March 22, 1966 W. W. DEGENHARDT 3,241,822

CARBURETOR AND FUEL NOZZLE THEREFOR

Filed March 8, 1965

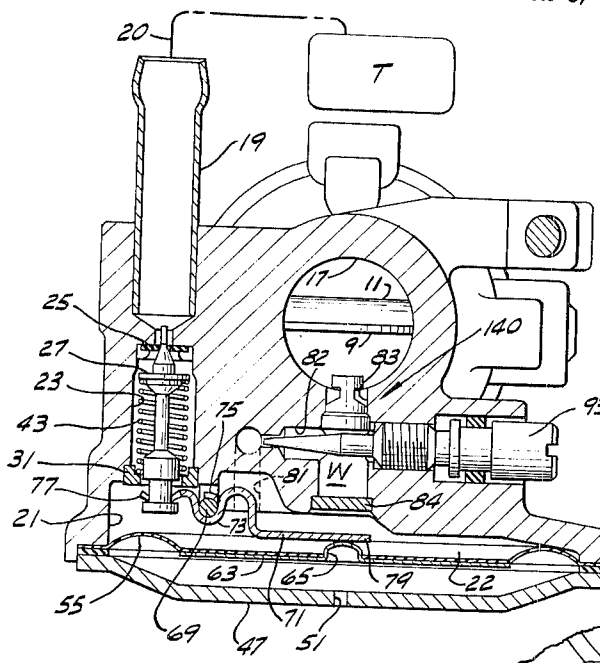


FIG. 2.

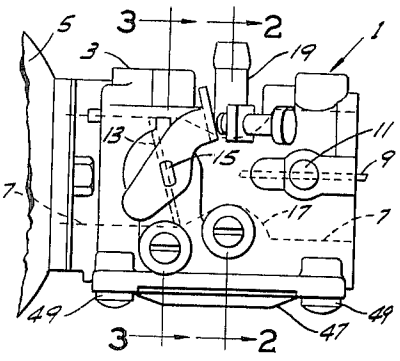


FIG. 1.

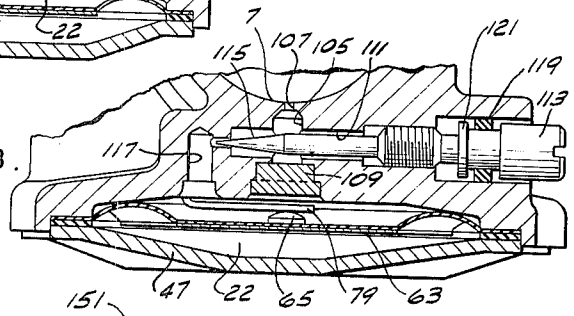
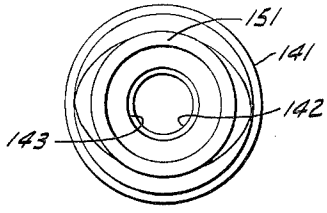


FIG. 3.

FIG. 5.



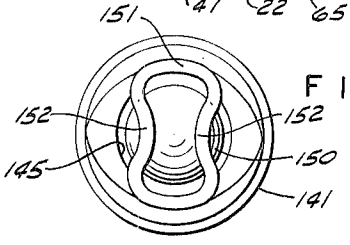


FIG. 7.

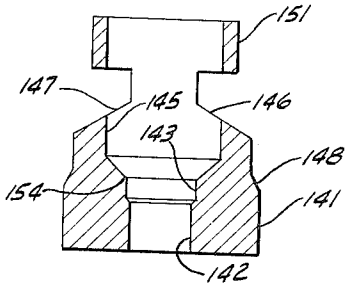


FIG. 4.

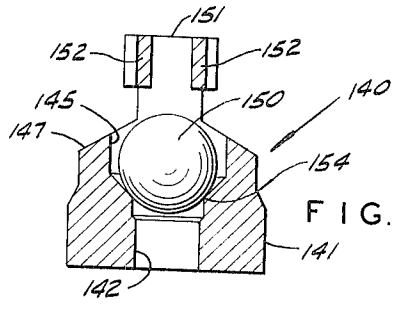


FIG. 6.

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CARBURETOR AND FUEL NOZZLE THEREFOR

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This invention relates to carburetors, and more particularly to carburetors for small engines. In one of its aspects, the invention relates to a novel fuel nozzle for a carburetor. In another of its aspects, the invention relates to a fuel nozzle having a ball check disposed therein. The carburetors of this invention are suitable for engine driven devices including chain saws and other portable power tools.

Carburetors for small engines such as those used with power saws and other portable tools must be small to provide the desired portability and must also be sensitive and quickly responsive to the operating conditions of the engine. The tool and hence the carburetor are frequently moved to various attitudes or positions and the carburetor is required to perform equally well in all positions.

Among the various objects of this invention may be noted the provision of a novel carburetor for engines of the type described which has optimum operating characteristics under various operating conditions. It is another object of the invention to provide a carburetor which is sensitive and quickly responsive to change in throttle position. Still another object of the invention is to provide a novel fuel nozzle for a small carburetor which nozzle will prevent back bleeding of air into the fuel system under idle conditions. Other objects, features and advantages will become apparent from a reading of the following specification, the claims and appended drawings.

In the accompanying drawings in which the invention is illustrated,

FIGURE 1 is a side elevation of a carburetor of the invention, showing a portion of an engine to which it is attached;

FIGURE 2 is a sectional view taken on the line of 2—2 of FIGURE 1;

FIGURE 3 is a sectional view taken along line 3—3 of FIGURE 1;

FIGURE 4 is a cross-section of the fuel nozzle of the invention in an intermediate stage of manufacture;

FIGURE 5 is a top view of the nozzle of FIGURE 4;

FIGURE 6 is a sectional view of the completed nozzle assembly and,

FIGURE 7 is a top view of the nozzle of FIGURE 6.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to the drawing, the carburetor of this invention is indicated in its entirety by the reference number 1. Carburetor 1 has body 3 connected at one end to the intake manifold portion of an engine 5. A fuel and air mixture conduit 7 in body 3 receives air and fuel and mixes them in the conduit, the mixture moving from right to left as shown in FIGURE 1 into the intake manifold of engine 5. Movement of fuel and air in the conduit 7 is governed by operating conditions in the intake manifold of engine 5 as well as a manually operated throttle valve 13 rotatably mounted on a throttle shaft 15 journaled in the carburetor body 3.

A choke valve 9 is located in the upstream or inlet end of the fuel and air mixture conduit 7. Choke valve 9 is mounted on a choke shaft 11 which is journaled in the body 3 of the carburetor. Downstream from the choke valve 9 is a throttle valve 13. A venturi section 17 is

formed in conduit 7 between the choke valve 9 and the throttle valve 13.

A nipple 19 is mounted on body 3 for connection to a fuel line 20 from a source of fuel as fuel tank T. The body 3 of the carburetor is formed with a cavity 21 of small volume or capacity which forms part of a fuel chamber 22 which receives fuel from nipple 19 through a passage 23. Passage 23 has a restricted opening or orifice at its upper end which is provided with a valve seat 25 as shown.

Positioned within the passage 23 is an inlet valve 27 which is held in place by annular retainer 31 which is press-fitted into the end of the passage 23. Valve 27 is biased towards a closed position by a spring 43. A fuel chamber cover plate 47 is mounted at the bottom of the carburetor by screws 49 passing through edge portions of the plate into threaded holes in the body 3. Cover plate 47 has a hole 51 in the center thereof.

A molded diaphragm 55 made of a flexible fuel resistant material is interposed between the body 3 of the carburetor and cover plate 47 as shown. A diaphragm backing plate 63 is adhesively bonded to the lower surface of the diaphragm 55, plate 63 being centered in the diaphragm by means of an integrally formed button 65 which passes through a hole or aperture in the diaphragm. Button 65 projects above the upper surface of the diaphragm 55. As shown, diaphragm 55 forms with cavity 21 a sensing fuel chamber 22.

A pivot pin 69 is mounted in the body 3 extending across pump chamber 22. A valve operating lever or arm 71 is pivotally mounted on pin 69, the latter being received in a loop 73 of the arm. Arm 71 has a struck out tang or tangs 75 overlaying the pin to hold the arm on the pin with the weight of the arm being carried by the pin.

The arm of lever 71 has a forked end 77 received in a groove of needle 33 and in engagement with adjacent portions of the needle so that movement of the arm or lever 71 counter-clockwise moves the needle 33 down thereby to open the valve assembly 27 to the passage of fuel. The end 79 of arm 71 is in downward engagement with the button 65 of the diaphragm assembly so that when the diaphragm is flexed upward the button 65 engages the portion 79 of arm 71 to move the arm.

A fuel passage 81 connects cavity 21 and fuel chamber 22 to cross passage 82. Passage 82 communicates with main fuel passage 83. An adjusting screw 93 provided with a suitable packing or gasket is threaded into passage 82 for adjusting the flow of fuel therethrough. Main fuel passage 83 communicates with fuel chamber 22 but is separated therefrom by a plug 84. A lower portion of main fuel passage 83 above the plug 84 serves as a well W for holding a small quantity of fuel which becomes instantly available upon the opening of throttle 13 as will be described hereinafter.

Disposed in passageway 83 is the main nozzle 140 of the carburetor. Nozzle 140 is shown in detail in FIGURES 5 through 7. Nozzle 140 is comprised of a tubular body member 141 having a central bore 142, a counter bore 143, and a larger counter bore 145. A portion of the sidewall of the nozzle is cut away on opposite sides of the nozzle to provide a partial groove or slot in the wall of the nozzle as shown at 146 and 147. If desired, a tapered shoulder 148 may be provided on the exterior of the nozzle body. The tapered shoulder can be utilized to position the nozzle in passageway 83 when the nozzle is pressed into place, in which instance a corresponding shoulder will be placed in passageway 83. If there is no shoulder in the passageway or no shoulder on the nozzle body, the nozzle is simply pressed into place and retained there by the press fit.

In making the nozzle, a solid or tubular piece of stock material is first bored to create the central bore **142** and then subsequently is counter bored as shown at **143** and **145** after which the slots **146** and **147** are cut into the sidewall of the nozzle body. At this stage of manufacture the nozzle body is as shown in FIGURES 4 and 5. Following the initial shaping of the nozzle, a ball **150** is inserted into the cavity created by counter bore **145** and the upper cylindrical portion or flange **151** is crimped as at **152** to form a cage of modified or open figure 8 configuration for the ball check. Ball **150** is preferably made of a light material such as aluminum or plastic but other materials such as steel, brass, etc. can be used if desired.

It will be noted that ball **150** is free to move upwardly and to some extent laterally within the counterbore **145** and is prevented from escaping by the cage **151, 152.** Whenever the ball is in any possible extreme position within the cage, its contact with any surface is that of a rather short line. For example, when the ball is seated (FIGURE 6), the line of contact as shown at **154** is a line. If the ball is raised off its seat and contacts any other portion of the cage, this is a point contact or possibly a very short line contact, but in any event the amount of metal or other material contacting the ball is very small which reduces the tendency of the ball to stick to the fuel wet surfaces of the cage by adhesion or capillary atttraction.

An idle cavity **105** (FIGURE 3) in body **3** is in communication with mixture conduit **7** through a pair of ports or openings **107** located at opposite sides of throttle valve **13** when in its closed or idle position. The lower end of the idle cavity **105** is closed by a plug **109.** The plug **109** fills a substantial portion of the cavity **105** to thereby reduce the volume of the cavity and thus avoid slopping of fuel in the idle cavity. During idling operation of the engine, air from conduit **7,** passes through the upstream hole or port **107,** through the cavity **105** and is discharged through the other port **107** downstream of the throttle valve **11.** By maintaining cavity **105** at a minimum volume, emulsification of fuel and air in the cavity **105** is prevented. As a result substantially liquid fuel flows through the downstream port **108** sooner than carburetors having a larger idle cavity.

A passage **111** has an orifice at its inner end in communication with cavity **105.** An adjusting screw **113** is threaded in passage **111** and has a tapered end **115** positioned in the small end of passage **111** to control flow of fuel to the cavity **105.** A fuel well **117** provides a conduit for delivery of fuel from fuel chamber **22** to the passage **111** for transfer to the idle cavity **105.**

An annular seal or packing **119** surrounds the adjusting screw **113** and an annular washer **121** abuts this packing or seal **119.**

Operation of carburetor **1** is as follows.

Cranking of the engine **5** draws air through the fuel and air mixture conduit **7.** Flow of air past the main fuel nozzle **140** provides a sub-atmospheric pressure at the mouth or outlet of the nozzle at the venturi **17** in the conduit **7.** This low pressure at the mouth of the nozzle **140** is transferred through cavity **83,** passage **81,** and passage **82** to the pump chamber **22.** The bottom of the diaphragm assembly is at atmospheric pressure due to the hole **51** in plate **74.** As a result of this pressure differential the diaphragm assembly **51** is moved upwardly in chamber **21.** Upward movement of the diaphragm **55** moves the button **65** of the diaphragm backing plate **63** against the end portion **79** of the arm or lever **71** which pivots about pin **69** to pull down the needle valve **27** from its seat. Fuel then enters the body through the nipple **19** and flows past the valve seat into the cavity or passage **23.** Fuel is then delivered to the fuel chamber **22** and is passed through the passage **81** into the cavity **83** for delivery through nozzle **140** to the fuel and air mixture conduit **7.**

When the throttle valve **11** is at its idle position, ball **150** is normally seated at **154** in the nozzle and fuel is delivered through the idle cavity **105** and port **107** to the engine. During idle speeds, fuel passes from the fuel chamber **120** through the well **117** and passage **111** into cavity **105.** Air entering the upstream port **107** passes through the idle cavity **105** and is discharged with fuel through the downstream port **107.**

When throttle **13** is opened, the increased flow of air across nozzle **140** lifts ball **150** off its seat and the supply of fuel in well "W" becomes instantly available for acceleration. At this time the fuel flows upwardly around the ball which is held against an upper portion of the cage and because of the configuration of the cage, the fuel is broken up and sprayed outwardly into the venturi **17** where it is picked up by the stream of air and vaporized.

Some prior art carburetors utilizing a ball check type nozzle has used a ball retainer such as a simple bar across the nozzle, but this did not result in optimum dispersion of the fuel into the air stream. Applicant on the other had has provided a cage structure such that the fuel in passing around the ball is subjected to numerous sharp corners which beneficially break up the fuel resulting in a more even dispersion of the fuel in the air stream. Some difference in the pattern of dispersion is possible with applicant's nozzle according to the orientation of nozzle **140** in passage **83.** As shown in FIGURE 1, the air stream passes longitudinally of the crimped cage. However, it is within the province of the invention to orient the nozzle at 90° to that shown in FIGURE 2. Also it is to be mentioned that the nozzle can protrude a greater or lesser amount into the passageway than that as shown in FIGURE 1. For a particular application the change in orientation and amount of protrusion into the passageway **7** will be selected for optimum performance. In some instances, it is even possible to decrease the effective area of the venturi by extending the nozzle a greater distance.

Another advantage of the novel ball check of the invention is that the ball has no tendency to stick in the open position. This is so, because the ball has very little surface in contact with the cage. Prior art balls had a tendency to stick in the open position which problem is now overcome through use of this invention.

I claim:

1. A carburetor comprising:

(a) a body having a fuel and air mixture conduit,

(b) said body having a fuel chamber and a fuel inlet passage extending to said chamber,

(c) an inlet valve in said fuel passage,

(d) a diaphragm of flexible material across said chamber,

(e) said daphragm having a center hole,

(f) a plate secured to one surface of the diaphragm and having a button projecting through said hole in said diaphragm,

(g) valve operating means connecting to said inlet valve and operable by said button for operation of said inlet valve by said diaphragm to regulate delivery of fuel through said passage to said chamber.

(h) said body having a fuel connection between said fuel chamber and said fuel and air mixture conduit for transfer of fuel from said chamber to said conduit,

(i) said fuel connection being proided with a ball check fuel nozzle comprising:

(1) a tubular body member having a central bore,

(2) at least one groove or slot in the body of said nozzle,

(3) a ball seat disposed below the groove or slot,

(4) a ball disposed in said central bore and a cage of modified figure 8 configuration above said ball and above said slot to retain said ball in said nozzle, and

(5) means positioning said nozzle in said conduit so that air may flow into said groove or slot.

2. A carburetor comprising:

(a) a body having a fuel and air mixture conduit,

(b) said body having a fuel chamber and a fuel inlet passage extending to said chamber,

(c) an inlet valve in said fuel passage,

(d) a diaphragm of flexible material across said chamber,

(e) said diaphragm having a center hole,

(f) a plate secured to one surface of the diaphragm and having a button projecting through said hole in said diaphragm,

(g) valve operating means connecting to said inlet valve and operable by said button for operation of said inlet valve by said diaphragm to regulate delivery of fuel through said passage to said chamber,

(h) said body having a fuel connection between said fuel chamber and said fuel and air mixture conduit for transfer of fuel from said chamber to said conduit,

(i) said fuel connection being provided with a ball check fuel nozzle comprising:

(1) a tubular body member having a central bore,

(2) at least one groove or slot in the body of said nozzle,

(3) a ball seat disposed below the groove or slot,

(4) a ball disposed in said central bore and a cage of modified figure 8 configuration above said ball and above said slot to retain said ball in said nozzle, said nozzle being positioned in said connection so that the cage extends into said mixture conduit, and

(5) means positioning said nozzle in said conduit so that air may flow into said groove or slot.

3. A carburetor comprising:

(a) a body having a fuel and air mixture conduit,

(b) said body having a fuel chamber and a fuel inlet passage extending to said chamber,

(c) an inlet valve in said fuel passage,

(d) a diaphragm of flexible material across said chamber,

(e) said diaphragm having a center hole,

(f) a plate secured to one surface of the diaphragm and having a button projecting through said hole in said diaphragm,

(g) valve operating means connecting to said inlet valve and operable by said button for operation of said inlet valve by said diaphragm to regulate delivery of fuel through said passage to said chamber,

(h) said body having a fuel connection between said fuel chamber and said fuel and air mixture conduit for transfer of fuel from said chamber to said conduit,

(i) said fuel connection being provided with a ball check fuel nozzle comprising:

(1) a tubular body member having a central bore,

(2) a pair of grooves on opposite sides of the body of said nozzle,

(3) a ball seat disposed below the said grooves,

(4) a ball disposed in said central bore and a cage of modified figure 8 configuration above said ball and above said slot to retain said ball and said nozzle, said nozzle being so positioned as to have the said grooves aligned with the flow of air in said mixture conduit whereby air enters one of said grooves and passes out through the other of said grooves.

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