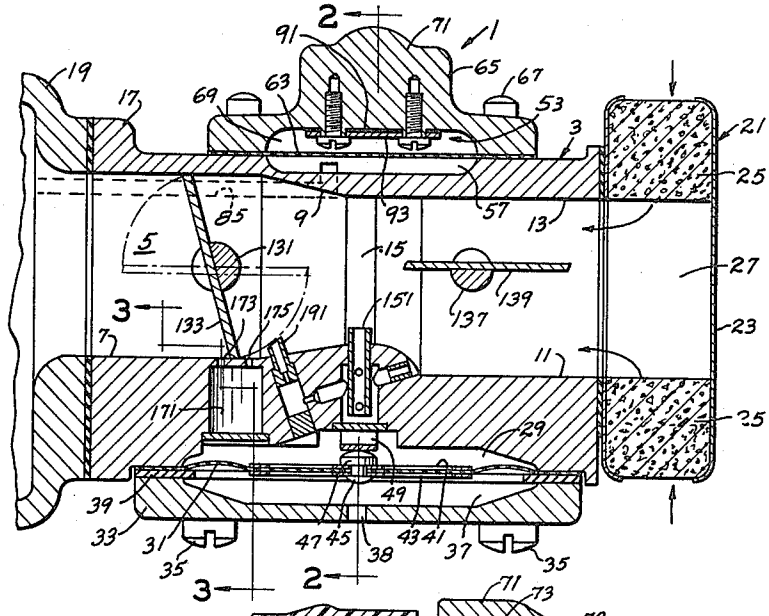
Feb. 9, 1965 C. L. MARTIN ETAL 3,169,154

CARBURETOR

Filed Sept. 28, 1962

FIG. 1.



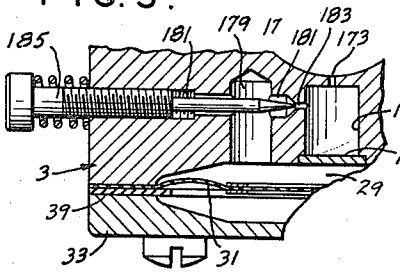


FIG. 3.

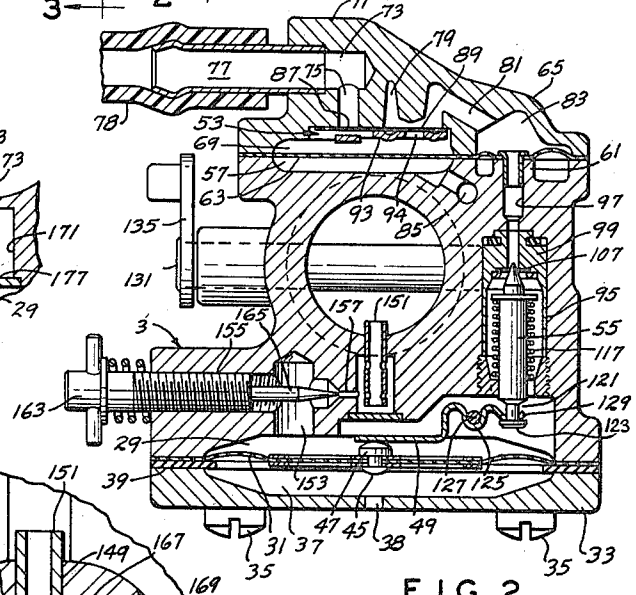


FIG. 2.

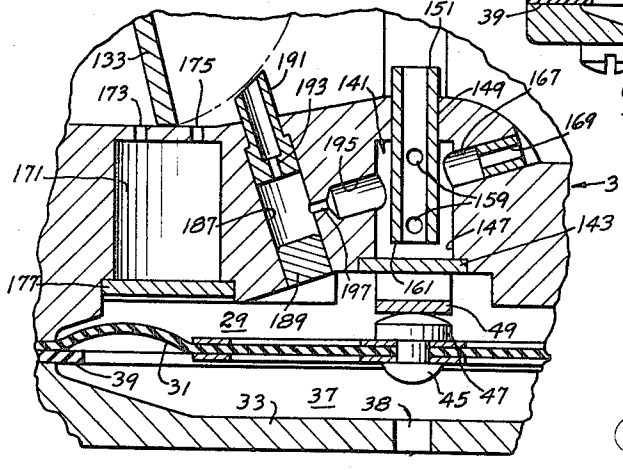


FIG. 4.

INVENTORS
CHARLES L. MARTIN
MORRIS C. BROWN
BY

AGENT

United States Patent Office

3,169,154
Patented Feb. 9, 1965

3,169,154

CARBURETOR

Charles L. Martin, St. Johns, and Morris C. Brown, St. Louis, Mo., assignors to ACF Industries Incorporated, New York, N.Y., a corporation of New Jersey

Filed Sept. 28, 1962, Ser. No. 227,029
3 Claims. (Cl. 261—41)

This invention relates to carburetors, and more particularly to carburetors of the diaphragm type, by which is meant a carburetor as to which delivery of fuel to a fuel chamber of the carburetor is controlled by a diaphragm, as distinguished from being controlled by a float.

The invention is particularly applicable to a small diaphragm-type carburetor for small internal combustion engines such as are used in portable tools (chain saws, for example), in lawn mowers, small automotive vehicles such as are sometimes called go-carts, etc.

Peak performance of any carburetor requires that the carburetor include an acceleration system for supplying additional fuel to the mixture conduit of the carburetor when the throttle of the carburetor is opened quickly to produce rapid acceleration of the engine, in order to avoid leaning of the air/fuel mixture and lag in response. In a conventional carburetor, the acceleration system includes a pump actuated on opening the throttle to pump fuel into the mixture conduit. Among the several objects of this invention may be noted the provision in a diaphragm-type carburetor, and particularly a small carburetor of this class, of an acceleration system adapted without any pump to supply additional fuel to the mixture conduit on opening of the throttle for fast acceleration; and the provision, in a carburetor of the class described having a high speed fuel system for delivery of fuel to the mixture conduit when the throttle is opened and an idle system for delivery of fuel and air to the mixture conduit downstream from the throttle when the throttle is at idle, of an acceleration system such as described which is reliable in operation and economical to provide. In general, the acceleration system of this invention is characterized in that fuel for fast acceleration is delivered from a fuel well which feeds the high speed nozzle of the carburetor through a passage opening into the mixture conduit at a point upstream from the throttle idle position and which is traversed by the periphery of the throttle when the throttle is opened, with an air bleed for bleeding air into the well. Air bled into the well along with fuel in the main nozzle well assists the flow of fuel out of the accelerating well when the throttle sweeps the accelerating nozzle. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated;

FIG. 1 is a longitudinal section of a diaphragm-type carburetor having an acceleration system of this invention;

FIG. 2 is a transverse section taken generally on line 2—2 of FIG. 1; and

FIG. 3 is a fragmentary section of the carburetor shown in FIG. 1, taken generally on line 3—3 of FIG. 1.

FIG. 4 is an enlarged fragmentay sectional view of the carburetor shown in FIG. 1.

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

Referring to the drawings, a carburetor constructed in accordance with this invention, and generally designated 1, is shown to comprise a main body 3 formed to provide a

mixture conduit 5 extending therethrough from one end to the other. As appears in FIG. 1, the mixture conduit 5 is formed to have a cylindric throttle bore 7 toward one end, an intermediate venturi section 9, and an inlet section 11 toward its other end. The latter is generally cylindric, but with a flat as indicated at 13. The throat (the region of smallest cross section) of the venturi is indicated at 15. Body 3 has a flange 17 at the said one end of the mixture conduit (which constitutes its downstream end) for attaching the carburetor to the intake manifold 19 of an internal combustion engine as appear in FIG. 1, the flange being provided with suitable bolt holes (not shown) for receiving bolts extending from the intake manifold for this purpose.

An air filter 21 is attached in suitable manner to the body 3 at the upstream end of the mixture conduit. As appears in FIG. 1, this air filter is of a type comprising a casing 23 containing an annular filter element 25. The hole in the center of the filter element is indicated at 27. This hole is aligned with the mixture conduit 5. Air enters the filter peripherally, as indicated by the arrows in FIG. 1, flows through the filter element to the hole 27, and thence through the mixture conduit during the operation of the engine.

Body 3 is formed with a shallow recess 29 of circular outline in one side thereof (its bottom side as appears in the drawings). This recess, which constitutes a fuel chamber, has its center generally in the plane of the venturi throat 15, and is closed by a flexible diaphragm 31 (made of fuel-resistant synthetic rubber, for example). The margin of the diaphragm 31 is clamped against the body by a cover 33, fastened to the body by screws as indicated at 35. Cover 33 is recessesd as indicated at 37 and has a vent hole 38. A gasket 39 is interposed between the margin of the diaphragm and the cover. The central portion of the diaphragm is maintained substantially flat and rigid by a pair of flat spoked wheel-like backing members 41 and 43 lying on opposite faces of the diaphragm, and held in assembly with the diaphragm by a rivet 45 having its shank entered in a center hole in the diaphragm and center holes in members 41 and 43. The inner end head of the rivet is in the form of a button 47 for engagement by one end of a valve-actuating lever 49.

Fuel is adapted to be supplied to fuel chamber 29 from a fuel tank (not shown), the carburetor including fuel pump means as generally indicated at 53 for pumping fuel to chamber 29, and a needle valve 55 controlled by the aforementioned lever 49 for controlling delivery of fuel to the fuel chamber 29. For purposes of providing the fuel pump means, body 3 is formed with a shallow circular recess 57 constituting a pulsation chamber in the side thereof (its top side as shown) opposite the chamber 29. Recess 57 is closed by a flexible pump diaphragm 63 (made of fuel-resistant synthetic rubber, for example) clamped against the body all around the recess 57 by a pump cap 65. The latter is fastened to the body by screws as indicated at 67. It has a recess 69 constituting a pumping chamber on the opposite side of the diaphragm from recess or pulsation chamber 57.

The pump cap is formed with an upwardly extending boss 71 having a horizontal hole 73 extending inward from one side of the carburetor and a vertical hole 75 extending down from the inner end of hole 73 to the pumping chamber 69. Holes 73 and 75 together constitute a fuel inlet passage. A nipple 77 pressed in the end of hole 73 is adapted for connection of a fuel line 78 leading from the fuel tank (not shown). The pump cap is also formed with an outlet dome 79 which opens upward from pumping chamber 69 alongside hole 75, from which there is an inclined outlet passage 81 to a cavity 83 in the pump cap on the opposite side of pump diaphragm 63. From the

pulsation chamber 57 there is a passage 85 through the body 3 of the carburetor for communication between the intake manifold 19 of the engine and the pulsation chamber 57. Pressure pulsations such as occur in the intake manifold (as in the case of a two-cycle engine, for example) are transmitted through passage 85 to chamber 57 and cause flexing of pump diaphragm 63. Fuel is thereby drawn into pumping chamber 69 from the fuel tank through inlet passage 73, 75 on downstrokes of diaphragm 63 and forced out of pumping chamber 69 on upstrokes of the diaphragm 63 through outlet chamber 79 and outlet passage 81 under control of flapper-type inlet and outlet check valves 87 and 89. These are formed by C-shaped cuts in a valve member consisting of a disk 91 of fuel-resistant synthetic rubber, for example, held in place by a retainer 93. The inlet flapper valve 87 flexes down to open when diaphragm 63 flexes down (outlet check 89 then being closed), and flexes up to close off the lower end of hole 75 when diaphragm 63 flexes up. The outlet flapper valve 89 flexes up to open when diaphragm 63 flexes up (inlet check 87 then being closed) and flexes down to close off an outlet hole 94 in retainer 93 when diaphragm 63 flexes down.

Body 3 has a cylindric pocket 95 extending up from fuel chamber 29 alongside the mixture conduit 5, this pocket being aligned with the aforementioned boss 61. A passage 97 extends down through the boss 61 and the body 3 to the upper end of the recess 95. A tubular cylindric needle valve body 99 is received in recess 95, being held in recess 95 by a screw-threaded fitting threaded in the lower end of this recess. A resilient valve seat 107, consisting of a disk of fuel-resistant synthetic rubber, for example, having a center hole, is retained within fitting 99.

Needle valve 55 has a tapered nose at its upper end for engagement with valve seat 107. Valve body 99 is formed for flow of fuel therethrough around the stem of the needle valve. A coil compression spring 117 surrounding the needle valve reacts from the lower end of body 99 against a collar on the needle valve 55 to bias the needle valve to a closed position engaging the valve seat 107. The needle valve has an annular groove 121 at its lower end providing a lower end head 123 on the needle valve. The valve-actuating lever 49 comprises a metal strip bent as indicated at 125 to form an upwardly opening loop. Lever 49 is pivoted intermediate its ends on a pivot pin 127 received in loop 125. This pin extends parallel to the axis of the mixture conduit 5 across the fuel chamber 29. Lever 49 thus extends laterally in respect to the carburetor and has its inner end overlying button 47 on the control diaphragm 31. The outer end of the lever is forked as indicated and straddles the needle valve 55 within the groove 121 above the lower end head 123 of the needle valve.

A throttle shaft 131 is journaled in body 3 extending laterally across throttle bore 7 of the mixture conduit 5. Shaft 131 carries a throttle 133 constituted by an elliptical sheet metal plate, and has an operating arm 135 on one end. A choke shaft 137 is journaled in body 3 extending laterally across the inlet section 11 of mixture conduit 5. Shaft 137 carries a choke 139 constituted by a sheet metal plate, and, as will be understood, has an operating arm (not shown) on one end.

Body 3 is formed with a hole 141 (FIG. 4) extending up from fuel chamber 29 to mixture conduit 5, this hole being closed at its lower end by a plug 143. Hole 141 is stepped, having an enlarged lower portion 147 forming a fuel well and a smaller upper portion 149. A nozzle 151 is received in hole 141. This nozzle comprises a tubular element of outside diameter corresponding to the diameter of the upper portion 149 of hole 141, the tubular element being pressed into the upper portion of the hole. The lower end of the nozzle extends down into the fuel well 147 and the top of the nozzle extends up into the venturi throat 15.

Body 3 has a cavity 153 (FIG. 2) extending up from fuel chamber 29 alongside hole 141 (on the side thereof opposite the needle valve pocket 95). This is intersected by a lateral horizontal hole 155 which at its inner end is in communication with the fuel well 147 via an orifice 157. The lower portion of the nozzle has ports 159 and is open at its lower end 161 for communication from the fuel well 147 to the interior of the nozzle. Cavity 153, hole 155, orifice 157, fuel well 147, ports 159 and the passage in nozzle 151 constitute the high speed fuel circuit or system of the carburetor, fuel being adapted to flow therethrough from chamber 29 to the mixture conduit 5 upon opening throttle 133 and resultant flow of air through the mixture conduit. The flow is adapted to be metered by a high speed system adjusting screw 163 threaded in hole 155 and having a small-diameter pointed-end extension 165 reaching to the orifice 157.

Body 3 has an inclined hole 167 extending from the upper part of fuel well 147 to mixture conduit 5, opening into the conduit upstream of nozzle 151. A restriction 169 is pressed in the upper end of hole 167. Hole 167 and restriction 169 function as an air bleed for supplying air to the fuel well 147, where the air enters one or more of the ports 159 and mixes with the fuel in nozzle 151.

Downstream from hole 141, body 3 has a cavity 171 (see FIGS. 1 and 3) in the central longitudinal plane of the mixture conduit 5 extending up from fuel chamber 29. An idle port 173 opens from the upper end of this cavity into the mixture conduit 5 downstream from the closed throttle 133. An idle air bleed hole 175 opens into the upper end of this cavity from mixture conduit 5 upstream of the closed throttle. The lower end of cavity 171 is closed by a plug 177. Body 3 has a cavity 179 extending up from fuel chamber 29 alongside cavity 171. Cavity 179 is intersected by a lateral horizontal hole 181 which at its inner end is in communication with cavity 171 via an orifice 183. Cavity 179, hole 181, orifice 183, cavity 171 and port 173 constitute the low speed or idle system of the carburetor, fuel being adapted to flow therethrough from fuel chamber 29 to the mixture conduit 5, and air mixing with the fuel via port 175. The flow is adapted to be metered by an idle adjusting screw 185 threaded in hole 181 reaching to the orifice 183.

Upstream from hole 171, but downstream from hole 141, body 3 is formed with an inclined hole 187 extending up from fuel chamber 29 to mixture conduit 5. The lower end of the hole is plugged as indicated at 189. A nozzle 191, which may be referred to as an acceleration nozzle, is pressed into the upper end of hole 187 opening into conduit 5, the tip of the nozzle being angled and located generally on an arc centered in the axis of the throttle shaft 131 to be traversed by the periphery of the throttle 133 when the throttle is opened a predetermined amount from closed throttle position (see the broken line indication of the arcuate path of the throttle periphery in FIG. 1). The lower end of nozzle 191 is formed with a restriction 193. Body 3 also has an inclined passage 195 extending from fuel well 147 downwardly to hole 187 (below nozzle 191). A restriction 197 is formed at the lower end of passage 195. The passage 195, hole 187 and nozzle 191 constitute the acceleration system of the carburetor.

Operation is as follows:

On starting the engine (choke 139 set in starting position for limited supply of air to mixture conduit 5, and throttle 133 opened), fuel for starting is delivered from fuel chamber 29 to mixture conduit 5 via the high speed circuit, i.e., cavity 153, hole 155, orifice 157, fuel well 147, ports 159 and the passage in nozzle 151, and via the low speed circuit, i.e., cavity 179, hole 181, orifice 183, cavity 171, and ports 173 and 175. Fuel may also be delivered from the fuel well 147 to the mixture conduit 5 via the acceleration system, i.e., passage 195, hole 187 and nozzle 191. The fuel mixes with air flowing through mixture conduit, and as regards the fuel in high

speed circuit and the acceleration circuit, it mixes with air flowing into fuel well 147 through the air-bleed restriction 169. The large amount of fuel delivered to mixture conduit 5 through the high speed, idle and acceleration systems provides a relatively rich air/fuel mixture for starting.

After the engine has started and warmed up, choke 139 may be fully opened, and throttle 133 controlled as desired for high speed operation. As previously noted, intermediate section 9 of mixture conduit 5 is restricted to provide a venturi effect such as to generate a partial vacuum in the mixture conduit in the region of high speed fuel nozzle 151. This induces flow of fuel from fuel chamber 29 to mixture conduit 5 via cavity 153, hole 155, orifice 157 (metered by screw 163), fuel well 147, ports 159 and the passage in nozzle 151. Air bleeds into fuel well 147 via bleed hole 167.

For engine idling, throttle 133 is returned to its FIG. 1 solid-line idle position. A partial vacuum is drawn downstream from the throttle, and this induces a flow of fuel from fuel chamber 29 to mixture conduit 5 downstream from the throttle via cavity 179, hole 181, orifice 183 (metered by screw 185), cavity 171 and port 173. Air bleeds through port 175 into hole 171 for mixture with fuel flowing therethrough to the port 173.

Diaphragm 31 is subject on its outer side to atmospheric pressure via vent hole 38, and is adapted to move inward against the bias of spring 117 (exerted on the button 47 through lever 49 and valve 55) in response to decrease in pressure in fuel chamber 29 as results upon delivery of fuel from chamber 29 to mixture conduit 5. Upon inward movement of the diaphragm, lever 49 is rocked clockwise as viewed in FIG. 2, pulling needle valve 55 open for delivery of fuel to chamber 29 to replace fuel delivered from the chamber 29 to mixture conduit 5. The fuel in fuel well 147 above the lower edge of the lip of passage 195 adjacent the fuel well flows into the hole 187 so that a substantial amount of fuel may be maintained in the acceleration hole 187.

As the throttle 133 is opened for fast acceleration, it sweeps past the tip of the acceleration nozzle 191 and the low pressure downstream from the throttle immediately induces flow of the fuel in hole 187 to the mixture conduit 5 for prompt mixture enrichment. The partial vaccum also induces a flow of fuel from fuel chamber 29 to hole 187 via cavity 153, hole 155, orifice 157, fuel well 147 and passage 195. As described previously, fuel is maintained in hole 187 so as to be immediately available for fast acceleration. Also, as the throttle 133 sweeps past nozzle 191 the manifold vacuum also induces air to bleed into the fuel well 147 via air bleed 167. This air mixes with fuel passing from the fuel well through the passage 195 and hole 187 and out the acceleration nozzle 191. This air speeds up the fuel flow so that it passes quickly out nozzle 191 into the mixture conduit for rapid engine acceleration.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A carburetor comprising a body having a mixture conduit extending therethrough and a fuel chamber at one side of said body, a diaphragm closing said fuel chamber, means for delivering fuel to said chamber controlled by said diaphragm, said mixture conduit being formed to provide a venturi, a rotatable throttle shaft extending across said mixture conduit downstream from said venturi, a throttle on said shaft, a high speed fuel system comprising a first fuel well in said body located between said fuel chamber and mixture conduit, a high speed fuel passage connecting said well and said mixture conduit and a high speed nozzle in said high speed fuel passage at the throat of the venturi, a conduit, connecting said fuel chamber and first fuel well, means for metering the flow of fuel through said conduit to the fuel well, an acceleration system comprising separate passaging from said well to said mixture conduit including a second well and an accelerating nozzle having one end opening into the mixture conduit at a point at which said end of the accelerating nozzle is traversed by the periphery of the throttle when the throttle is moved from a closed to an open position and between said high speed nozzle and said throttle shaft, an air bleed passage into said first well and into said accelerating system from the mixture conduit upstream of said high speed nozzle, whereby air is bled into said first well and said accelerating system when said throttle is moved to a position to place the accelerating nozzle downstream of the throttle, and an independent idle fuel means including an idle port downstream from the high speed fuel nozzle and a separate idle fuel passage between said idle port and said fuel chamber for delivery of fuel from the fuel chamber to the mixture conduit when the throttle is at a closed idle position, and means for metering flow of fuel through said idle fuel passage.

2. In a carburetor as set forth in claim 1 wherein said end of the accelerating nozzle is located generally on an arc centered on the axis of said throttle shaft to be traversed by the periphery of the throttle when the throttle is opened a predetermined amount from idle position, whereby air flow between said nozzle end and said throttle periphery is restricted to thereby increase suction at the nozzle end to increase fuel flow from said nozzle and the flow of air through said fuel.

3. The invention of claim 1, including a single manually operable and variable control means in said conduit for metering the flow of fuel between said fuel chamber and said first well to said high speed and said accelerating systems.

References Cited in the file of this patent

UNITED STATES PATENTS

1,542,168	Paterson et al.	June 16, 1925
2,215,683	Wirth	Sept. 24, 1940
2,827,272	Phillips	Mar. 18, 1958
2,926,894	Price	Mar. 1, 1960
2,984,465	Hazzard	May 16, 1961
3,065,957	Phillips	Nov. 27, 1962
3,072,390	Phillips	Jan. 8, 1963