Feb. 8, 1966 B. C. PHILLIPS 3,233,878

CHARGE FORMING APPARATUS

Filed Aug. 25, 1961 4 Sheets-Sheet 1

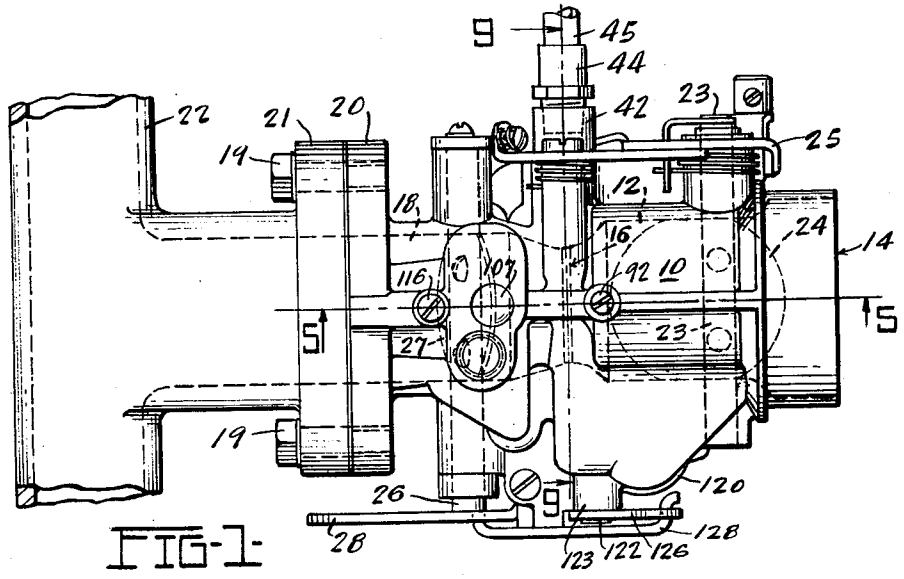

FIG-1-

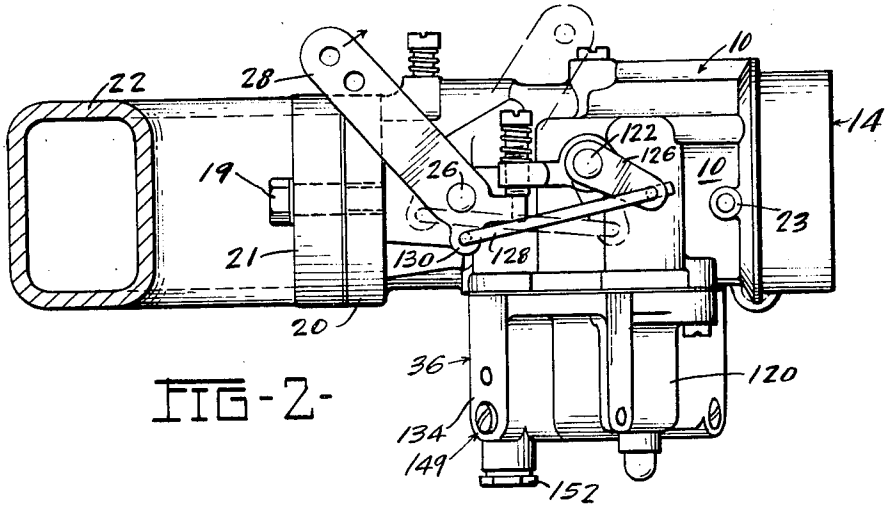

FIG-2-

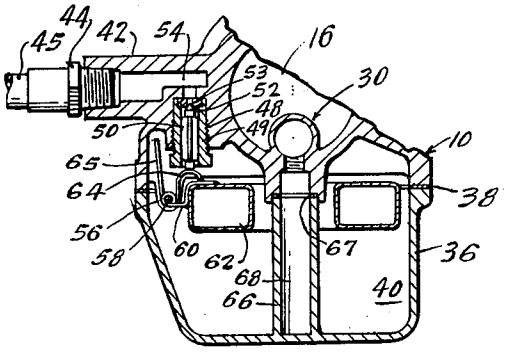

FIG-9-

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CHARGE FORMING APPARATUS

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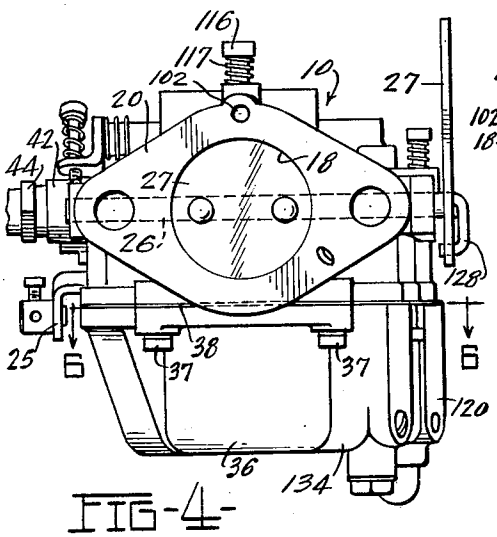

FIG-4-

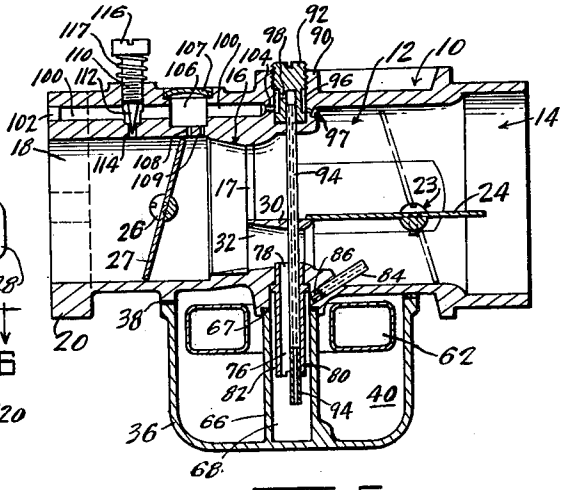

FIG-5-

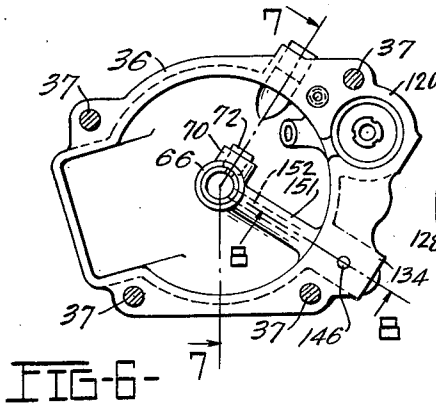

FIG-6-

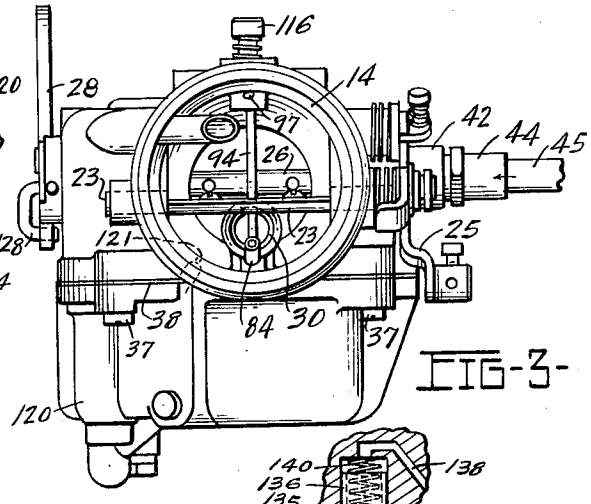

FIG-3-

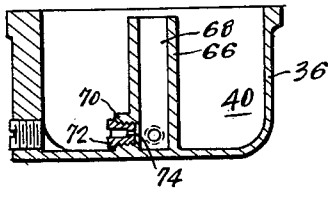

FIG-7-

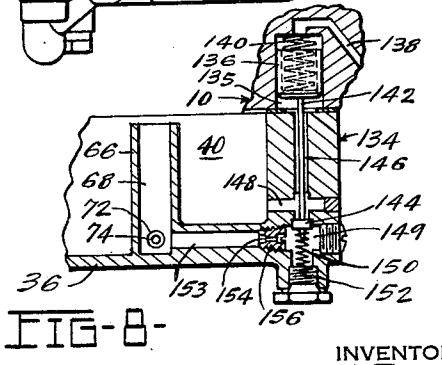

FIG-8-

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CHARGE FORMING APPARATUS

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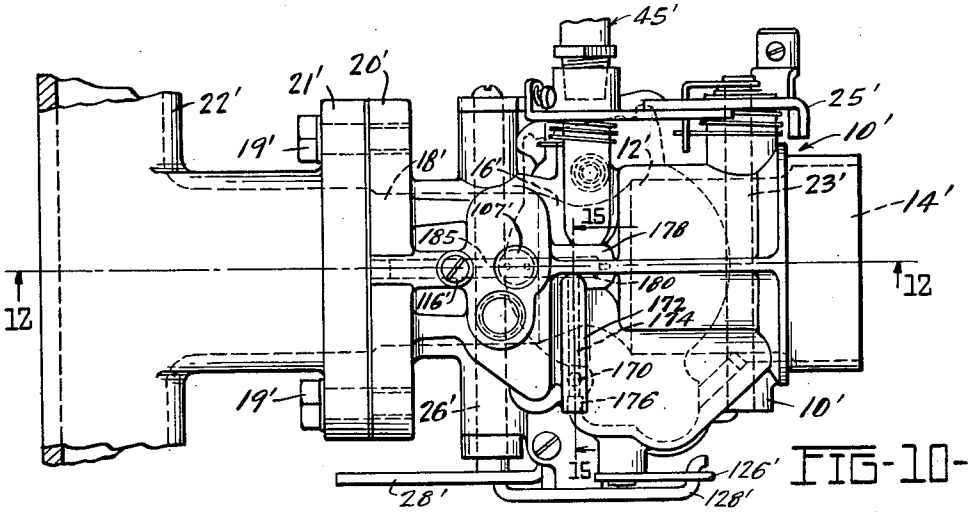

FIG-10-

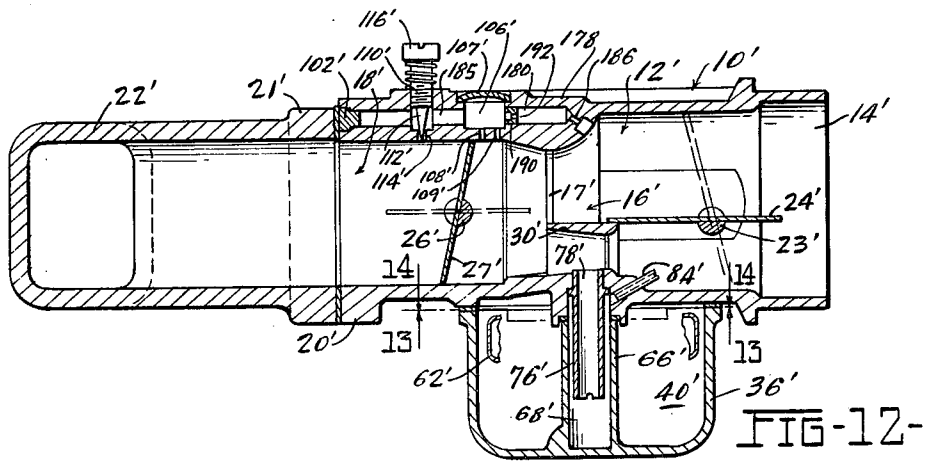

FIG-12-

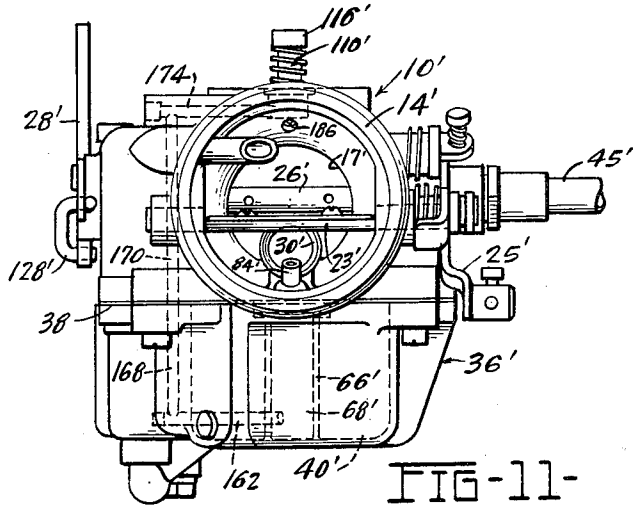

FIG-11-

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Feb. 8, 1966 B. C. PHILLIPS 3,233,878

CHARGE FORMING APPARATUS

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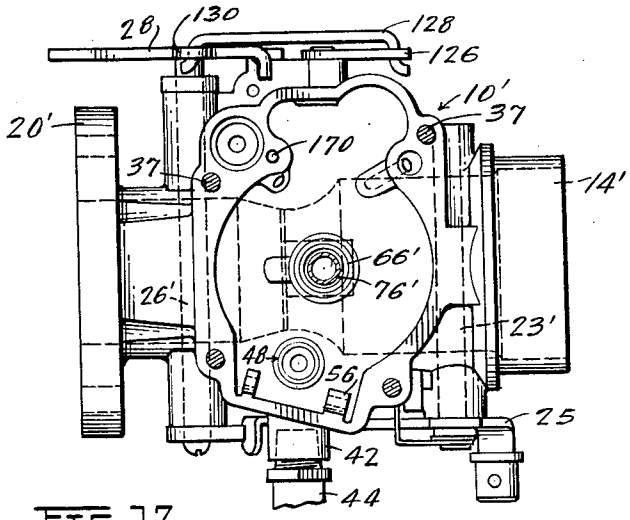

FIG-13-

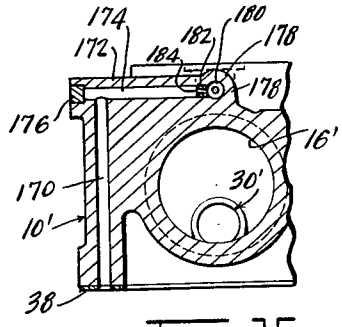

FIG-15-

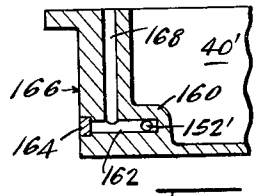

FIG-16-

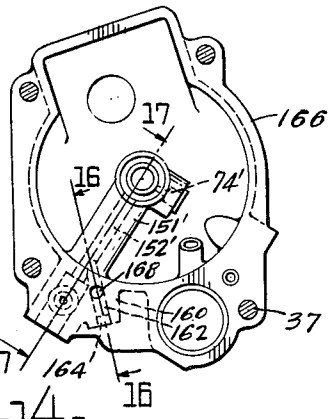

FIG-14-

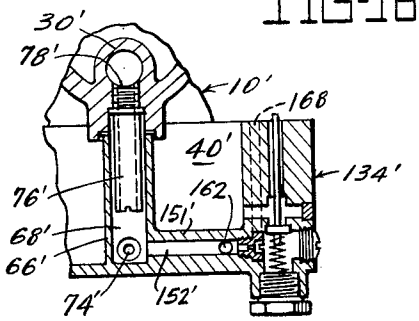

FIG-17-

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United States Patent Office 3,233,878 Patented Feb. 8, 1966

3,233,878

CHARGE FORMING APPARATUS

Bernard C. Phillips, Toledo, Ohio, assignor to The Tillotson Manufacturing Company, Toledo, Ohio, a corporation of Ohio

Filed Aug. 25, 1961, Ser. No. 133,933
2 Claims. (Cl. 261—23)

This invention relates to charge forming apparatus and more particularly to a charge forming apparatus or carburetor having a mixing passage embodying a double Venturi and a fuel chamber wherein the fuel level in the chamber is regulated by a float controlled valve mechanism.

Charge forming apparatus has been heretofore employed wherein a supplemental Venturi is concentrically arranged with a main Venturi in order to enhance delivery of liquid fuel into the mixing passage through increased air velocity moving through the supplemental Venturi. Heretofore, the supplemental Venturi, being concentric with the main Venturi, required substantial lift or aspiration in order to effect delivery of fuel through the main orifice into the supplemental Venturi.

In float-type carburetors wherein the supplemental Venturi is in concentric relation with the main Venturi, the substantially high lift or high aspiration required to effect delivery of fuel through the main orifice encourages the formation of lean mixtures at comparatively low engine speeds especially under load conditions.

The present invention embraces the provision of a float-controlled carburetor having a main Venturi in the mixing passage and a supplemental Venturi disposed eccentric to the axis of the main Venturi and in close proximity to the fuel level in the fuel chamber whereby the aspiration or lift required to effect delivery of fuel through the main orifice is substantially reduced.

An object of the invention is the provision of a float-controlled carburetor having main and supplemental Venturis in the mixing passage wherein the supplemental Venturi is arranged to maintain effective lift upon the fuel particularly at engine idling or low speed operating conditions whereby improved fuel and air mixture ratios are obtained at engine idling and low speed and further assuring more more rapid delivery of fuel through the main nozzle when the throttle valve is moved toward open position.

Another object of the invention resides in a float bowl type carburetor having a main Venturi and an eccentrically positioned supplemental Venturi in the mixing passage wherein the float is concentric with the main fuel delivery channel or duct whereby the carburetor is operable in substantial angular positions or positions of tilt from a horizontal position.

Another object of the invention resides in the use of a disc-type throttle valve movable about a horizontal axis whereby the distribution of the fuel and air mixture in the intake manifold of an engine is improved.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

FIGURE 1 is a top plan view illustrating one embodiment of the charge forming apparatus of the invention;

FIGURE 2 is a side elevational view of the charge forming apparatus shown in FIGURE 1;

FIGURE 3 is an elevational view of one end of the charge forming apparatus shown in FIGURES 1 and 2;

FIGURE 4 is an elevational view of the opposite end of the charge forming apparatus shown in FIGURES 1 and 2;

FIGURE 5 is a longitudinal sectional view taken substantially on the line 5—5 of FIGURE 1;

FIGURE 6 is a view taken substantially on the line 6—6 of FIGURE 4;

FIGURE 7 is a detail sectional view taken substantially on the line 7—7 of FIGURE 6;

FIGURE 8 is a detail sectional view taken substantially on the line 8—8 of FIGURE 6;

FIGURE 9 is a detail sectional view taken substantially on the line 9—9 of FIGURE 1;

FIGURE 10 is a top plan view illustrating a modified form of charge forming apparatus of the invention;

FIGURE 11 is an end elevational view of the charge forming apparatus illustrated in FIGURE 10;

FIGURE 12 is a longitudinal sectional view taken substantially on the line 12—12 of FIGURE 10;

FIGURE 13 is a view taken substantially on the line 13—13 of FIGURE 12;

FIGURE 14 is a view taken substantially on the line 14—14 of FIGURE 12;

FIGURE 15 is a detail sectional view taken substantially on the line 15—15 of FIGURE 10;

FIGURE 16 is a detail sectional view taken substantially on the line 16—16 of FIGURE 14, and

FIGURE 17 is a detail sectional view taken substantially on the line 17—17 of FIGURE 14.

While the forms of carburetor or charge forming apparatus of the invention are particularly usable for forming fuel and air mixtures for multicylinder internal combustion engines, it is to be understood that the charge forming apparatus of the invention may be utilized with single cylinder engines or with any arrangement requiring a fuel and air mixture.

Referring to the drawings in detail, the charge forming apparatus or carburetor, shown in FIGURES 1 through 9, is fashioned with a body or body member **10** formed with a normally horizontally arranged mixing passage **12**, the mixing passage being inclusive of an air inlet **14**, a main Venturi **16** and a mixture outlet region **18**.

The outlet end of the carburetor is formed with a mounting flange **20** adapted to be attached by means of bolts **19** to a flange **21** of a mixture distribution chamber or manifold **22** adapted to convey fuel and air mixture to the combusion chamber or chambers of an internal combustion engine.

Extending across the air inlet **14** is a shaft **23** which is preferably horizontally arranged and which is equipped with a disc type valve **24** forming a choke valve for engine starting purposes. A manipulating arm **25** is affixed to the shaft **23** for manipulating the choke valve. A second shaft **26** extends horizontally across the mixture outlet region **18** and is equipped with a disc type throttle valve **27** as particularly shown in FIGURE 5. A throttle manipulating or control arm **28** is fixed to the shaft **26** exteriorly of the body **10**.

Disposed within the main Venturi **16** is a supplemental or auxiliary Venturi **30** of comparatively small diameter and is arranged beneath the longitudinal axis of the main Venturi **16** with the carburetor body in a horizontal position as viewed in FIGURES 4 and 5. The supplemental Venturi is positioned lengthwise of the mixing passage and the outlet region **32** of the supplemental Venturi opens into the choke band or zone of maximum restriction **17** of the main Venturi **16**. The axis of the supplemental Venturi **32** is between the axis of the main Venturi and the fuel chamber in close proximity to the fuel chamber as is practicable.

A fuel receptacle or float bowl **36** providing a fuel chamber or reservoir **40** is disposed beneath the mixing passage **12** and is secured to the carburetor body **10** by

means of screws 37, a sealing gasket 38 being disposed between the receptacle 36 and the carburetor body 10. The fuel chamber 40 receives fuel from a supply or fuel tank for delivery into the mixing passage 12 and therein mixed with air providing combustible mixture. The ingress of fuel into the chamber 40 provided by the receptacle 36 is regulated by a float-controlled valve means shown in FIGURE 9.

The carburetor body 10 is formed with a boss 42 which is bored and threaded to accommodate a fitting or coupling 44 for a tube or fuel line 45 connected with a fuel supply tank (not shown). Liquid fuel may be supplied through the tube 45 from a fuel tank by gravity or the tube may be connected with a fuel pump of conventional construction for supplying fuel under comparatively low pressure to the carburetor.

The body 10 is provided with a threaded bore 48 accommodating a tubular fitting 49 in which is slidably disposed a valve member 50 formed with a cone-shaped valve portion 52 which cooperates with an annular valve seat 53 supported by the fitting 49. The port in the valve seat 53 is in communication with a fuel supply tube 45 through an inlet duct 54. The valve member 50 is of polygonal cross-section to accommodate the flow of liquid fuel past the valve member into the fuel chamber or reservoir 40 provided by the receptacle or bowl 36.

Mounted in a boss 56 depending from the body 10 into the chamber 40 is a stub shaft or pin 58 upon which is pivotally mounted an arm 60 provided with an annularly-shaped float member 62. The arm 60 is fashioned with a raised portion 64 adapted to engage the lower end of the valve member 50 whereby the position of the float 62 and the arm 60 controls the position of the valve member 50 and hence regulates the flow of liquid fuel into the fuel chamber 40. Through the use of this mechanism a substantially constant level of fuel is maintained in the chamber 40. The arm 60 is provided with an upwardly extending portion 65 for limiting the downward movement of the float 62.

The receptacle 36 is formed with an upwardly extending tubular portion 66, an annular gasket 67 being disposed between the upper end of the tubular portion 66 and the adjacent region of the body 10, as shown in FIGURE 9. The hollow interior of the tubular portion 66 provides a supply well 68 to receive fuel from the reservoir or chamber 40. As shown in FIGURE 7, a boss 70 on the portion 66 is bored to accommodate a bushing or fitting 72 which has a restricted opening 74 for metering fuel flow from the chamber 40 into the well 68.

The region of the body 10 adjacent the restricted zone of the supplemental Venturi 30, is provided with a bore accommodating a tubular member 76, the upper open end of which provides a main fuel discharge outlet or orifice 78 for delivering fuel into the supplemental Venturi. The fitting 76 is formed with a sleeve portion 80 of lesser diameter than the diameter of the supply well 68, the sleeve portion depending into the well 68, as shown in FIGURE 5.

The sleeve portion 80 provides with the tubular portion 66 an annular space 82 which is in communication with the air inlet region 14 through a tube 84 to admit or bleed a small amount of air through the annular space 82 for admixing with the fuel delivered through the main orifice 78. The air bleed tube 84 is formed with a restricted passage 86 for metering the air bled into the fuel. The metering restriction 86 may be of desired size and may be varied in size to secure the proper amount of air bled into the fuel.

The carburetor of the invention is provided with an arrangement for delivering fuel into the mixing passage for engine idling and low speed purposes. With particular reference to FIGURE 5, the body 10 is provided with a boss 90 which is bored and threaded to accommodate a fitting 92. The fitting has an interior bore arranged to receive a fuel conveying tube or member 94 which extends downwardly through the main and supplemental Venturis and through the main orifice 78 and the sleeve 80 and terminates at a region substantially below the lower terminus of the sleeve 80, as shown in FIGURE 5.

By terminating the lower end of the tube 94 at the region illustrated in FIGURE 5, liquid fuel will be conveyed through the tube 94 to the secondary fued delivery system without any air being mixed with the fuel. The tube 94 is supported by the fitting 92. The fitting 92 is provided with a reduced portion forming an annular chamber or passage 96 which is in communication with the tube 94 through a transverse passage 98 formed in the fitting 92.

An air bleed channel 97 opening into the air inlet region 14 is provided for admitting a restricted amount of air into the fuel to be delivered through the secondary fuel delivery system.

Drilled into the body 10 in a direction substantially parallel with the axis of the mixing passage is a fuel passage or channel 100, the outer end being closed by a plug 102. The channel 100 is in communication with the annular passage 96 by means of a restricted passage or channel 104, the latter restriction metering the fuel delivered into the channel 100. Formed in the body 10 in communication with channel 100 is a chamber 106 which is closed by means of a Welsh plug 107. The wall of the mixing passage adjacent chamber 106 is formed with two fuel delivery orifices 108 and 109 of the secondary fuel delivery system for discharging fuel into the passage when the throttle is in partially open position for low speed engine operation.

The body 10 is formed with a threaded bore accommodating a threaded valve member 110 having a needle valve portion 112 projecting across the channel 100 and extending into an engine idling orifice 114 formed in the wall of the mixing passage at the mixture outlet region 18. The valve member 110 is provided with a head 116 to facilitate adjustment of the valve member to meter fuel delivered through the orifice 114. A coil spring 117 beneath the head 116 and the body 10 establishes friction to maintain the valve member 110 in adjusted position.

From the foregoing description it will be apparent that the aspiration or reduced pressure in the mixture outlet region 18 with the throttle 27 in substantially closed or engine idling position causes flow of fuel from the supply well 68 through tube 94, passages 98, 96, 104 and 100 through the orifice 114 for engine idling operation. At partial open position of the throttle, aspiration in the mixing passage is effective on the secondary orifices 108 and 109 to effect delivery of additional fuel into the mixing passage to facilitate low speed operation of the engine prior to appreciable delivery of fuel through the main orifice 78 into the Venturi 30.

By positioning the supplemental Venturi 30 as close as practicable to the fuel level in chamber 40, early delivery of fuel through the main orifice is attained, assisted by the comparatively high air velocity through the small supplemental Venturi 30. It has been found desirable in the use of the carburetor with a multicylinder engine having a horizontal manifold to dispose the throttle shaft 26 in a horizontal position, especially by reason of the eccentric location of the supplemental or secondary Venturi 30.

During engine operation with fuel delivering through the main orifice 78, the fuel and air mixture issuing from the secondary Venturi 30 expands in the mixture outlet region 18 in the shape of a flattened cone, that is, flattened in the lower region of the mixture outlet 18 of the mixing passage.

In view of the comparatively short length of the outlet region 18, the fuel is not dispersed uniformly vertically in the mixture outlet region. By reason of this

condition, the fuel mixture pattern in the mixture outlet will be appreciably more rich in fuel in the lower region of the mixture outlet than in the upper region.

By placing the throttle shaft substantially parallel with the manifold **22**, the fuel and air mixture tends to stratify in the mixture outlet of the carburetor, and delivery of such mixture into the T of the intake manifold **22** facilitates distribution of substantially uniform mixture throughout the length of the manifold. Hence there is no tendency for any region of the manifold at either side of the T to receive a nonuniform mixture even though fuel stratification exists vertically in the mixture outlet of the carburetor. In installations where the carburetor is used with single cylinder engines, the positioning of the axis of the throttle is immaterial as stratification of fuel in the mixture outlet of the carburetor or in the manifold does not affect the operation of a single cylinder engine.

The carburetor is provided with a boss portion **120** which is in vertical position when the fuel receptacle or chamber is horizontal. The boss **120** is provided with a vertical bore accommodating an accelerating pump or mechanism (not shown) of conventional construction for delivering additional fuel through an orifice **121** shown in FIGURE 3, and opening into the mixing passage for engine accelerating purposes. As shown in FIGURE 3, the accelerating fuel delivering orifice is spaced from the supplemental Venturi **30**. The accelerating pump mechanism is actuated by rotation of the throttle shaft **26** when the throttle is rapidly opened.

As particularly shown in FIGURES 1 and 2, a shaft **122** is journaled in a boss **123** formed on the body **10** and is connected with the accelerating pump mechanism by means (not shown). Secured to the shaft **122** is an arm **126** which is connected by a link or rod **128** with a projection **130** formed on the throttle operating arm **28**. The extremities of the link **128** are pivotally associated with the arm **126** and the projection **130**. Movement of the throttle control arm **27** toward open position rotates a shaft **122** through the medium of the link **128** to actuate the accelerating pump.

The carburetor embodies a vacuum operated power jet or economizer of conventional construction for providing a more rich mixture under certain engine load conditions and to effect economy in fuel consumption when the engine is operating under light load conditions, particularly, at substantially constant speed of the engine.

The power jet arrangement is contained in a boss **134** which is bored to accommodate a suction or vacuum operated plunger actuated or influenced by aspiration or reduced pressure in the mixing passage through a channel or passage (not shown) opening into the mixing passage, preferably at the down stream region of the Venturi **16**.

Such arrangement is illustrated in FIGURE 8. The carburetor body **10** is provided with a bore **135** in which is slidably mounted a hollow cup-like member or plunger **136**, the bore being connected with the mixing passage by means of a duct **138**. An expansive coil spring **140** biases the cup-shaped member **136** downwardly as viewed in FIGURE 8, which exerts downward pressure upon a valve stem **142** which is equipped with a valve member **144**. The duct or channel **146** accommodating the stem **142** is in communication with the fuel chamber **40** by means of a channel or passage **148**.

Disposed beneath the valve portion **144** in a supplemetal chamber **149** is an expansive coil spring **150** which seats on a member **152** threaded into a projection on the boss **134**. The spring **150** normally biases the valve **144** toward closed or fuel interrupting position as shown in FIGURE 8. The supplemental chamber **149** is in communication with the fuel well **68** by means of a passage **153** and a restricted or fuel metering passage **154** provided in a bushing or sleeve **156**.

When the engine with which the carburetor is used is operating under light load conditions with a substantial vacuum or aspiration in the mixing passage, the cup-like member **36**, influenced by the suction in the channel **138**, is maintained in its uppermost position whereby the expansive pressure of the spring **150** urges or maintains the valve **144** in closed position preventing the flow of fuel through the passage **148** past the valve **144**.

When the engine is operating under substantial load at intermediate speeds, low air velocity and hence low aspiration or suction exists in the mixing passage. Under such conditions the expansive pressure of spring **140** exceeds the pressure of aspiration on the plunger **136** and moves the cup-shaped member **136** downwardly as viewed in FIGURE 8, opening the valve **144** by downward pressure upon the stem **142**, thereby providing for additional fuel to flow from the fuel chamber **40** through passage **148** past the valve **144**, through the auxiliary chamber **149**, restricted metering passage **154** and passage **153** for delivery through the main orifice **78** into the supplemental Venturi **30**.

Through this arrangement, adlitional fuel providing a more rich mixture is delivered into the mixing passage for engine operation under substantial load conditions. When the engine load is reduced, the increase in velocity in the mixing passage sets-up or establishes increased aspiration effective through the duct **138** to lift the cup-like member **136**, compressing the spring **140**.

The upward movement of the member **136** results in upward movement of the valve **144** toward closed position to thereby interrupt or prevent flow of additional fuel past the valve **144**. Thus a reduction of the proportion of fuel in the mixture is attained when the engine is operating at substantial speed under light load conditions.

The float **62**, controlling the fuel inlet valve **52**, is arranged substantially concentric with the axis of fuel well **68** and the orifice **78**. Through such arrangement, the carburetor may be tilted substantially without materially disturbing the operation of the carburetor. It is found that the carburetor may be tilted at an angle of about thirty-five degrees relative to a vertical axis through the main orifice before appreciable impairment of operation is encountered.

FIGURES 10 through 17 illustrate a modified form of carburetor of the invention illustrating a modified arrangement for the delivery of fuel from the main fuel chamber to the secondary fuel discharge system or the engine idling and low speed orifices. The carburetor of this form is inclusive of a body **10'** having a mixing passage **12'**, an inlet region **14'**, a main Venturi **16'** and a mixture outlet region **18'**. The body is formed with a mounting flange **20'** which is secured by bolts **19'** to a flange **21'** formed on a horizontally disposed engine intake manifold or mixture distribution chamber **22'**.

A shaft **23'** extends across the inlet region **14'**, and is provided with a disc-type choke valve **24'**. A shaft **25'** extends across the outlet region **18'** and is equipped with a disc-type throttle valve **27'**. A supplemental Venturi **30'** is arranged in the mixing passage eccentric to the axis of the main Venturi **16'** and has its outlet at the region of the choke band or maximum restricted region **17'** of the main Venturi **16'**.

Secured to the carburetor body **10'** is a receptacle **36'** providing a fuel chamber **40'**. The fuel chamber **40'** contains an annular float of the character shown in FIGURE 9 which controls fuel flow from the supply pipe **45'** and the fuel inlet valve construction as shown in FIGURE 9.

The receptacle **36'** is formed with an upwardly extending hollow projection or sleeve **66'** which forms a fuel well **68'**. A tubular member **76'** extends into the fuel well **68'** and is provided with a main orifice **78'** at its extremity arranged to deliver fuel into the supplemental or eccentrically disposed small Venturi **30'**. An air bleed **84'** opens into the upper region of the well **68'** and admits air from the inlet region **14'** of the mixing passage for admixing with the fuel being discharged through the main orifice **78'**.

The carburetor shown in FIGURES 10 through 12 is also provided interiorly with a throttle-operated accelerating pump and a power vacuum operated jet or fuel economizer of the character described in connection with the carburetor shown in FIGURES 1 through 9. In this form of the invention, the fuel for the secondary fuel discharge system for engine idling and low speed operations is conveyed to the secondary discharge system by channels and ducts spaced from the main and supplemental Venturi, the ducts and channels being formed in the receptacle **36'** and the body **10'**.

The well **68'** provided by the tubular member **66'** receives its fuel from the chamber **40'** in the same manner as shown in FIGURE 7. The power jet arrangement in this form of the invention, a portion of which is shown in FIGURE 17, is of the same character as illustrated in FIGURE 8, which is contained in the hollow interior of the boss **134'**. The boss portion **151'** is formed with a passage **152'** for conveying fuel from the chamber **40'** through the power jet valve mechanism into the well **68'** for enrichening the mixture under certain load conditions.

The fuel wall **68'** normally receives fuel direct from the fuel chamber **40'** through a metering passage such as shown at **74'** to accommodate normal delivery of the fuel through the main orifice **78'**, the latter being the outlet of the sleeve or tube **76'**. With reference to FIGURES 14 and 16, a boss portion **160** is formed with a drilled passage or duct **162**, the entrance of which is closed by a plug **164**. Disposed vertically in a wall region of the receptacle **166** is a drilled passage or duct **168** which is in communication with the duct **162**. The duct **162** is in communication with the passage or duct **152'**.

As shown in FIGURE 15, the body **10'** is fashioned with a vertically arranged pasage or duct **170** which, when the body **10** is assembled with the receptacle or bowl **166**, shown in FIGURE 16, is in registration with the passage **168**. The upper region of the body **10'** above the mixing passage is formed with a transversely extending boss portion **172** which is provided with a drilled passage **174** shown in FIGURES 10 and 15, the end of the passage **174** being closed by a plug **176**.

The passage **170** is in communication with the passage **174**. A boss portion **178** exending lengthwise of the body is provided with a passage **180**. Arranged between the passage **174** and passage **180** is a fitting or member **182** provided with a restricted passage **184** which establishes restricted communication between the passage **174** and the passage **180**.

Referring to FIGURE 12, the secondary fuel delivery system, which is similar to the system shown in FIGURE 5, is inclusive of a passage **185**, a supplemental chamber **106'**, one wall of the chamber being a Welsh plug **107'**, the wall of the mixing passage being provided with fuel delivery orifices **108'** and **109'** for delivering fuel into the mixing passage for low speed engine operation when the throttle **27'** is in partial open position. The pasage **185** is drilled into the body and the outer end thereof closed by a plug **102'**.

An idling orifice **114'** opens into the mixture outlet region **18'** of the mixing passage on the downstream side of the throttle valve for engine idling purposes. Disposed in a threaded opening in the body **10'** is a valve body **110'** fashioned with a needle valve portion **112'** extending into the engine idling orifice **114'**, the valve body **110'** being provided with a head **116'**. The valve body **110'** is rotatable to adjust the needle valve portion **112'** in the orifice **114'** for controlling or metering the delivery of fuel mixture into the outlet region **18'** of the carburetor.

The passage **180** is in communication with a restricted air bleed passage **186** shown in FIGURE 12 for admitting air from the air inlet region **14'** of the carburetor into the passage **180** for admixing with the fuel delivered through the orifices **108'**, **109'** and **114'**. The air bleed restriction **186** may be of a dimension to provide a small amount of air for admixing with the fuel for the secondary system. Disposed in the passage **180** is a member **190** provided with a restricted passage **192** for metering or restricting the fuel and air mixture flow from passage **180** into the chamber **106'** and the passage **185**.

In this form of the invention, the fuel for the secondary fuel discharge system is conveyed to the discharge orifices **108'**, **109'** and **114'** through the intercommunicating passages **152'**, **162'**, **168**, **170**, **174**, **184**, **180**, and **192** into the supplemental chamber **106'** for distribution to the engine idling and low speed orifices or secondary fuel delivery system. Through this arrangement, the fuel for the secondary system is conveyed by means spaced transversely from the mixing passage so that there is no impediment or obstruction in the main Venturi **16'** or the supplemental Venturi **30'**.

It is to be understood that the secondary fuel delivery system may be arranged in other regions of the mixing passage than that shown in FIGURE 12, but it has been found preferable to deliver fuel through secondary orifices arranged out of the direct path of the fuel and air mixture flowing through the supplemental Venturi in order to secure improved distribution of the fuel in the air moving through the main Venturi.

If a throttle valve shaft **26'** is disposed for rotation about an axis other than a horizontal position, a secondary fuel discharge system should be correspondingly modified so that fuel from the secondary system is delivered into the mixing passage adjacent the periphery of the valve disc **27'** at its region of maximum movement relative to its supporting shaft. The restriction **184** in passage **174**, illustrated in FIGURE 15, meters or controls the flows of liquid fuel from the chamber **40'** into the passage **180**. The restricted opening **192** shown in FIGURE 12 meters or controls the fuel and air mixture from passage **180** into auxiliary chamber **106'**.

It is apparent that, within the scope of the invention, modifications and different arrangements may be made other than as herein disclosed, and the present disclosure is illustrative merely, the invention comprehending all variations thereof.

I claim:

1. Charge forming apparatus of the character disclosed, in combination, a body construction provided with a horizontal air and fuel mixing passage and a fuel chamber beneath the mixing passage adapted to contain liquid fuel, a throttle valve in said passage, a fuel inlet for the fuel chamber, a valve in said fuel inlet, annularly-shaped float means arranged to control said fuel inlet valve, said mixing passage being formed with a main Venturi and a supplemental Venturi having their axes in parallel relation, the supplemental Venturi being within the confines of the main Venturi so that the main Venturi air fuel mixture circulates around a major portion of the outside wall of said supplemental Venturi, the axis of said supplemental Venturi being offset from the axis of the main Venturi and parallel to the surface of the fuel in the fuel chamber and being immediately adjacent the surface of the fuel in said fuel chamber, means formed in said fuel chamber providing a fuel well, tubular means in said well having its axis normal to the axis of the supplemental Venturi, the outlet of the tubular means opening into the supplemental Venturi and forming a main fuel discharge orifice, a secondary fuel discharge orifice formed in the body construction and opening into the mixing passage, channel means in communication with the secondary fuel discharge orifice and the fuel chamber for conveying fuel to the secondary orifice under the influence of aspiration in the mixing passage, and an air bleed for admitting air into the fuel well for admixing the fuel discharge through the main orifice.

2. Charge forming apparatus of the character disclosed, a body construction formed with a horizontal air and fuel mixing passage and a fuel chamber beneath the mixing passage, a throttle valve in said passage, said mixing pas-

sage including a main Venturi and a supplemental Venturi of reduced size disposed within the confines of the main Venturi so that the main Venturi air fuel mixture circulates around a major portion of the outside wall of said supplemental Venturi, the axis of said supplemental Venturi being offset from the axis of the main Venturi and parallel to the surface of the fuel in said fuel chamber and being immediately adjacent the surface of the fuel in said fuel chamber, means in said fuel chamber providing a fuel well, tubular means extending into said well having its axis normal to the axis of the supplemental Venturi and terminating in a fuel delivery orifice opening into the supplemental Venturi, a fuel inlet formed in the body arranged to be connected with a fuel supply, valve means in the fuel inlet, an annularly-shaped float in said chamber substantially concentrically arranged with the axis of the tubular means, a member connected with the float for controlling said valve means to regulate the level of liquid fuel in the chamber, secondary fuel delivery orifices formed in a wall region adjacent the throttle valve for supplying fuel for engine idling and low speed engine operation, said throttle valve being adjustable about a substantially horizontal axis, the axes of said main and supplemental Venturis being spaced vertically and in parallel relation, a tube extending through the Venturis and the tubular means for conveying fuel from the fuel well to said secondary orifices, a restriction in said duct means for metering fuel for the secondary orifices, an air bleed channel for admitting air to the fuel for the secondary orifices, and a second restriction for metering the fuel and air mixture delivered through the secondary orifices.

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