June 9, 1964 J. L. SZWARGULSKI 3,136,827

CARBURETOR

Filed Aug. 14, 1961 2 Sheets-Sheet 1

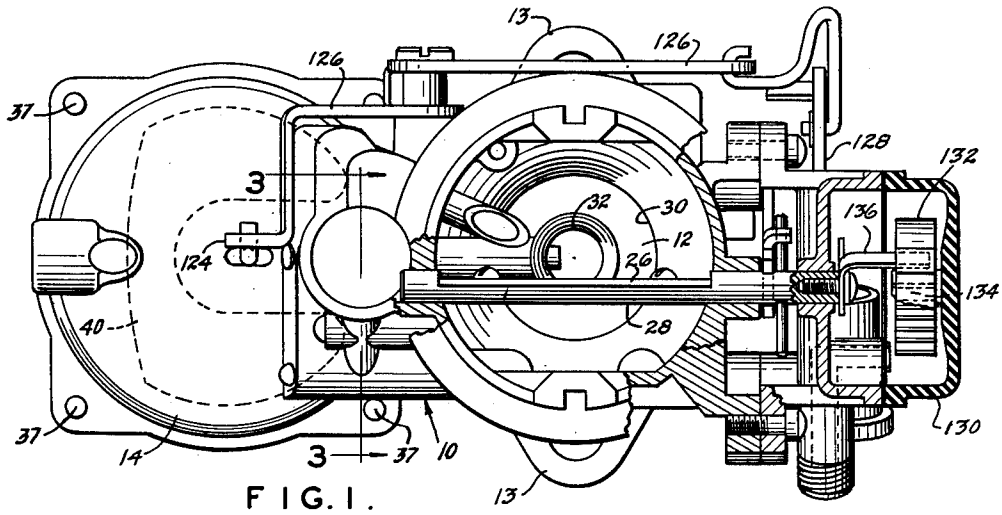


FIG. 1.

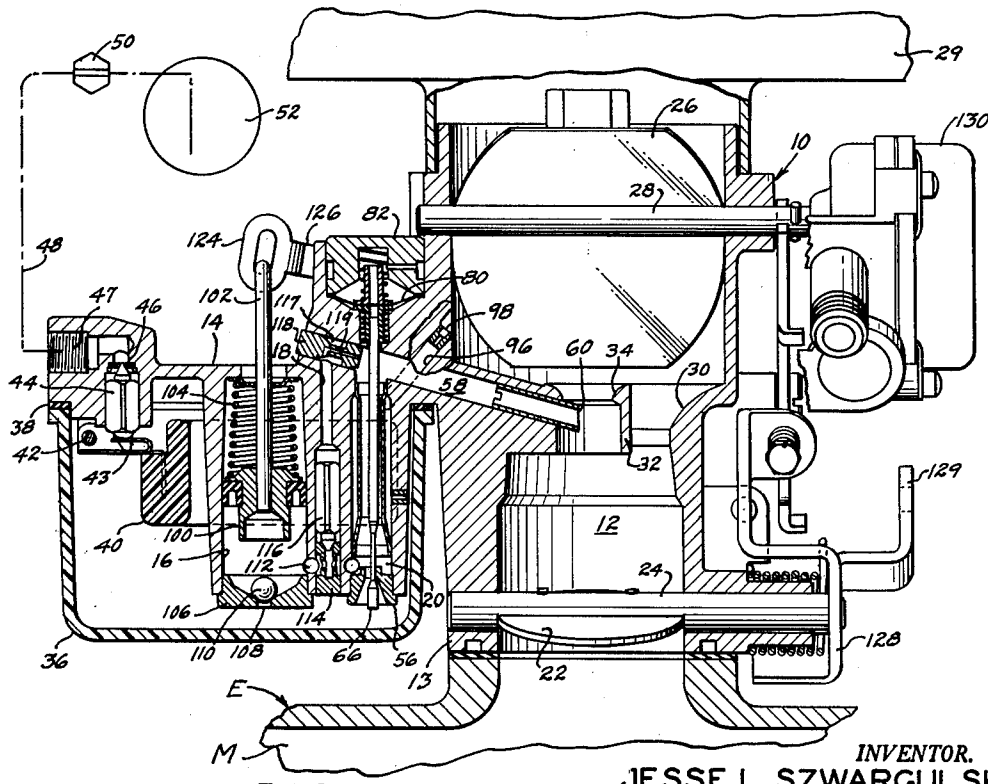


FIG. 2.

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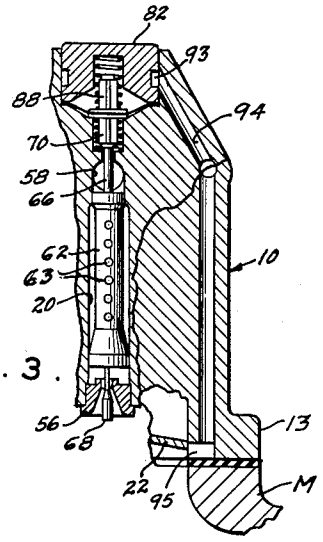


FIG. 3.

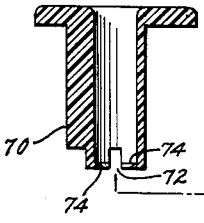


FIG. 5.

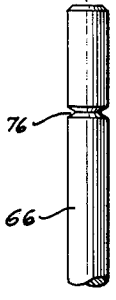


FIG. 6.

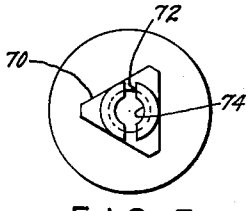


FIG. 7.

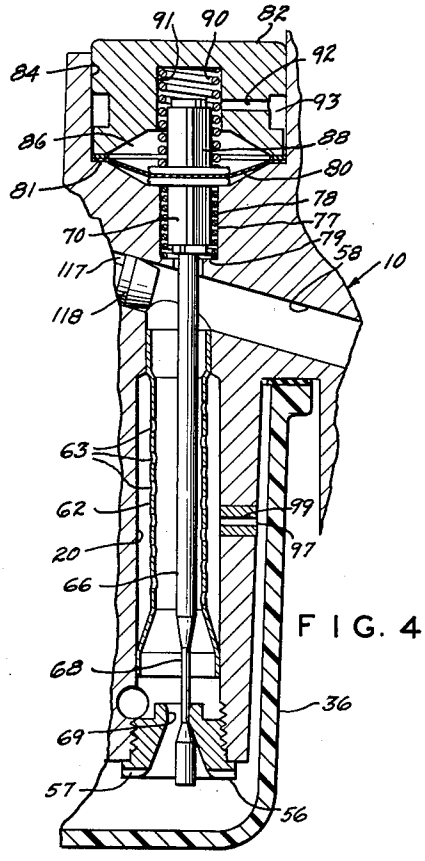


FIG. 4.

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CARBURETOR

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3 Claims. (Cl. 261—60)

This invention is directed to the fuel system for supplying fuel to an internal combustion engine and particularly to a carburetor.

In one type of carburetor the fuel passage from the source of fuel to the air and fuel mixing conduit of the carburetor includes a metering jet such as a predetermined restricted orifice to meter fuel to the mixing conduit. The fuel flow through this jet is metered or controlled in accordance with the demands of the engine. The type of carburetor described utilizes a metering rod with one end having a thickness of varying amounts. This end of the rod is arranged to be adjustably moved within the restricted orifice to provide more or less fuel, depending upon the demand of the engine. The metering rod is operated by an air motor connected to the mixing conduit of the carburetor downstream of the throttle, so that it is responsive to the pressure conditions of the intake manifold which vary during engine operation. The air motor moves the tapered end of the metering rod through the fuel metering jet to permit more or less fuel to pass through the jet in accordance with engine demands.

It is desirable in carburetors of this type to be able to change the jet at will and with a minimum amount of effort. It is also desirable to change the metering rods to ones of different sizes which are determined by the characteristics of the engine with which the carburetor is used.

It is therefore an object of this invention to provide a novel carburetor structure utilizing a metering rod which is easily replaceable.

It is another object of this invention to provide a fuel and air mixing device utilizing novel structure including a metering rod in a fuel passage thereof which is easily accessible for replacement purposes.

The invention is directed to a carburetor utilizing a fuel metering rod in the fuel passage thereof in which the fuel metering jet is at the base of a fuel well, which in turn is a portion of the body casting. This well portion of the body is suspended within the fuel bowl of the carburetor. Upon removal of the fuel bowl alone, the metering jet is immediately accessible for removal. The metering rod is arranged such that the tapered or metering end of the rod is operatively positioned within the fuel metering jet. However, the rod itself is of a dimension such that the jet need not be removed for removing and replacing the metering rod. The upper end of the metering rod is held within a resilient retainer so that the rod may be removed by grasping the lower end of the rod and pulling it out of the retainer. A new rod can be inserted in reverse order and its upper end will snap into the retainer to be again releasably held in operative position. The retainer forms a means for connecting the metering rod to an air motor which may be either a piston or a diaphragm movably operated by a spring in one direction and by atmospheric pressure in the other direction in response to manifold vacuum.

FIGURE 1 is a plan view of a carburetor embodying the novel features of this invention.

FIGURE 2 is substantially a longitudinal sectional view of the carburetor of FIGURE 1, which is shown mounted on an engine manifold and with an air filter partially in section.

FIGURE 3 is a partial sectional view of the carburetor

of FIGURE 1 and along section lines 3—3 of FIGURE 1.

FIGURE 4 is an enlarged sectional view of a portion of FIGURE 3 illustrating the features of the invention.

FIGURE 5 is a sectional view of a retainer utilized in the carburetor and in accordance with the invention.

FIGURE 6 is a partial view of one end of a metering rod in accordance with the invention.

FIGURE 7 is a plan view from below of the retainer of FIGURE 5.

The carburetor shown in FIGURES 1 and 2 consists essentially of a single casting 10, which is formed with a fuel and air mixture conduit 12 and a fuel bowl cover portion 14 from which is integrally formed a depending accelerating pump cylinder 16 and accelerating fuel passage 18 and a fuel well structure 20. As shown, the mixture conduit 12 is arranged and aligned vertically during operation and is connected by a flange 13 to the intake manifold M of an internal combustion engine E. In the lower part of the conduit 12 there is rotatably mounted a throttle valve 22 fixed to a throttle shaft 24 journaled in appropriately aligned apertures of the body casting 10. In the upper portion of the fuel-air mixture conduit 12 there is similarly mounted for rotational movement an unbalanced choke valve 26 fixed to a choke valve shaft 28, which is also journaled in aligned apertures through the body casting 10. To the top of the mixture conduit 12 is connected an air filter 29, partially shown in section in FIGURE 2. Between the upper and lower portions of the mixture conduit 12 is formed a venturi or air flow restricting surface portion 30. A small booster venturi 32 is formed integrally with the body casting 10 and has an inner venturi surface 34 coaxially aligned with the mixture conduit 12 and the primary venturi surface 30.

A plastic fuel bowl 36 is fixed beneath the fuel bowl cover 14 and is held with its rim tightly against a gasket 38 fitted between the rim of the fuel bowl 36 and matching portions of the fuel bowl cover 14 by screws (through holes 37) threaded into flanged portions of the fuel bowl cover 14. A float structure 40 is pivotally mounted from pin 42 journaled in a depending portion of fuel bowl cover 14. A lever arm of the float lever 43 fixed to float 40 abuts the lower end of a needle valve 44 having an upper tapered end extending into a valve seat 46 of the inlet 47 to the fuel bowl 36. A fitting may be threaded into inlet 47 to connect the carburetor to a fuel line 48. Fuel is forced under pressure by a pump 50 from a fuel tank 52, both schematically shown, through the fuel line 48 and into the carburetor inlet 47. With the fuel level in bowl 36 low, the float 40 is lower and lever arm 43 allows valve 44 to be pressed by fuel pressure and gravity to an open position. Fuel flows into the bowl 36 and when it reaches a predetermined level, the float lever 43 presses upwardly against the needle valve 44 to close the inlet to the fuel bowl.

The lower end of the fuel well 20 is closed by a threaded fitting 56 having a central orifice 69 (FIGURE 4) therethrough which is carefully formed to provide a metering jet for the flow of fuel from the fuel bowl 36 to the mixture conduit 12. A screw driver slot 57 is provided in the bottom of fittting 56 to provide for its removal. The upper end of the fuel well 20 intercepts a cross fuel passage 58 directed downwardly into the secondary venturi structure 32. A nozzle fitting 60 is press-fitted into the end of passage 58 and has one end thereof extending into the center of the secondary venturi surface 34. Press-fitted within the well 20 is a fuel emulsion tube 62 having apertures 63 therethrough along its length, as shown in FIGURE 4.

In accordance with the invention, a metering pin 66 is suspended wihtin the fuel well 20. Pin 66 has an end

68 formed with varying thicknesses. The formed end 68 is positoned within the main fuel jet orifice 69 for operation in response to engine requirements. Flow of fuel through the main jet 56 is controlled by the metering rod 66 and in accordance with that portion of the formed end 68, which is positioned within the jet 56, as described below. The metering rod 66 is supported from a retainer 70 in which the upper end of rod 66 is frictionally engaged. The retainer 70 has somewhat the shape of an eyelet, as shown in cross-section in FIGURE 5, and is bifurcated at its lower end at 72, as shown in FIGURE 5 and 7. The retainer is made of a resilient plastic material such as Delrin and has an axial passage therethrough with an opening at its lower end which is smaller than the diameter of the upper end of the metering rod 66. Because of the resilient nature of retainer 70 the rod 66 may be pressed into the open end 72 and a sharp rib 74 around the inner periphery of the opening 72 is caused to snap into a circumferential groove 76 formed in the upper end of the metering rod 66.

A light spring 78 is positioned within a bore 77 between a shoulder portion 79 of the body casting 10 and the upper flanged end of the retainer 70. Spring 78 is of a strength to merely overcome the weight of retainer 70 and the rod 66 and to thus always bias the upper surface of retainer 70 against a diaphragm 80 which is sealed in an air tight manner at its peripheral edge between a shoulder 81 of the body casting 10 and a fitting 82 pressed into a matching bore 84 of the body casting. Diaphragm 80 extends across a cavity 86 which is formed from a depression in the bottom of bore 84 and fitting 82. On the upper side of diaphragm 80, opposite to the side against which the retainer 70 is biased, is positioned a second retainer structure 88 identical in construction to retainer 70. A spring 90 is positioned between the top of a central bore 91 of fitting 82 and the lower flanged surface of the retainer 88 to bias the retainer 88 and diaphragm 80 in a downward position, as shown in FIGURES 2 and 4, for example. Bores 91 and 77 are coaxially aligned but off to one side of the axis of the cylindrical well 20. This suspends metering rod 66 to one side of the well axis and biases the rod end 68 eccentrically within jet orifice 69 against the side of the jet fittting 56. This provides a consistent flow of fuel through orifice 69 for any position of the metering rod 66.

The bore 91 is connected by a cross passage 92 to an annular passage 93 formed in the peripheral surface of the fitting 82. As shown in FIGURE 3, in particular, a passage 94 is formed through the body casting 10 to the flange portion 13 of the carburetor and opens at 95 into the mixing conduit and manifold M below or downstream of the throttle 22. In this manner, passage 94 connects the portion of cavity 86 above the diaphragm 80 to the manifold pressure of the engine.

A passage 96 (FIGURE 2) is formed between the mixing conduit 12 from a region between the choke valve 26 and the throttle valve 22 to extend downwardly into the upper portion of well 20. Within the passage 96 is press-fitted a restriction element 98 for controlling air flow through passage 96 into the well 20. As shown in FIGURE 4, well 20 is also connected to the fuel in bowl 36 by a passage 97. Fuel flow through this passage is controlled by a jet 99 of predetermined size in the order of 0.030 inch.

Mounted within the cylindrical recess 16 formed in body casting 10 is a pump piston 100 (FIGURE 2), which is connected to a pump piston rod 102. A spring 104 is fitted between the upper end of the pump cylinder 16 and the piston 100. The lower end of the pump cylinder 16 is closed by a fittting 106 having a central aperture 108 therethrough above which, biased by gravity, is a ball valve 110. A fuel passage 112 extends between the pump cylinder 16 and the cylindrical passage 18 formed in the body casting 10. Passage 112 permits fuel flow into a fitting 114 closing the lower end of cylindrical passage 18

and having at its upper end a valve seat in which the pointed end of a gravity biased check valve 116 is fitted. The cylindrical passage 18 extends upwardly and intercepts the main fuel passage 58, at which point a closure fitting 118 is fixed. Fitting 118 forms an annular channel 117 with passage 58. Channel 117 is connected with a small aperture 119 through which fuel can be ejected from the cylindrical passage 18 into the main fuel passage 58 under pressure from the pump piston 100. Aperture 119 is formed off axis relative to passage 58 so that the ejected fuel will not strike rod 66 and be directed into the well 20.

The operation of the structures described are as follows: Fuel from the fuel bowl 36 flows into both the pump cylinder 16 and the well structure 20, to fill these recesses to the level of the fuel in the bowl. Upon the turning over of the engine, air is sucked through the air filter 29 into the mixture conduit 12 and the intake manifold M. The flow of air through the booster venturi 32 provides a sub-atmospheric pressure within the venturi surface 34 which extends back through the fuel passage 58 to the upper end of fuel well 20. The atmospheric pressure on the surface of the fuel within bowl 36 raises the fuel within the well 20 and simultaneously air is sucked through the restriction 98 and the bleed passage 96 into the upper portion of the fuel well. This air passes around and through the apertures 63 in the emulsion tube 62 to mix with the fuel and its vapor and to form an air-fuel emulsion. The emulsion is carried upwardly from the fuel well into the main fuel passage 58 and out the nozzle 60 to form a fuel and air mixture with the air passing through the mixture conduit 12. At high speeds, the flow of air through the apertures 63 in the emulsion tube 62 tends to remove all the fuel from between the well wall and tube 62 so that more apertures 63 are uncovered and an excessive amount of air passes into tube 62 to provide too lean a mixture. The provision of the fixed jet 99 and passage 97 from fuel bowl 36 allows the fuel level between the well wall and tube 62 to be maintained with the provision of a sufficiently rich mixture.

At low speeds, the throttle 22 is partially closed so that the manifold vacuum in the intake manifold M below the throttle 22 is relatively high. This vacuum is effective through the passage 94 upon the upper surface of diaphragm 80 so that the pressure of air in the main nozzle 58 against the under surface of diaphragm 80 will press the diaphragm upwardly and permit the metering rod and its retainer 70 to be carried with it in an upward direction. At low speeds the air in the mixture conduit 12, upstream of the throttle is at a greater pressure than the pressure of air in the itake manifold downstream of the throttle. This upstream pressure is effective upon the diaphragm 80 through nozzle passage 58 and bore 77. This brings the thicker portion of the metering rod end 68 into the main jet orifice 69 to cut down the flow of fuel through this orifice in accordance with the lower engine speed. As the throttle 22 is opened progressively from low speed to high speed, the vacuum pressure in the manifold drops and permits spring 90 to bias the diaphragm 80 and the metering rod 66 downwardly until a thinner portion of the rod end 68 enters the jet orifice to provide a greater flow of fuel into the mixing conduit 12.

The accelerating pump rod 102 is connected with a lost motion connection 124 (FIGURES 1 and 2) by a linkage 126 to the throttle lever 128 which is fixed for simultaneous movement with the throttle shaft 24. Throttle lever 128 has an arm 129 adapted to be connected to any means for manual operation of the throttle 22. Any opening of the throttle by lever 128 will allow spring 104 through the lost motion connection 124 to press accelerating pump piston 100 downwardly and force fuel out of the lower portion of the pump cylinder 16 through passage 112 upwardly past the gravity biased valve 116 and into the annular portion 117 of the fitting 118. This accelerating fuel under pressure will spurt out

of the passage **119** and will be directed into the nozzle structure **60** to provide additional fuel for the increased air flow due to the opening of the throttle **22**. This provides rapid response of the engine upon opening of the throttle.

A low speed or idle circuit is provided in the carburetor and is not shown in this application as it does not constitute a part of the invention. However, it may be similar to that described and disclosed in the copending application of Ralph E. Kalert, Jr., and Jesse L. Szwargulski, Serial No. 146,896, filed October 23, 1961.

The choke valve **26** is controlled during cold weather and during cold starts by a thermostatic choke control device enclosed in a housing structure **130**. The choke control consists of a thermostatic coiled bi-metallic spring **132** having one end fixed to a stationary stud **134** mounted on the housing **130**. The other end of the thermostatic spring rests against one arm **136** of a lever fixed to the choke shaft **28**. When the engine is cold, the thermostatic spring is tensioned in one direction to press against the end of the lever **136** and rotate the choke valve **26** toward a closed position. The flow of air through the mixing conduit **12** at this point will partially open the unbalanced choke valve **26** to permit sufficient air to pass on into the intake manifold M. As the engine heats up, the spring **132** relaxes and releases the end of lever **136** so that after a predetermined temperature has been reached the thermostatic coil **132** has no effect on the choke **26**, which now will remain open by gravity, due to its unbalanced construction. The details of the choke are shown and described in the copending application of Jesse L. Szwargulski, Serial No. 140,371, filed September 25, 1961.

The novel combination of the metering pin **66** and its supporting structure enables a rapid removal and replacement of the metering rod. The only requirements necessary are the removal of bowl **36** by loosening screws **37** to expose the lower end **68** of rod **66**. Any appropriate tool may be used to pull the rod **66** downwardly through the orifice **56**. Because of the flexible nature of the rib portions **74** of the retainer **70**, they will release and flex out of the groove **76**. A new rod can be replaced by inserting it upwardly through the jet orifice **56** until its upper end contacts the resilient rib portions **74** of retainer **70**. These will again flex over the rod end and permit the end of the rod to enter the retainer **70** and allow peripheral ribs **74** to snap into the groove **76** of the rod to lock it in position. This novel arrangement of metering rod support permits rapid removal of the metering rod for replacement with other rods having a different formed end structures **68** to compensate for different operating conditions of the engine.

I claim:

1. A carburetor for an internal combustion engine, said carburetor comprising a body formed with an air and fuel mixture conduit adapted to be connected to the intake manifold of said engine, a fuel bowl, means for removably fixing the bowl to said carburetor body, said body including a portion extending into said fuel bowl and having a fuel passage extending between said fuel bowl and said mixture conduit, a throttle movably mounted within said mixture conduit, said fuel passage within said body portion including a fuel well, a fitting having a restricted orifice therethrough opening into said fuel bowl and fixed to said body portion between said fuel bowl and said fuel well, a metering rod within said fuel well and having one end thereof formed with a varying thickness and positioned for movement through said restricted orifice, means for imparting reciprocable movement to said metering rod end including a retainer formed with a flexible wall defining an opening for receiving the other end of said metering rod, said opening being smaller in diameter than the diameter of said rod, means on said rod for receiving a portion of said flexible wall for preventing displacement of the latter, said one metering rod end extending through said orifice into said fuel bowl whereby said metering rod can be gripped for removal and replacement in said retainer upon removal of said fuel bowl.

2. A carburetor for an internal combustion engine, said carburetor comprising a body formed with an air and fuel mixture conduit adapted to be connected to the intake manifold of said engine, a fuel bowl, means for removably fixing the bowl to said carburetor body, said body including a portion depending into said fuel bowl and having a fuel passage extending between said fuel bowl and said mixture conduit, a throttle movably mounted within said mixture conduit, said fuel passage within said depending body portion including a fuel well, a fitting having a restricted orifice therethrough opening into said fuel bowl and fixed to said body portion between said fuel bowl and said fuel well, a metering rod suspended by one end within said fuel well, said metering rod having the other end thereof formed with a varying thickness and positioned for movement through said restricted orifice, a retainer supporting said one end of said metering rod, said retainer having an opening therethrough removably receiving said one metering rod end, said retainer having a plurality of resilient end portions arranged to form said opening, said one metering rod end having a groove therein to receive in releasably gripping engagement a part of each one of said resilient end portions, means for imparting reciprocable movement to said metering rod for moving said other metering rod end through said orifice, said other metering rod end extending through said orifice into said fuel bowl whereby said metering rod can be gripped for removal and replacement in said retainer upon removal of said fuel bowl.

3. A carburetor for an internal combustion engine and comprising a body formed with an air and fuel mixture conduit adapted to be connected to the intake manifold of said engine, a fuel bowl, means for removably fixing the bowl to said body, said body including a portion depending into said fuel bowl and formed with a fuel passage extending between said fuel bowl and said mixture conduit, a throttle movably mounted within said mixture conduit, said fuel passage including a fuel well within said body portion, a removable fitting having a restricted orifice therethrough fixed at the bottom of said depending body portion and closing the lower end of said fuel well from said fuel bowl, a metering rod suspended vertically by one end within said fuel well, said metering rod having the other end thereof formed with a varying thickness and positioned for movement through said restricted orifice, means for moving said metering rod including a retainer supporting said one end of said metering rod, said retainer having an opening therethrough removably receiving said one metering rod end, said retainer having a plurality of resilient end portions arranged to form said opening, said one metering rod end having a groove therein to receive in releasably gripping engagement a part of each one of said resilient end portions, said other metering rod end extending through said orifice into said fuel bowl whereby said metering rod can be gripped for removal and replacement in said retainer upon removal of said fuel bowl.

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