber 26 causes a reduction in pressure in chamber 26 relative to atmospheric pressure which is applied to the upper side of door 54, and door 54 accordingly is pulled downwardly into chamber 26 in opposition to biasing spring 86. As door 54 moves downwardly into chamber 26 it provides a generally rectangular opening between the free edge of door 54 and the front wall of body member 10, and the air requirement of the engine is drawn into chamber 26 through this opening. As door 54 moves downwardly into chamber 26, it also draws metering rod 104 out of sleeve 94 thereby exposing additional openings 108 in metering rod 104, and the additional fuel requirement of the engine is supplied through these additional exposed fuel supply ports 108.

It will be noted that the exposed fluid delivery ports 108 are thus provided on a line which extends generally centrally through the opening between the free edge of the door 54 and the front wall of body 10; this positioning of fuel supply openings 108 at the vortex of the air stream entering the carburetor, coupled wih the fact that apertures 108 are directed laterally toward the ends of said opening produces the maximum evaporation of fuel supplied from apertures 108 and the maximum uniformity of the fuel-air mixture produced by such evaporation. Additionally, the fact that additional apertures 108 are exposed for each incremental increase in the size of the opening between valve door 54 and body 10 insures that this uniformity of fuel-air mixture is maintained regardless of the position of valve door 54 and the quantity of air passing through the opening between valve door 54 and body member 10.



It should be noted that the line of action of tension spring 86 with respect to the axis of arm 64 forms an acute angle which decreases towards zero degrees as door 54 opens, thus, providing a reduction in the working arm of spring 86 as the door 54 is opened and the spring 86 is stretched.

In operation of the carburetor illustrated in FIGS. 1 to 3, slide valve 132 is normally open so that piston-cylinder combination 114 is in operation. The effect of the operation of piston-cylinder combination 114 is to provide more accurate control of the opening and closing of valve door 54 as it is opened to a greater extent and to provide more immediate response of valve door 54 to the closing of butterfly valve 28. Thus, atmospheric pressure applied to the upper side of piston 126 cooperates with vacuum chamber 24 to apply an additional biasing force to arm 64 tending to close valve door 54 responsive to increases in the vacuum (reduction in pressure) in chamber 24. It will be noted that the line of application of piston-cylinder combination 114 on arm 64 approaches 90 degrees, and thus approaches maximum effectiveness of piston-cylinder combination 114, as valve door 54 approaches its wide open position. Thus, as the effective lever arm of spring 86 is decreasing, the effective lever arm of piston-cylinder combination 114 is increasing.

Not only does piston-cylinder combination 114 effect more accurate control of the position of valve door 54, it also may be rendered inoperative by closing slide valve 132, thereby choking the engine (making the fuel-air mixture richer in fuel). Thus, when piston-cylinder combination 114 is in operation it provides an additional biasing force tending to close valve door 54; when this additional biasing force is removed, the door 54 opens to a greater extent for the same vacuum in chamber 26 and this increased opening of valve door 54 at constant pressure causes an increase in the number of fuel supply openings 108 uncovered without a corresponding increase in the volume of air passing through the opening between the free edge of door 54 and the front wall of body 10.

In addition to providing choking in this way, the piston cylinder combination 114 automatically adjusts the carburetor to provide different richness of the fuel-air mixture at different operating conditions of the engine. Thus, under cruising conditions, when the engine is running rapidly and the butterfly valve 28 is positioned in an intermediate, partially closed, position, a relatively high vacuum exists in the vacuum chamber 24. This high vacuum, applied to the piston cylinder combination 114, biases the valve door 54 toward a more closed position than it would occupy if the piston cylinder combination 114 were not present; this partial closing of the valve door 54 reduces the fuel supply from the ports 108 by closing off some ports without causing a corresponding reduction in the volume of air flowing past the valve door. In this way, the piston-cylinder combination causes a leaning of the fuel air mixture during cruising conditions; however, when the butterfly valve 28 is opened wide for acceleration conditions of the engine, the vacuum chamber 24 is placed in more direct communication with the atmosphere; the degree of vacuum in the vacuum chamber is reduced, and the fuel air mixture becomes richer because the biasing effect of the piston-cylinder combination is reduced.

As indicated above the provision of the many adjusting screws in the structure of FIGS. 1 to 3 permits maximum adjustment of the carburetor to suit various environments. By manipulation of set screw **80** and bolt **82**, the tension and working angle of spring **86** may be adjusted. By manipulation of set screw **124** and a slide valve **132** shown schematically, the force and working angle of piston-cylinder combination **114** can be adjusted. The lower body member **12** can be replaced to facilitate mounting of the carburetor on other internal combustion engines.

In the carburetor illustrated in FIG. 4, lower body member **12** has been replaced by body member **12'** to facilitate use of the carburetor on an engine designed for a two-barrel carburetor. Body member **12'** is provided with two barrels **136** and **138** spaced on opposite sides of the vertical plane through axle **30**. It has been found that the most efficient distribution of the fuel-air mixture in the carburetor of this invention is obtained when the axis of pivotal mounting of butterfly valve **28** is perpendicular to the axis of pivotal mounting of valve door **54**; most efficient distribution of fuel to two separate barrels of the carburetor of FIG. 4 is obtained when this arrangement of axes is employed and the two barrels are spaced on opposite sides of the axle of valve **28**.

As illustrated in FIGS. 5 and 6, the carburetor of this invention is readily adapted for use on engines designed for four-barrel carburetors. In the apparatus of FIGS. 5 and 6, a twin carburetor arrangement is provided by mounting two of the upper body members **10** and **10'** on a single base **12''**. Each of the upper body members **10** and **10'** carries all of elements mounted on body **10** in FIGS. 1 to 3, with the exception that the butterfly valves **28** and **28'** in FIGS. 5 and 6 are operated in synchronization by meshing of bevel gears **34** and **34'**, and the operating finger **44** is attached directly to the axle **30** of valve **28**. Lower carburetor body **12''** is provided with floor barrels **136, 138, 136'** and **138'** which are adapted to deliver the fuel-air mixture produced by the twin carburetors to the four barrels of an internal combustion engine which is designed for the use of a four barrel carburetor. It should be noted that the carburetor barrels **136, 138, 136'** and **138'** terminate in a generally square configuration at the base of lower carburetor body **12''** where the latter is attached to the intake manifold **140** of an internal combustion engine.

It will thus be noted that by the proper formation of the lower carburetor body member **12**, the upper carburetor body **10** and all the functional elements thereon may be employed on substantially every internal combustion engine whether it is designed for a single, double or four barrel carburetor.

In the improved carburetor of this invention illustrated in FIGS. 7 and 8, all moving parts in the device are contained inside of the carburetor where they can not be damaged or interfered with by other devices in the automobile. In this carburetor, a body **142** is provided with a lower round passageway **144** and an upper square passageway **146** separated by a butterfly valve **148** which may be manipulated by any suitable means. The two passageways **144** and **146** define vacuum and mixing chambers respectively, and a valve door **150** is mounted in the mixing chamber forming one wall thereof for providing a variable venturi **152** through which air flows into the carburetor.

The valve door **150** is mounted on a pair of rods **154** by means of brackets **156** attached by snap rings **158** so that the door **150** may slide longitudinally of the rods **154** as the door opens. The rods **154** are attached to a pivot shaft **160** by which the door is pivotally mounted on the body **142**. A torsion spring **162** is mounted on the shaft **160** for resiliently urging the door **150** toward its closed position. One end of the spring engages one of the rods **154**, and the other end of the spring engages an adjustment gear **164** which is connected to the body **142** by a worm **166** for adjusting the tension of the spring. Spacer sleeves **167** are mounted on the shaft **160** to give the outer surface of the shaft a cylindrical shape to which the door **150** is substantially tangent; this substantial tangency permits movement of the door with respect to the shaft **160** while eliminating air flow into the mixing chamber **146** at the upper edge of the door.

Adjacent to the free swinging end of the door is a pair of axially aligned passageways **168** and **170** on opposite sides of the mixing chamber with an atmospheric vent **192** provided in the passageway **168**. The passageway **168** also has an inner end wall **174**.

A nut **176** is screwed into the passageway **170** and has a hollow shank **178** of reduced outside diameter, and a pair of O-rings **180** and **182** are mounted in grooves on the periphery of the shank defining a fuel supply area of the passageway **170**. A lateral fuel supply bore **184** communicates with this area of the passageway **170** for conducting fuel thereinto from a fuel pump. The shank of the bolt **176** is provided with a peripheral groove **186** between the O-rings **180** and **182**, and a plurality of holes **188** for conducting fuel into the hollow center of the shank.

A metering tube **190** positioned in the passageways **168** and **170** and extending across the mixing chamber **146** is pivotally connected to the free swinging edge of the valve door **150** at the center of that edge by means of a pivot pin **191**. A "Teflon" sleeve **193** having an outwardly tapered mouth in the mouth of the hollow shank **178** provides a fluid seal around the metering tube while permitting the tube to slide out of the shank responsive to opening of the valve door. As in the other embodiments of the invention illustrated above, the metering tube **190** is provided with a central bore **195** therethrough and two lines of lateral fuel delivery ports **197** for spraying fuel across the variable venturi as the door **150** opens.

The central bore in the metering tube **190** does not extend the full length of the tube, but instead, the tube is solid from the pivot pin **191** to the end of the tube in the passageway **168**. A piston **194** is mounted on the metering tube **190** in the cylindrical passageway **168** with the piston supported on the tube with a light compression spring **196** between two snap rings **198** and **200**. The cylindrical passageway **168** has a small radius shoulder **202** against which the piston is seated in FIG. 7, and a vacuum passage **204** connects the vacuum chamber **144** with the space in the cylinder **168** between the piston **194** and the end wall **174**.

The operation of the carburetor of FIGS. 7 and 8 is similar to that of the other embodiments described above. The butterfly valve **148** is opened manually to permit air to be drawn into the vacuum chamber **144** from the mixing chamber **146**. The resulting reduction in pressure in the mixing chamber causes the valve door **150** to open enlarging the venturi **152** and drawing the metering tube or rod **190** across the venturi so that an increasing number of fuel supply ports are distributed across the increasing venturi. The opening of the valve door **150** by pivotal movement around the axis of shaft **160** is accompanied by sliding motion of the door upwardly on the rods **154**.

As the metering rod **190** starts to move across the mixing chamber, movement of the snap ring **200** starts to compress spring **196** until the spring lifts piston off of shoulder **202**; thereafter the full biasing effect of the piston **194** is applied to the metering rod to close the valve door **150** since the vacuum in chamber **144** is applied to the left face of piston **194** via passageway **204**, and motion of the piston **194** to the left on metering rod **190** is prevented by snap ring **200**.

It should be noted that the torsion spring **162** in this embodiment of the invention does not give the same variation in effective biasing force as does the spring **86** and arm **74** in FIG. 3; spring **162** has the same effect as would a compression spring between piston **194** and vent **172**. However, in some circumstances an effect similar to the spring **86** and arm **74** may be obtained by positioning the fuel delivery ports in the metering rod at irregular spacings from each other so that as the valve door **150** approaches its fully opened position, the number of fuel supply ports entering the mixing chamber increases rapidly for only small increases in the size of the venturi.

While the above description on the attached drawings describe several specific embodiments of the invention it is apparent that the carburetor of the invention may be constructed with many modifications and dimensions, arrangements of parts, and omission and addition of parts without departing from the spirit and scope of the invention.

I claim:

1. In a carburetor comprising a carburetor body defining at least in part a vacuum chamber adapted to communicate with the intake manifold of an internal combustion engine and a fuel mixing chamber and adjustable valve means for providing variable communication between said vacuum chamber and said mixing chamber, the improved means for introducing fuel and air into said mixing chamber comprising a valve door forming a wall of said mixing chamber, spring means biasing said door to a closed position with one edge of said door being movable responsive to increasing vacuum in said mixing chamber to provide an opening of increasing size in said wall of said mixing chamber, a sleeve pivotally mounted on said body adjacent to said one edge of said door and a metering rod slidably received in said sleeve and pivotally connected to said one edge of said door near the center of said door to be withdrawn from said sleeve into said increasing opening responsive to opening movement of said door, said metering rod having a bore therethrough adapted to be connected to a fuel supply and opposed lateral passageway means communicating with said bore and each having a fluid discharge area distributed along the length of said rod for introducing fuel into said opening at a plurality of fuel supply points spaced across said opening with the number of said fuel supply points increasing as the size of said opening increases.

2. The carburetor of claim 1 characterized further by the inclusion of a piston cylinder combination having a vacuum intake port in its cylinder and a pair of mounting means on its piston and cylinder with said pair of mounting means movable with respect to each other responsive to fluid pressure changes at said intake port, means connecting one of said mounting means to said body and the other of said mounting means to said valve door for urging said valve door toward said closed position responsive to reduction in pressure at said intake port at all positions of said valve door with respect to said body, and conduit means connecting said intake port to said vacuum chamber, whereby the vacuum condition in said vacuum chamber biases said valve door toward said closed position to provide a leaner fuel-air mixture during cruising conditions of said engine than during acceleration conditions of said engine.

3. The carburetor of claim 2 in which said spring means is connected to said door to bias said door toward said closed position with the biasing effect of said spring decreasing as said door is opened and with the biasing effect of said piston cylinder combination increasing as said door is opened.

4. In a carburetor comprising a carburetor body defining at least in part a vacuum chamber adapted to communicate with the intake manifold of an internal combustion engine and a fuel mixing chamber, and adjustable valve means for providing variable communication between said vacuum chamber and said mixing chamber,



the improved means for introducing fuel and air into said mixing chamber comprising a valve door pivotally mounted on said body and forming a wall of said mixing chamber, spring means biasing said door to a closed position with one edge of said door movable with respect to said body to provide an increasing opening into said mixing chamber responsive to increasing vacuum in said mixing chamber, and means for introducing fuel into said opening comprising a fuel metering rod pivotally connected to one edge of said door adjacent to the center of said door and having a bore therethrough adapted to be connected to a fuel supply and opposed lateral passageway means communicating with said bore and each having a fluid discharge area distributed along the length of said rod, a sleeve movably mounted on said body adjacent to said center of said one edge of said door and telescopically enclosing said metering rod, said metering rod extending across said opening and positioned to be progressively withdrawn from said sleeve as said door is opened.

5. The carburetor of claim 4 characterized further by the inclusion of selectively operable means for automatically changing the biasing of said door towards said closed position responsive to changes in pressure in one of said chambers.

6. The carburetor of claim 5 in which said selectively operable means comprises means for additionally biasing said door toward said closed position responsive to increases in the vacuum in said vacuum chamber.

7. The carburetor of claim 5 in which said spring means and said selectively operable means are both connected to said door to bias said door toward said closed position with the biasing effect of said spring decreasing as said door is opened and with the biasing effect of said selectively operable means increasing as said door is opened.

8. The carburetor of claim 4 characterized further in that said opening is generally rectangular in shape, said metering rod extends generally across the center of said opening and said fuel delivery ports are directed generally in the plane of said opening.

9. A carburetor comprising a body defining at least in part a lower, generally cylindrical, chamber adapted to communicate with the intake manifold of an internal combustion engine and an upper, generally rectangular fuel mixing chamber, a butterfly valve pivotally mounted in said body and defining a common wall between said chambers, means for manipulating said butterfly valve to provide variable communication between said chambers, a generally rectangular door forming a wall of said mixing chamber and having an edge thereof pivotally connected to said body with the opposite edge thereof movable with respect to said body to provide a variable opening into said mixing chamber, means for spring biasing said door toward a closed position, a fuel metering rod pivotally connected to said opposite edge of said door near the center of said edge and having generally opposed lateral fuel delivery ports therein spaced along the length of said rod, a central bore in said rod communicating with said ports and adapted to convey fuel to said ports and a sleeve pivotally mounted on said body and telescopically embracing said metering rod with the edge of said sleeve adjacent to said door lying closely adjacent to the line of contact between said body and said opposite edge of said door when said door is in said closed position.

10. The carburetor of claim 9 in which a biasing arm is mounted on said door for pivotal movement with said door; said spring biasing means comprises a tension spring with one end thereof connected to said arm and the other end thereof connected to said body and a piston cylinder combination having a vacuum intake port in its cylinder and a pair of mounting means on its piston and cylinder with said pair of mounting means movable with respect to each other responsive to fluid pressure changes at said intake port, means connecting one of said mounting means

to said body and the other of said mounting means to said door, and conduit means connecting said intake port to said lower chamber.

11. The carburetor of claim 10 in which the line of action of said tension spring on said arm approaches the axis of pivotal connection between said body and said door as said door opens; the line of action of said piston-cylinder combination on said arm regresses from said axis as said door opens.

12. The carburetor of claim 9 in which said metering rod lies generally in the vertical plane through the axis of pivotal mounting of said butterfly valve.

13. The carburetor of claim 12 in which said lower chamber communicates with the intake manifold of said engine through two barrels, and said barrels are spaced on opposite sides of said vertical plane.

14. The carburetor of claim 10 characterized further by the inclusion of means for adjusting the tension of said spring and the angle of operation of said spring on said arm and means for moving along the length of said arm the point at which said piston-cylinder combination operates on said arm.

15. The carburetor of claim 9 characterized further by the inclusion of means for adjusting the position of said edge of said sleeve relative to said opposite edge of said door.

16. In a fuel injection carburetor having a body defining at least in part a vacuum chamber adapted to communicate with the intake manifold of an internal combustion engine and a fuel mixing chamber, adjustable valve means forming a common wall of said chambers for controlling the passage of a fuel-air mixture from said mixing chamber into said vacuum chamber, a panel movably mounted on said body and defining with said body a variable venturi through which air passes into said mixing chamber with said panel having resilient mounting means uriging said panel toward a venturi closing position for controlling the cross sectional area of said venturi in inverse proportion to the pressure in said mixing chamber, and fuel injection means connected to said panel for injecting into said mixing chamber at said venturi a quantity of fuel which is proportional to the area of said venturi, the improvement comprising: a piston cylinder combination having a vacuum intake port in its cylinder and a pair of mounting means on its piston and cylinder with said pair of mounting means movable with respect to each other responsive to fluid pressure changes at said intake port, means connecting one of said mounting means to said body and the other of said mounting means to said panel for urging said panel toward said venturi closing position responsive to reduction in pressure at said intake port at all positions of said panel with respect to said body, and conduit means connecting said intake port to said vacuum chamber, whereby the vacuum condition in said vacuum chamber biases said panel toward a venturi closing condition to provide a leaner fuel-air mixture during cruising conditions of said engine than during acceleration conditions of said engine.

17. In a carburetor comprising a carburetor body defining at least in part a vacuum chamber adapted to communicate with the intake manifold of an internal combustion engine and a fuel mixing chamber having wall portions thereof and adjustable valve means for providing variable communication between said vacuum chamber and said mixing chamber, the improved means for introducing fuel and air into said mixing chamber which comprises:

(A) a valve door forming a first wall portion of said mixing chamber with said door having an edge adjacent to a second wall portion of said mixing chamber and defining with said second wall portion an entrance opening into said mixing chamber, means mounting said valve door for movement from a closed position toward an open position to move said door edge away from said second wall portion in response to increased vacuum in said mixing chamber,

(B) spring means biasing said door toward a closed position,

(C) a fuel supply means mounted on said body adjacent to said mixing chamber and adapted to be connected to a source of fuel under pressure, and

(D) a metering tube in said opening between said door edge and said second wall portion with said tube slidably received in said supply means and means connecting said tube with said door for movement with said door edge away from said second wall portion,

(E) said metering tube having an axial bore therethrough communicating with said source and a pair of laterally directed passageway means communicating with said bore, with said pair of passageway means positioned on opposite sides of said tube and with each passageway means of said pair having a fluid discharge area thereof distributed along the length of said tube partially within said fuel supply means and partially outside said fuel supply means between said door edge and said second wall portion when the door is partially open.

18. The carburetor of claim 17 characterized further by the inclusion of a piston cylinder combination having a fluid intake port therein with said piston cylinder combination connected to said door for urging said door toward said closed position responsive to the application of suction to said intake port, and passageway means connecting said intake port of said piston cylinder combination to said vacuum chamber of said carburetor body.

19. The carburetor of claim 18 characterized further in that said piston cylinder combination comprises a cylindrical recess in said carburetor body in axial alignment with said metering tube and a piston mounted on said metering tube and received in said cylindrical recess with said intake port extending into said cylindrical recess on one side of said piston.

20. In a carburetor comprising a carburetor body defining at least in part a vacuum chamber adapted to communicate with the intake manifold of an internal combustion engine and a fuel mixing chamber having wall portions thereof, and adjustable valve means for providing variable communication between said vacuum chamber and said mixing, the improved means for introducing fuel and air into said mixing chamber which comprises:

(A) a valve door forming a first wall portion of said mixing chamber with said door having an edge adjacent to a second wall portion of said mixing chamber and defining with said second wall portion an entrance opening into said mixing chamber, means mounting said valve door for movement from a closed position toward an open position to move said door edge away from said second wall portion in response to increased vacuum in said mixing chamber,

(B) spring means biasing said door toward a closed position,

(C) a fuel supply passageway formed in said body adjacent to said mixing chamber and adapted to be connected to a source of fuel under pressure, and

(D) a metering tube in said opening between said door edge and said second wall portion with said tube slidably received in said passageway for linear movement out of said passageway and means connecting said tube to said door for movement with said door edge away from said second wall portion,

(E) said metering tube having an axial bore therethrough communicating with said passageway and a pair of laterally directed passageway means communicating with said bore, with said pair of passageway means positioned on opposite sides of said tube and with each passageway means of said pair having a fluid discharge area thereof distributed along the length of said tube partially within said fuel supply passageway and partially outside said fuel supply passageway between said door edge and said second wall portion when the door is partially open.

21. The carburetor of claim 20 in which a support frame is pivotally mounted on said body at a hinge axis along one side of said mixing chamber remote from said metering tube, and means mounting said valve door on said support frame for sliding movement perpendicular to said hinge axis with said valve door having a free swinging edge remote from said hinge axis and pivotally connected at its center to said metering tube.

22. The carburetor of claim 20 characterized further by the inclusion of a cylindrical recess in said carburetor body in axial alignment with said metering tube and on the opposite side of said mixing chamber from said fuel supply passageway with said recess having an end wall adjacent to said mixing chamber through which said metering tube extends, a piston mounted on said metering tube in said recess and dividing said recess into a vacuum cylinder area between said piston and said end wall of said recess and an atmospherically vented cylindrical area on the side of said piston remote from said end wall, and passageway means connecting said vacuum cylinder area to said vacuum chamber.

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