Dec. 18, 1956 R. F. BRACKE 2,774,582

CARBURETOR

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Fig. 1.

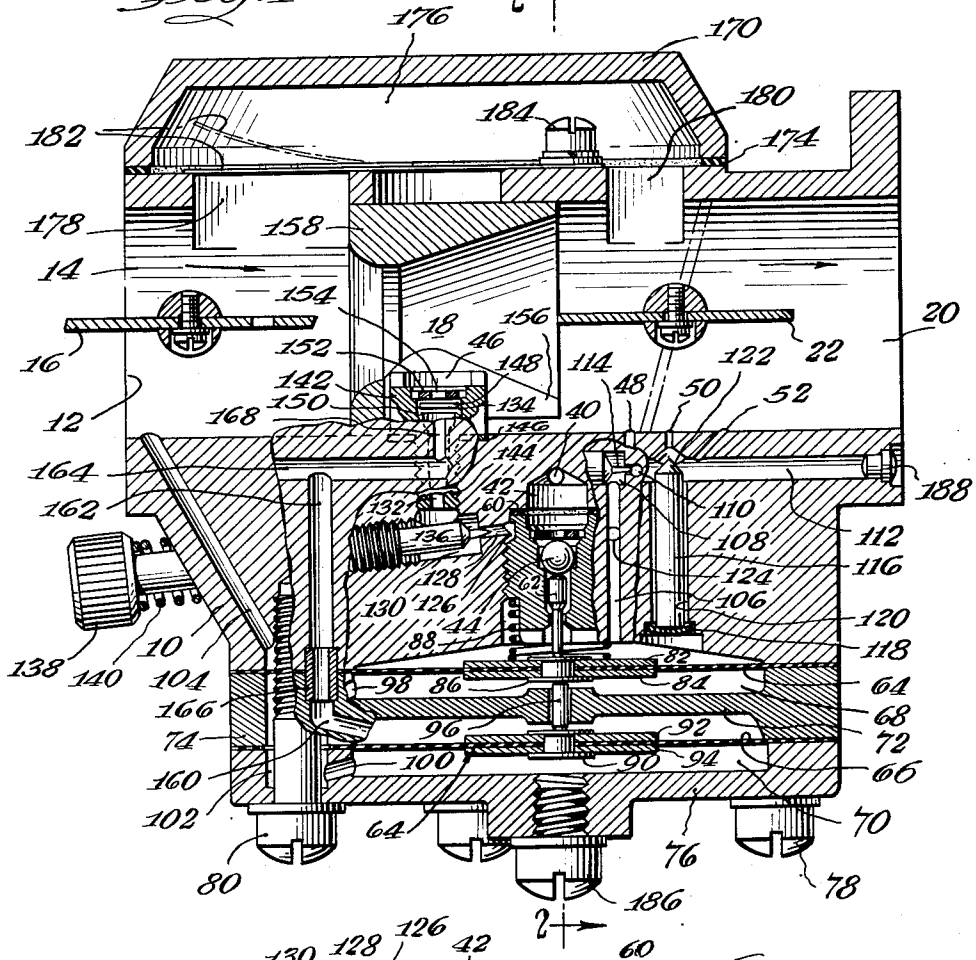
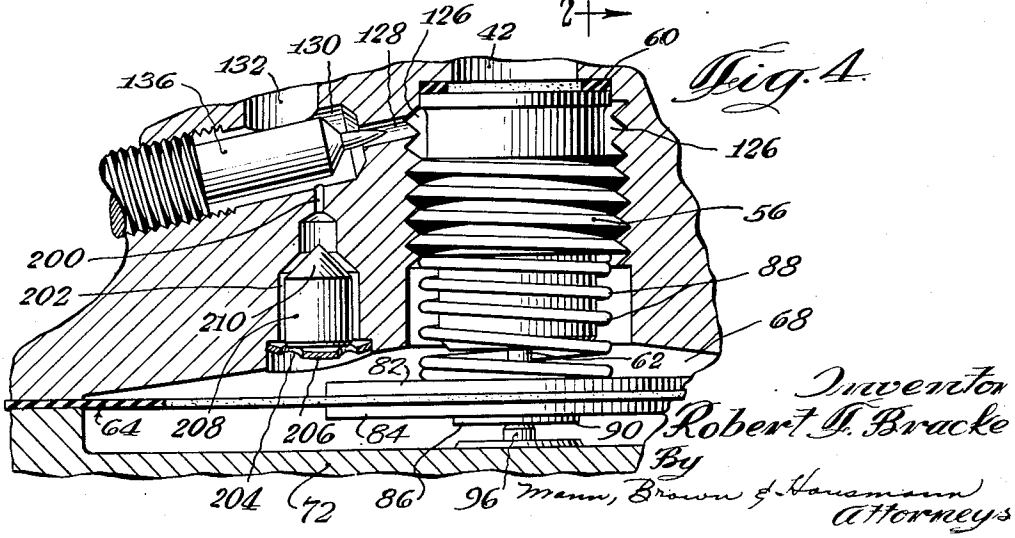


Fig. 4.



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Fig. 2.

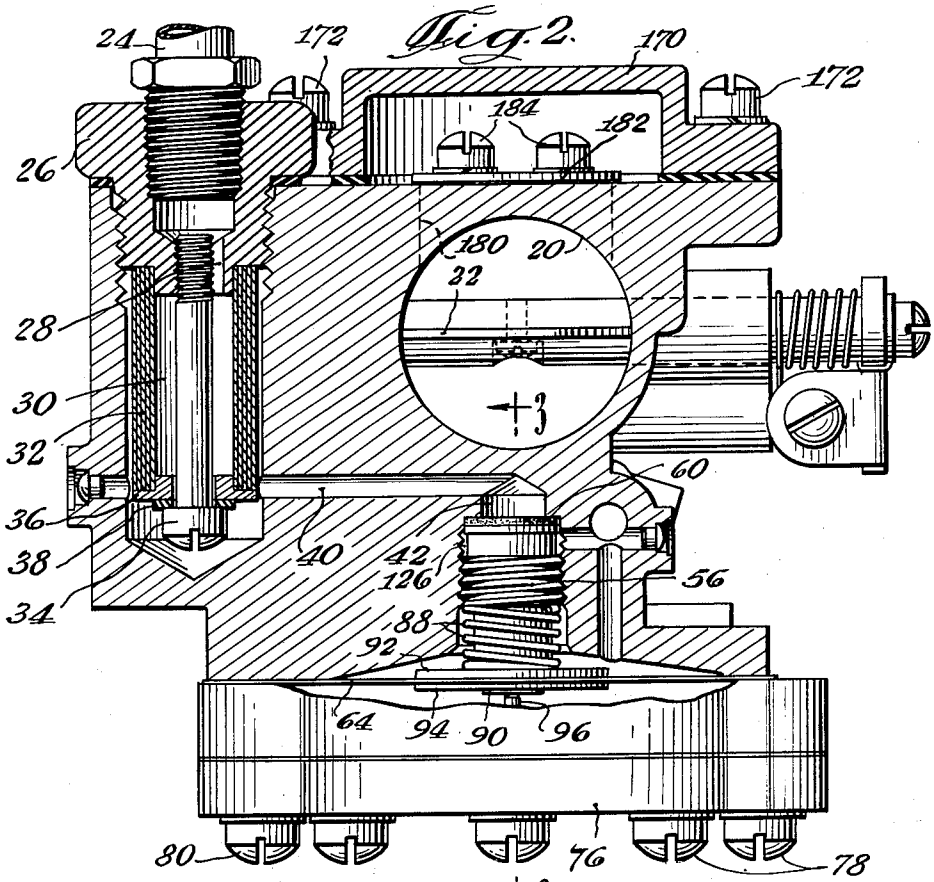
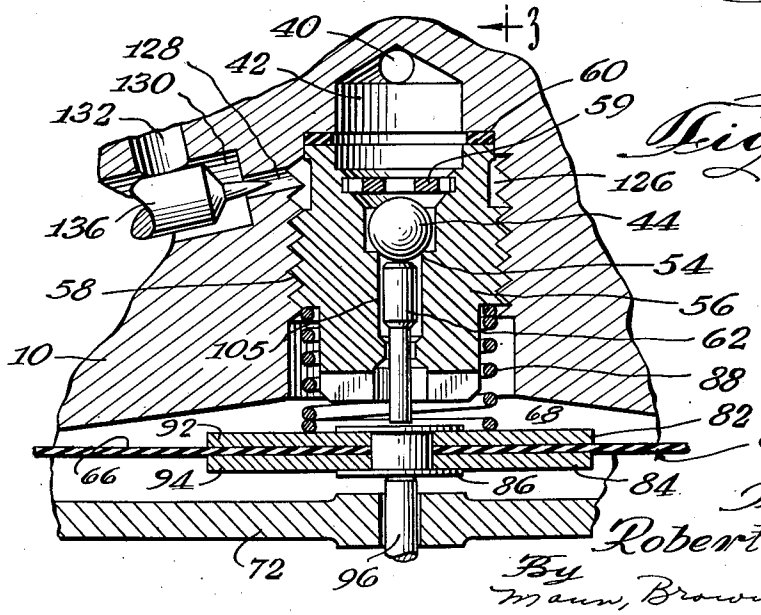


Fig. 3.



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CARBURETOR

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Application April 3, 1952, Serial No. 280,321

5 Claims. (Cl. 261—41)

My invention relates to carburetors, and is more particularly concerned with, but not necessarily limited to, a compact, simple, inexpensive, and efficient carburetor especially adapted for small tools and similar uses and capable of operating effectively in all positions.

An object of my invention is to provide such a carburetor having a new and improved diaphragm arrangement for controlling the flow of fuel.

A further object of my invention is to provide a multi-jet carburetor having new and improved means for preventing back bleed.

Another object of my invention is to provide a carburetor having new and improved means for compensating for changes in position.

Still a further object of my invention is to provide a carburetor having a new and improved fuel valve.

Another object of my invention is to provide a new and improved carburetor wherein the number of close tolerances is reduced to a minimum and which accordingly can be manufactured inexpensively by mass production methods.

Other objects and advantages will become apparent as the description proceeds.

This application is a continuation-in-part of my copending application Serial No. 191,260, filed October 20, 1950, now Patent No. 2,680,605, issued June 8, 1954.

In the drawings:

Fig. 1 is a sectional elevational view of one embodiment of my invention;

Fig. 2 is a transverse sectional, elevational view taken on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged sectional view showing the fuel valve and is taken on the line 3—3 of Fig. 2; and

Fig. 4 is an enlarged partial sectional, elevational view taken in the plane of Fig. 1 and showing a modification.

Referring first to the embodiment of Figs. 1, 2, and 3, it will be seen that I have illustrated therein a carburetor having a body 10 providing an air inlet 12 communicating with a choke bore 14 containing the usual choke valve 16. A Venturi 18 is between the choke bore 14 and the throttle bore 20, the latter containing a throttle valve 22.

Fuel is supplied to the carburetor through a pipe 24. The pipe 24 is attached to a fitting 26 providing a passage 28 leading into the central portion of a filter chamber 30 in which a cylindrical filter 32 is located. The filter 32 is illustrated as being an inexpensive one composed of a sheet of paper wrapped upon itself to form a cylinder and removably secured to the fitting 26 by a bolt 34 and washers 36 and 38. The construction is such that upon disconnection of the pipe 24 from the fitting 26, the latter, with the filter attached thereto, may be removed as a unit for ready inspection or replacement of the filter.

A fuel passage 40 connects that portion of the filter chamber 30 which is exterior of the cylindrical filter 32 with the upper end of a main fuel valve chamber 42. A main fuel valve 44 controls communication between the chamber 42 and passages leading to the main fuel

jet 46 and idle jets 48, 50, and 52. This main fuel valve 44 is in the form of a free ball of metal or other suitable material and normally rests upon a valve seat 54 provided by a valve seat member 56 threadedly attached at 58 to the main body 10 of the carburetor. A perforated washer 59 located in the upper end of the valve seat member 56 limits movement of the valve 44 away from its seat 54. A gasket 60 may be interposed between the valve seat member 56 and the carburetor body 10 to effect a perfect seal therebetween.

When the carburetor is in the normal position as shown in the drawing, the main fuel valve 44 is urged toward its seat 54 by gravity and also by the flow of fuel when the engine is operating. This valve is moved away from its seat by a push rod 62 which is under the control of a pair of diaphragms 64 and 66 located respectively in diaphragm chambers 68 and 70. The diaphragm chamber 68 is formed between the cupped lower end of the carburetor body 10 and the web 72 of a spacer ring 74, whereas the diaphragm chamber 70 is formed between the web 72 and a cover 76. The spacer ring 74 and cover 76 are secured to the body 10 by screws 78 and 80.

The diaphragm 64 is formed of a specially treated material which is impervious to gas, gasoline, and oil, and which has a certain amount of flexibility permitting the central part of the diaphragm to move in a vertical direction while the periphery of the diaphragm is firmly clamped between the spacer ring 74 and the lower end of the body 10. The central part of the diaphragm 64 is provided with oppositely disposed metal plates 82 and 84 secured to the diaphragm by a rivet 86. The push rod 62 rests upon the upper face of the rivet 86 and a spring 88 urges the center portion of the diaphragm 64 downwardly so that push rod 62 does not contact valve 44 when the engine to which the carburetor is attached is not operating.

The lower diaphragm 66 is preferably of the same construction as the upper diaphragm 64. The periphery of diaphragm 66 is firmly clamped between the cover 76 and spacer ring 74, and the rivet 90 which clamps metal plates 92 and 94 to the central portion of this diaphragm engages a pin 96 freely slidable in the web 72 of spacer ring 74. The lower sides of the two diaphragms are in open communication with each other and with the carburetor inlet by way of passages 98, 100, 102, and 104.

The upper diaphragm 64 may be referred to as a wet diaphragm since the upper side of this diaphragm is exposed to the fuel flowing past the main fuel valve 44 and downwardly around the push rod 62 which forms a loose fit in the passageway 105 formed in the lower end of the valve seat member 56. The lower diaphragm 66, on the other hand, may be referred to as a dry diaphragm since both sides of this diaphragm are not in contact with the fuel. The upper side of this diaphragm 66 is in communication with the throat of the Venturi 18 in a manner which I shall hereinafter describe.

The fuel valve 44 controls flow of fuel from the chamber 42 to the upper part of the upper diaphragm chamber 68 which communicates with the idle jets 48, 50, and 52 by way of passages 106, 108, 110, and 112. A needle valve 114 regulates flow between passages 108 and 110 to control the flow of fuel to the idle jets 48, 50, and 52.

When the carburetor is in the upright position shown in the drawing, fuel for the idle jets must be lifted by the suction at these jets through a height equivalent to the vertical distance between the upper ends of these jets and the plane of the valve seat 54. On the other hand, when the carburetor is inverted, this same head of fuel tends to feed fuel to the idle jets 48, 50, and 52. In order to compensate for this variation, I have provided a weight 116 which rests on a plug 118 when the

carburetor is in the position shown. The weight 116 is loosely mounted in the bore 120 and the plug 118 seals the lower end of this bore from the upper part of the diaphragm chamber 68. When the carburetor is inverted, the weight 116 moves under the action of gravity to a position where its pointed end 122 closes idle jet 50. In this manner the flow of fuel from the idle jets is substantially uniform for all positions of the carburetor.

The main fuel valve 44 also controls the flow of fuel to the main jet 46. Communication between the main fuel jet 46 and the upper portion of diaphragm chamber 68 is provided by bores 106 and 124, annular space 126, bores 128, 130, and 132, and valve chamber 134. A needle valve 136 controls communication between bores 128 and 130 so that the flow of fuel to the main jet 46 can be regulated by turning the knurled handle 138 of needle valve 136. A spring 140 serves to hold the needle valve in adjusted position.

The valve chamber 134 is located in a valve housing 142 threadedly attached to the carburetor body 10, as indicated at 144, and providing the passage 132 heretofore referred to. A gasket 146 may be clamped between a shoulder of the housing 142 and an adjacent portion of the carburetor body to form a seal therebetween. A disc valve 148 is located in the valve chamber 134 and is freely movable between a seat 150 and a triangular retainer 152 having a central opening 154 through which the fuel may pass to the Venturi 18. Fuel may also flow past the three sides of the triangular member 152. The upper end of the housing 142 is located in a slot 156 in the member 158 which provides the restricted passage or Venturi 18.

The valve disc 148 may be made of plastic, metal, or fabric, and is preferably extremely light so that it offers no appreciable resistance to flow of fuel to the main jet. The valve disc 148 prevents back flow of fuel in the passages leading to the main jet and prevents the entry of air into such passages by way of the main jet.

That portion of diaphragm chamber 70 which is located above the diaphragm 66 is always in direct communication with the throat of the Venturi 18. A passage 160 in spacer ring 74 communicates at one end with the upper portion of diaphragm chamber 70 and at the other end with vertical bore 162 connecting with a horizontal bore 164, the latter two bores being in the main body of the carburetor. A nipple 166 connects the passageway 160 with the vertical bore 162 and extends through a suitable opening in the diaphragm 64. The right-hand end of horizontal bore 164 is connected by a vertical bore 168 with the throat of Venturi 18 at one side of the main jet 46. As viewed in Fig. 1, the vertical bore or passage 168 is located in front of the main jet 46 and valve housing 142.

From the foregoing it will be apparent that the lower or dry diaphragm 66 reflects the difference in pressure existing between the throat of the Venturi 18 and the air inlet 12, whereas the wet diaphragm 64 reflects the difference in pressure between the air inlet 12 and intermediate portion of the fuel passages between the main fuel valve 44 and the needle valves controlling the flow to the idle jets and main jet respectively. Both of these diaphragms cooperate to open the main fuel valve 44 and the extent to which this valve is opened reflects the sum of the diaphragm forces acting thereon.

Another feature of my carburetor lies in the particular means for admitting additional air when the engine is operating at high speed full throttle, thus giving the effect of an expandible carburetor. The upper part of the carburetor body 10 has a cap 170 attached thereto by screws 172 with a gasket 174 clamped between the cap and body. The cap 170 provides an elongated valve chamber 176 connected to the choke bore 14 at one end by a port 178 and connected at the other end to the throttle bore 20 by a port 180. Within the chamber 176 is a reed valve 182 secured at one end to the body 10 by a screw 184.

The valve 182 may be of thin sheet steel or other suitable resilient material and normally lies in the full line position shown in Fig. 1. In this position it closes the port 178 to prevent flow of air through this port and into chamber 176. However, when the differences in pressure between the choke bore 14 and throttle bore 20 become sufficiently great, the suction in chamber 176 causes the free end of the valve 182 to flex upwardly as indicated in dotted lines to admit additional air to the engines.

This feature of my invention is claimed in my aforesaid copending application Serial No. 191,260, filed October 20, 1950, now Pat. No. 2,680,605, issued June 8, 1954.

It will be understood that the right-hand end of the carburetor as viewed in Fig. 1 is intended to be attached to the intake port or manifold of an engine in any suitable manner and that the flow of air through the choke bore 14, Venturi 18, and throttle bore 20, is in the direction of the arrows in such bores. If desired, an air filter may be attached to the left-hand or air inlet end of the carburetor. Preferably the source of fuel supply is either a fuel pump or a tank located slightly above the carburetor and feeding fuel thereto by gravity.

In operating my novel carburetor, needle valves 114 and 136 are open from one-half to three-fourths of a turn, and if the engine is cold, the choke valve 16 is closed or partially closed to enrich the starting mixture, the throttle valve 22 would be partly opened, and the engine would then be cranked to produce a flow of air through the carburetor. Suction caused by this flow of air through Venturi 18 is conducted by means of passages 168, 164, 162, and 160 to the upper side of diaphragm 66, with the result that this diaphragm is moved upwardly by the atmospheric pressure therebelow and opens fuel valve 44. Thereupon fuel flows past this valve and around push rod 62 into the upper portion of diaphragm chamber 68. From thence it may readily flow through the relatively short and open passages to the idle jets 48, 50, and 52 and the main jet 46. The opening movement of the fuel valve 44 is also aided by diaphragm 64 since the lower side of this diaphragm is exposed to atmospheric or substantially atmospheric pressure, whereas the upper side of this diaphragm is subject to such degree of suction or vacuum as may be created in the upper portion of the diaphragm chamber 68 by the subatmospheric pressure existing at the idle and main jets.

If the choke valve 16 was closed or partly closed during the starting operation, this valve is returned to fully open position as soon as the engine warms up. The throttle valve 22 of course is adjusted to give the desired speed of engine operation under the load imposed thereon.

It will be noted that the lower sides of both diaphragms 64 and 66 are exposed at all times to atmospheric pressure or to such slight departure from atmospheric pressure as may result from the application of an air filter to the air inlet of the carburetor. The upper side of the lower or dry diaphragm 66 communicates with the throat of Venturi 18 so that the pressure above this diaphragm reflects the suction created in the Venturi 18 by the flow of air therethrough and thus varies with engine demand. The upper diaphragm acts as a pressure regulator since the space thereabove is filled with fuel. This diaphragm tends to vary in accordance with variations in fuel pressure in the passages leading to the several jets and gives automatic compensation for variations in the fuel pressure at the fuel intake of the carburetor.

The main fuel valve 44 is a free ball which is not acted upon by any spring. When the carburetor is in the position shown, gravity tends to seat this valve, and for any position of the carburetor fuel pressure tends to seat this valve when fuel is flowing therepast. When fuel is flowing past this valve, the valve rotates and wipes both

itself and its seat free of dirt. This valve is much less affected by dirt than other types of valves and is an important feature of my invention.

The size of the ports **178** and **180** and the spring tension of the reed valve **182** are such that this valve remains closed during the starting operation, and even when the engine is operating at its lowest speed with wide open throttle valve. However, if the engine speed at wide open throttle is increased, as for example, by decreasing engine load, the reed valve **182** flexes upwardly to permit additional air to bypass Venturi **18** by flowing through port **178**, chamber **176**, and port **180** to the throttle bore **20**. This opening of the reed valve is produced by the increased suction at the higher engine speeds and the suction deflects the free end of the reed valve away from port **178**. This arrangement produces in effect an expandible carburetor since it gives in the wide open range an air valve carburetor without, however, giving the extreme sensitivity of mixture quality characteristic of an air valve carburetor at the idling and other low speed part throttle running conditions.

When the carburetor is in the position shown, all three idling jets are active in supplying fuel to the air flowing through the carburetor. If, however, the carburetor is inverted as frequently happens in the operation of small tools, the weight **116** moves to a position closing the jet **50** and thereby prevents the quantity of fuel delivered by the idling jets from increasing merely because of the inversion of the carburetor. This weight **116** is preferably made of stainless steel or other noncorrosive material, so that it will slide freely throughout the life of the carburetor. In case one of the diaphragms should become frozen, the screw **186** may be removed and a tool inserted to flex the diaphragm. The plug **188** serves merely as a means for sealing off one end of the bore **112**.

In the embodiment of Figs. 1, 2, and 3, means is provided to prevent increased discharge of fuel from the idle jets when the carburetor is inverted, but no such means is provided to prevent increased discharge of fuel from the main jet when the carburetor is inverted. Because the amount of fuel discharged by the main jet is substantially greater than that discharged by the idle jets, the discharge from the main jet is not affected by inversion of the carburetor as much as the discharge from the idle jets. It therefore is not ordinarily necessary or desirable to provide such a compensating means for the main jet. In Fig. 4, however, I have shown a modification in which such a compensating means is provided for the main jet.

In this Fig. 4 the passageways **128**, **130**, and **132** leading to the main jet receive fuel from the annular chamber **126** which connects with the upper portion of diaphragm chamber **68** by way of passages **124** and **106** (Fig. 1). In this Fig 4, passage **130** also receives fuel by way of bores **200**, **202**, and the openings **204**, in a retainer **206**. A weight **208** is located in the bore **202** and rests upon the retainer **206** when the carburetor is in normal upright position. When the carburetor is inverted, this weight **208** moves under the action of gravity to a position where its upper tapered end **210** cuts off communication between bores **200** and **202**. This cuts off one source of fuel supply to the passage **130** with the result that the fuel delivered to this passage **130** by way of passage **128** is the same in amount as would be delivered to the passage **130** from both of its sources of supply when the carburetor is in normal upright position.

From the foregoing description of the construction and mode of operation of my carburetor, it will be seen that I have provided a novel carburetor having one wet diaphragm and one dry diaphragm both coooperating to control the fuel valve. This arrangement is advantageous in combining the effects of two functions to afford a more accurate control of the fuel valve. One of these functions is compensation for variation in fuel pressure at the carburetor inlet due to variations in pump pressure or variations in fuel level in a gravity system. The other function is compensation for variations in engine demand. In this connection I wish to point out that the dry diaphragm connects with the point of highest suction and flexes more rapidly than the wet diaphragm to respond to engine acceleration and other variable conditions of engine operation.

I also wish to call attention to the simplicity of the fuel valve control and the fact that the ball valve and its seat are the only parts requiring precision manufacture. Steel balls made to precise measurements are readily available and accurate manufacture of valve seat **54** presents no problem. The other parts of the fuel control assembly may be readily made on conventional high production equipment within tolerances suitable for such equipment.

Another feature of my invention lies in the arrangement of the parts whereby the main fuel valve is located close to the main and idle jets so that variations in the effect of gravity on the operation of the carburetor when the latter is inverted are held to a minimum. Furthermore, I have provided means for compensating for such slight variations wherever compensation is desirable. Also, the passages connecting the fuel inlet with the delivery points are short and without unnecessary restrictions so that the fuel may flow freely therethrough except to the extent that it is controlled by the needle valves.

Another feature of my invention lies in the provision of the check valve **148** and its associated structure. This check valve is located in the fuel supply line to the main jet **46** but in no wise interferes with the flow of fuel to that jet. On the other hand this check valve closes instantly upon the creation of a condition which would tend to cause back bleed through the high speed jet and thereby insures accurate metering of the fuel and smooth operation of the engine when the throttle valve is in idle position or only slightly opened.

While I have illustrated only two forms of my invention, it is to be understood that my invention is not limited to the particular embodiments shown but may assume numerous other forms, and includes all modifications, variations, and equivalents coming within the scope of the appended claims.

I claim:

1. A carburetor of the class described comprising a body providing an air passage therethrough, a jet for supplying fuel to air passing through said passage, a fuel inlet for said carburetor, a pair of passages connecting said jet with said inlet, and a freely movable weight for controlling one of said passageways, said weight being normally inoperative but moved to close said passage under the force of gravity when said carburetor is inverted, whereby said weight meters the supply of fuel.

2. A carburetor of the class described comprising a body providing an air passage therethrough, a main jet for supplying fuel to air passing through said passage, idle jets for supplying fuel to air passing through said passage, a fuel inlet for said carburetor, a plurality of passages connecting said main jet and idle jets with the fuel inlet, and freely movable metering means interposed in one of said passageways between said jets and said source of fuel supply to restrict discharge from said jets when said carburetor is inverted, said metering means being normally inoperative but moved to restrict said passage under the force of gravity when said carburetor is inverted whereby said weight meters the supply of fuel.

3. A carburetor of the class described comprising a body providing an air passage therethrough, a jet for supplying fuel to air passing through said passage, a source of fuel supply for said jet, a plurality of passageways connecting said jet and source, and a freely movable weight for controlling one of said passageways, said

weight being normally inoperative but movable under the force of gravity to restrict said passageway when the carburetor is inverted, whereby said weight meters the supply of fuel.

4. A carburetor of the class described comprising a body providing an air passage therethrough, a plurality of jets for supplying fuel to air passing through said passage, a fuel inlet for said carburetor, a plurality of passages connecting said fuel inlet and said jets, and a freely movable weight for closing one of said passageways, said weight being normally inoperative but being moved by the force of gravity to close said passageway when the carburetor is inverted, whereby said weight meters the supply of fuel.

5. A carburetor of the class described comprising a body providing an air passage therethrough, a plurality of jets for supplying fuel to air passing through said passage, means for supplying fuel to said jets, said means including passageways communicating with said jets, one of said passageways having a tapered portion, a freely movable weight for controlling said passageway, said weight having a tapered end adapted to engage the tapered portion of said passage when the weight is in one position, and means for limiting movement of the weight away from the tapered portion of said passageway, said

weight being actuated by gravity to engage the tapered portion of said passageway when the carburetor is inverted to shut off the supply of fuel through said passageway, whereby said weight meters the supply of fuel.

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