Jan. 25, 1966 R. E. KALERT, JR 3,231,250

CARBURETOR

Filed Aug. 30, 1962 3 Sheets-Sheet 1

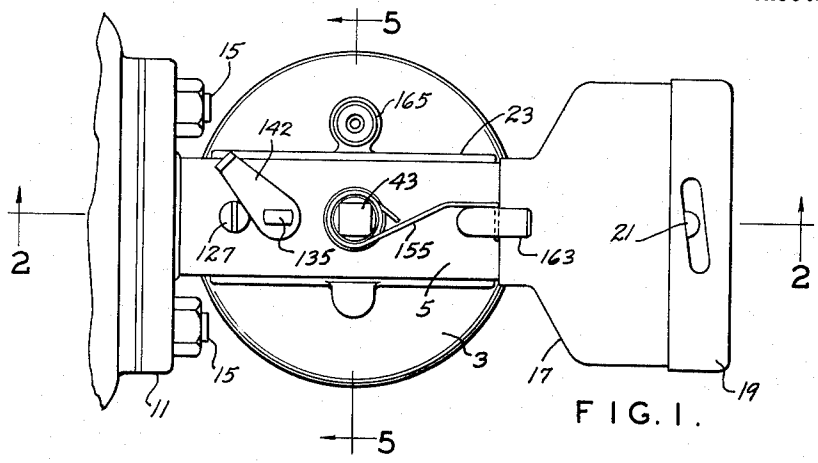


FIG. 1.

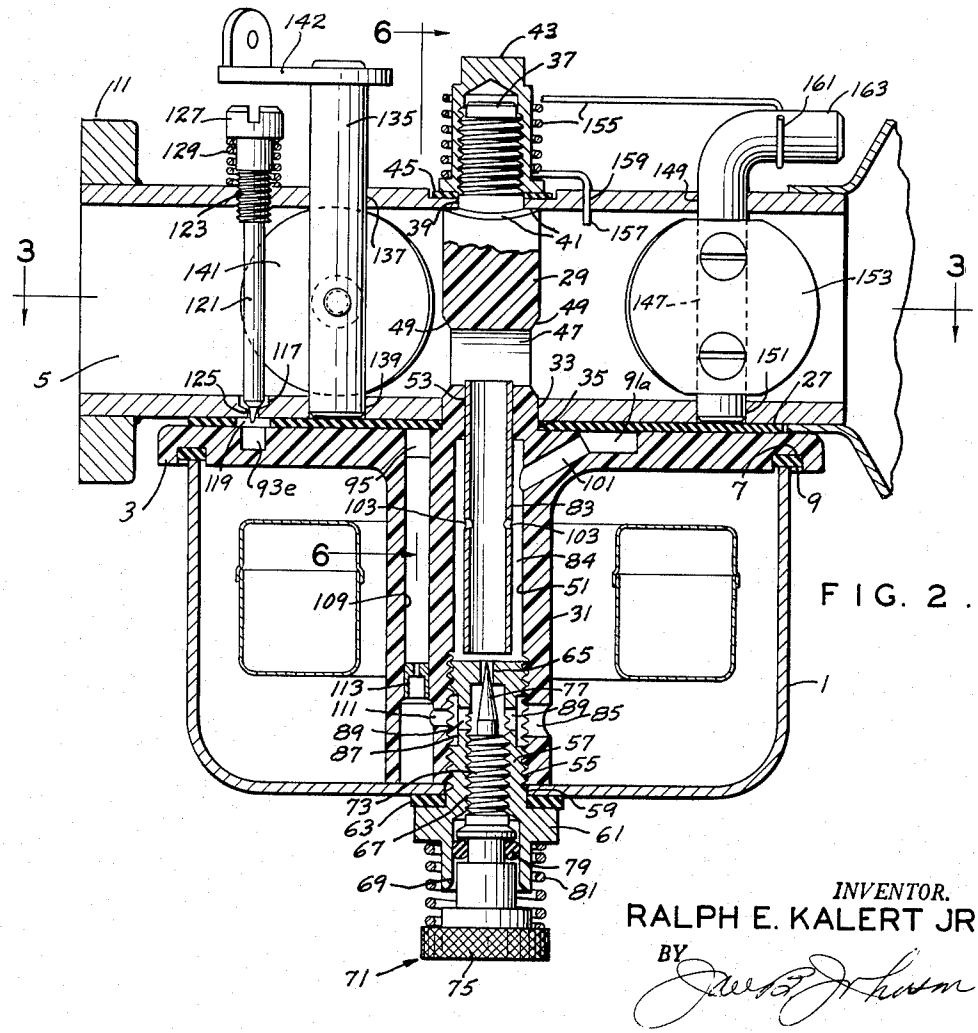


FIG. 2.

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CARBURETOR

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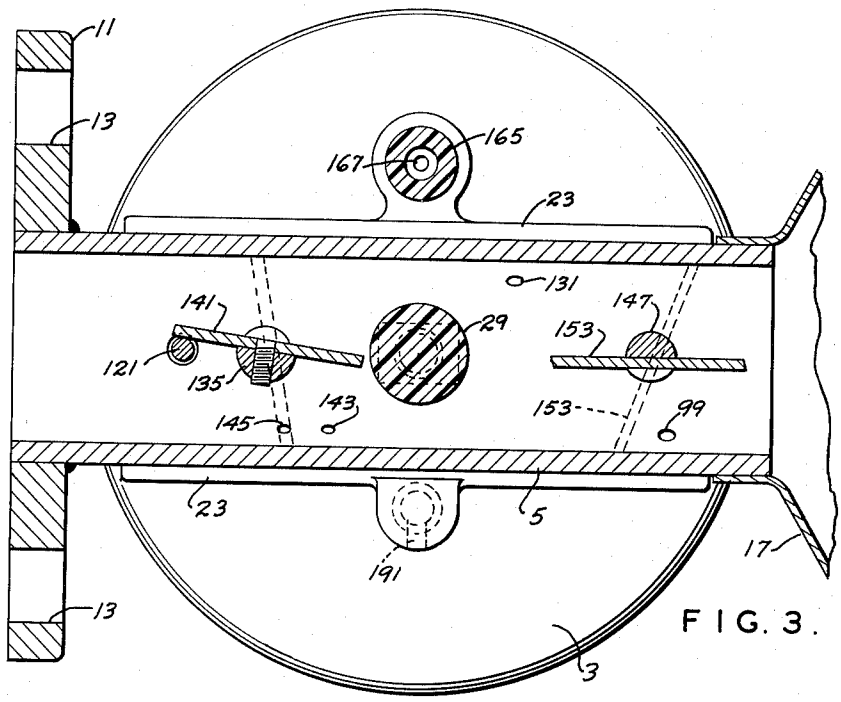


FIG. 3.

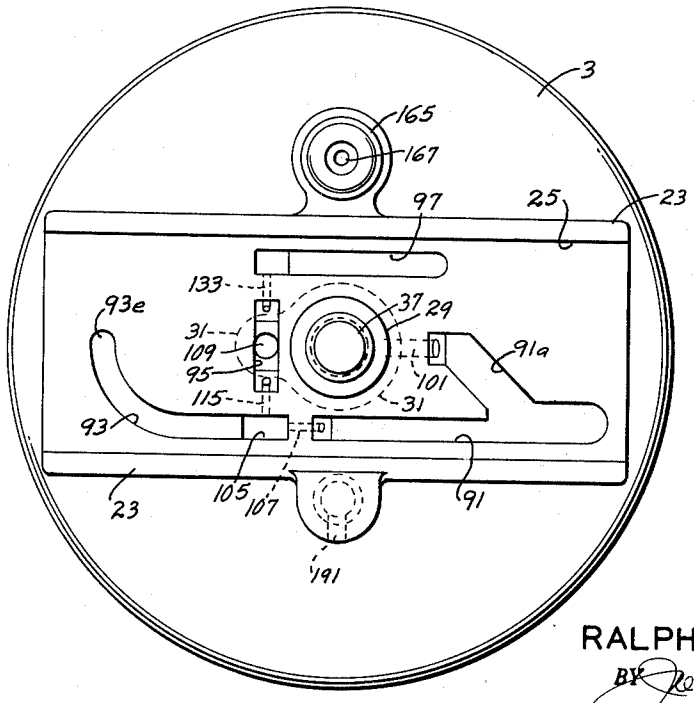


FIG. 4.

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CARBURETOR

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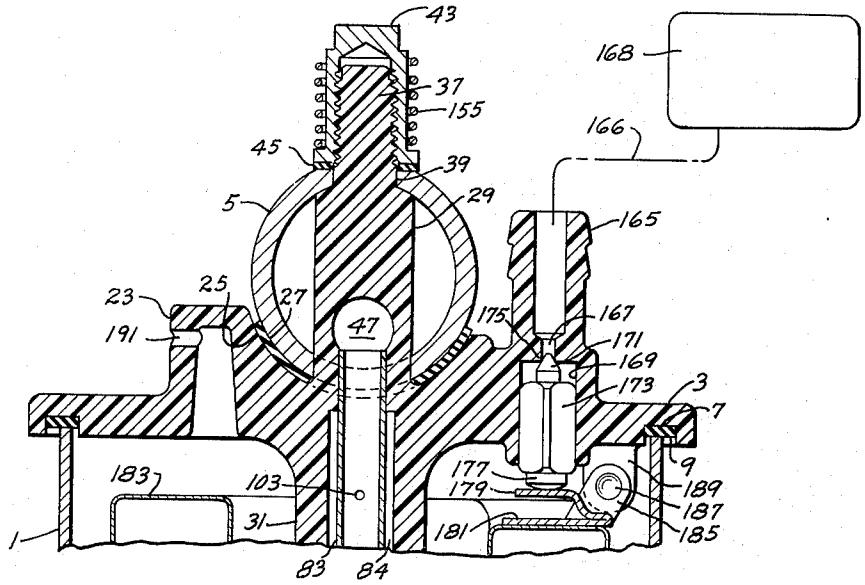


FIG. 5.

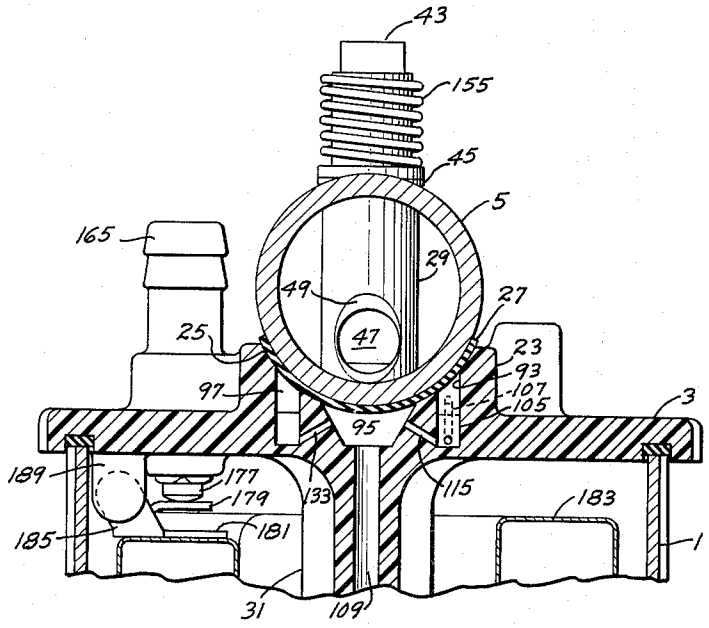


FIG. 6.

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3,231,250

CARBURETOR

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11 Claims. (Cl. 261—41)

This invention relates to carburetors, and more particularly to a carburetor of the type having a horizontal mixture conduit and a fuel bowl below the mixture conduit.

Among the several objects of the invention may be noted the provision of a carburetor of the class described for small internal combustion engines (such as are used on apparatus such as power lawn mowers and the like) which is of such construction that it may be manufactured at low cost primarily from sheet metal and molded plastic parts, including a sheet metal fuel bowl, a molded plastic bowl cover, and a sheet metal tube which constitutes the mixture conduit of the carburetor; the provision of a carburetor such as described having a construction which, in simple and economical manner, provides a boost venturi in addition to a main venturi; and the provision of a carburetor such as described having a low speed or idle fuel system, in addition to its high speed fuel system, with provision for adjustment of both the high speed and idle systems. 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 plan of a carburetor made according to the invention, showing the carburetor attached to the intake manifold of an internal combustion engine;

FIG. 2 is an enlarged vertical section taken on line 2—2 of FIG. 1 (omitting the intake manifold);

FIG. 3 is a horizontal section taken on line 3—3 of FIG. 2;

FIG. 4 is a plan of the bowl cover per se of the carburetor;

FIG. 5 is an enlarged vertical section taken on line 5—5 of FIG. 1; and

FIG. 6 is a vertical section taken on line 6—6 of FIG. 2;

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 is shown to comprise a fuel receptacle constituted by a bowl 1 and a cover 3 on the bowl. A mixture conduit 5 extends horizontally over the cover. Bowl 1 is shown as comprising a circuilar cup, and may be a deep-drawn sheet metal cup. Cover 3 is shown as a circular molded plastic cover having a circular groove 7 in its bottom adjacent its periphery receiving the rim of the cup-shaped bowl with a ring-shaped gasket 9 in the groove between the rim of the bowl and the cover. Mixture conduit 5 is constituted by a sheet metal tube, and has a flange or collar 11 secured on one end thereof. This has bolt holes 13 (see FIG. 3) for reception of bolts 15 (see FIG. 1) to attach the carburetor to the intake manifold M of an internal combustion engine. At the other end of the tube is an air horn 17 which may contain an air filter (not shown) and which has a cap 19 with a quick detachable bayonet connection 21 to the horn. It will be understood that cap 19 has openings in its end face for admission of air to the horn.

Cover 3 has an integral upwardly extending formation 23 (FIGS. 3, 4 and 5) on its top. This extends diametrically across the cover, and is formed with a recess 25 of arcuate shape in transverse cross section extending throughout its length. Tube 5 is seated in this recess with a gasket 27 underneath the tube. The length of the tube is somewhat greater than the diameter of the cover and the tube projects at both ends beyond the cover. Cover 3 also has an integral cylindric stud 29 extending upward from its center and in integral stud 31 of pear-shape in cross section (see FIG. 4) extending downward generally centrally of the cover. Stud 29 extends through a hole 33 (FIG. 2) in the wall of tube 5 at the bottom of the latter (there being a registering hole 35 in gasket 27), and has a reduced-diameter upper end extension 37 which extends through a hole 39 in the wall of tube 5 at the top. At the inner (lower) end of extension 37, stud 29 has an annular shoulder 41 on which the top of the tube 5 is seated. Shoulder 41 is suitably curved for this purpose (see FIG. 2). A cap nut 43 is threaded on extension 37 to hold the tube in assembly with cover 3 with a sealing washer 45 under the nut.

Stud 29 has a crosshole 47 extending lengthwise of tube 5 adjacent the bottom of the tube. The ends of crosshole 47 are beveled as indicated at 49, and crosshole 47 constitutes what may be termed a primary or boost venturi as will be later explained. Stud 31 extends down to the bottom of bowl 3 generally centrally of the bowl, and has a cylindric recess 51 which extends up from its lower end nearly to the top of cover 3, with a reduced-diameter hole 53 in continuation of the recess extending to the crosshole 47. Recess 51, toward its lower end, is tapped as indicated at 55. Threaded in the lower end of recess 51 is a screw 57 extending through a central hole 59 in the bottom of the bowl 3 and having a head 61 engaging a sealing washer 63 which seals against the bottom of the bowl. This holds the bowl and cover in assembly. Screw 57 is tubular, having a metering orifice 65 at its upper end communicating with a tapped bore 67 which opens at its lower end into an enlarged cylindric recess 69 in the lower end of the screw. A needle valve designated in its entirety by reference character 71 is adjustable in screw 57. As shown in FIG. 2, needle valve 71 has a stem 73 threaded at its upper end in the tapped bore 67 of screw 57, extending down through recess 69 and having a knurled head 75 on its lower end, and having a needle tip 77 movable up and down in metering orifice 65. An O-ring 79 is retained in an annular groove in the stem for sealing recess 69, and a coil compression spring 81 is provided between the knurled head 75 of the needle valve and the head 61 of screw 57.

A fuel tube 83 has its upper end pressed in hole 53 and extends down into recess 51 with its lower end somewhat above the upper end of screw 57. The portion of recess 51 above the upper end of screw 57 constitutes a fuel well 84 and fuel is adapted to flow into this well from the bowl 3 via a port 85 in stud 31 which communicates with a space around screw 57 provided by an annular peripheral groove 87 in the screw 57, ports 89 in the screw 57 providing for communication from groove 87 to the space within screw 57 above the stem 73 of the needle valve, and the metering orifice 65, with the rate of flow controllable by the adjustment of the needle valve 71.

Cover 3 is molded with grooves such as indicated at 91, 93, 95 and 97 in FIG. 4, grooves 91, 93 and 97 extending generally lengthwise and groove 95 extending crosswise of the tube-seating recess 25. Groove 91 is a relatively shallow groove extending from near the air horn end of the recess 25 (its upstream end) to the region of stud 29 on one side of the latter. A branch groove

91*a* angles off from groove 91 to the central vertical longitudinal plane of recess 25, terminating just upstream from stud 29. Air is adapted to bleed into the groove 91 at its upstream end via an air bleed hole 99 in tube 5 (see FIG. 3) and a registering hole in gasket 27, the remainder of the groove being covered by the gasket 27. Air bleeding into groove 91 through hole 99 is adapted to flow through branch groove 91*a* and through a passage 101 to the fuel well 84 (FIG. 2). Passage 101 angles downward from the end of branch groove 91*a* in the central vertical longitudinal plane of recess 25 to the well 84. Fuel tube 83 has holes such as indicated at 103 for bleeding air entering well 84 via passage 101 into the tube 83. These holes 103 are made of such size as appropriately to meter the flow of air into the fuel tube.

Groove 93 is a relatively shallow groove having its upstream end adjacent the downstream end of groove 91, and extends lengthwise of recess 25 in line with groove 91 for some distance, then curves inward so that its downstream end 93*e* is located in the central vertical longitudinal plane of recess 25. At its upstream end, groove 93 has a relatively deep pocket 105 (FIGS. 4 and 6). A passage 107 interconnects the downstream end of groove 91 and the upstream end of groove 93.

Groove 95 is a relatively deep groove located immediately adjacent stud 29 on the downstream side thereof and extending crosswise of recess 25. Stud 31 has a vertical idle system passage 109 (FIGS. 2, 4 and 6) extending down from groove 95 (on the downstream side of recess 51). This idle passage 109 extends all the way down to the lower end of stud 31. Fuel is adapted to enter passage 109 adjacent its lower end via a port 111 (see FIG. 2) providing for communication from annular groove 87 to passage 109. A metering jet 113 is pressed into passage 109 from its lower end, this jet being located just above port 111. An economizer passage 115 connects grooves 95 and 93, extending between one end of groove 95 to the pocket 105.

The wall of tube 5 has a stepped idle port 117 (see FIG. 2) in the bottom registering via a hole 119 in gasket 27 with the downstream end 93*e* of groove 93. Flow through this idle port is regulated by an idle adjusting screw 121 threaded in a tapped hole 123 in the wall of tube 5 at the top aligned with port 117. Screw 121 extends vertically downward through tube 5 and has a conical tip 125 at its lower end adjustably movable, up and down, in port 117 by the turning of screw 121 to vary the effective area of the port 117. Screw 121 has a notched head 127 at its upper end to receive a turning tool. A coil compression spring 129 is provided between head 127 and the top of tube 5.

Groove 97 extends on the side of recess 25 opposite grooves 91 and 93 and alongside the stud 29. Air is adapted to bleed into groove 97 at its upstream end via an air bleed hole 131 in the wall of tube 5 (see FIG. 3) and a registering hole in gasket 27, the remainder of the groove being covered by the gasket. Air bleeding into groove 97 through hole 131 is adapted to flow through a passage 133 (FIGS. 4 and 6) into groove 95, this passage 133 extending from the downstream end of groove 131 laterally to the respective end of groove 95.

A throttle shaft 135 extends vertically downward in tube 5 downstream from stud 29, being journaled in holes 137 and 139 in the wall of the tube at top and bottom. Fastened to shaft 135 in tube 5 is a throttle valve 141 constituted by an elliptical sheet metal disk. Shaft 135 is located between stud 29 and idle adjusting screw 121, and the throttle valve 141 is rotatable with the shaft between a closed idle or low speed position shown in dotted lines in FIG. 3 and the full-open position shown in solid lines in FIG. 3, the latter being determined by engagement of the throttle valve with the idle adjusting screw 121. Shaft 135 has an arm 142 on its upper end for connection thereto of a throttle-operating linkage.

The wall of tube 5 has an idle air bleed hole 143 in register with the upstream end of the groove 93 and a corresponding hole in gasket 27 for bleeding air into groove 93 from upstream of the throttle valve 141 when the latter is in the closed idle or low speed position. The wall of tube 5 also has a hole 145 constituting an acceleration port in register with groove 93 via a corresponding hole in gasket 27, this port 145 being located so as to be blocked by the rim of throttle valve 141 when the latter is in closed position.

A choke shaft 147 (FIG. 2) extends vertically downward in tube 5 upstream from stud 29, being journaled in holes 149 and 151 in the wall of the tube at top and bottom. Fastened to shaft 147 in the tube is a choke valve 153 constituted by an elliptical sheet metal disk. The choke valve is biased toward open position (see FIG. 3) by a torsion spring 155 positioned around nut 43, having one end 157 inserted in a hole 159 in the tube 5, and its other end 161 engaging a bent operating arm 163 at the upper end of shaft 147. Bleed hole 99 is located to be upstream from the choke when the choke valve is closeed. The choke valve swings closed in counterclockwise direction as viewed in FIG. 3 to a position indicated by the dotted structure 153.

Cover 3 is formed with a nipple 165 (FIGS. 5 and 6) extending upward therefrom at one side of formation 23 for connection of a fuel line schematically shown at 166 in FIG. 5, for delivery of fuel from a tank 168 to bowl 1. Nipple 165 communicates downward through a port 167 (see FIG. 5) to the upper end of a downwardly opening cylindric recess 169 in the cover. A needle valve 171 has a stem 173 of cruciform cross section vertically slidable in recess 169. Valve 171 is adapted for engagement on upward movement with the valve seat 175 provided at the upper end of the recess. Valve 171 has a button 177 at its lower end engaging an arm 179 on a float lever 181 pivoted for swinging movement on a horizontal axis underneath the cover 3 and carrying an annular float 183 surrounding stud 31. Lever 181 is formed of sheet metal with two side ears 185 each having outwardly extending bosses 187 snapped into corresponding recesses in a pair of lugs 189 extending down from the cover for holding the lever and float in pivoted assembly with the cover. Cover 3 is provided with a vent passage 191 for venting to the atmosphere fuel vapors in the bowl 1. Fuel may be fed from tank 168 to the fitting 165 by means of gravity or by a fuel pump.

With regard to the operation of the carburetor, it will be apparent that a predetermined level of fuel, well above the level of port 85, is maintained in the bowl 1 by means of the float-controlled needle valve 171. During high-speed operation with the throttle 141 open there is a maximum flow of air through tube 5 to the engine. Stud 29 provides a portion of restricted cross sectional area in tube 5 constituting a main venturi, and passage 47, which extends lengthwise in relation to tube 5 and provides a venturi effect in view of its beveled ends, acts as a boost venturi for boosting the delivery of fuel. The flow of air around stud 29 and through passage 47 is subatmospheric so that fuel is forced from bowl 1 through port 85 and through the passages in screw 57 to fuel well 84, and thence through fuel tube 83 to the hole 47 in stud 29. Air bleeds into fuel well 84 via air bleed hole 99, groove or passage 91*a* and passage 101. This air passes through ports 103 to mix with the fuel passing upwardly through the fuel tube 83. The flow of fuel for high speed operation is metered at orifice 65, depending on the adjustment of the needle valve 71.

With the throttle valve 141 in a closed position, shown by the dotted-line throttle position of FIG. 3, engine manifold vacuum exists downstream of the throttle valve. Fuel is forced from the bowl through passages 85, 89 and 111 into idle passage 109. Fuel flows into passages 95, 115, 93 and out the idle port 117. The restriction 113 in passage 109 is of a predetermined size depending on

the needs of the engine and meters the solid fuel flowing into the low speed system. Air is bled into the low speed system through port **131** upstream of the closed throttle valve **141**. This air flows in response to the pressure differential on opposite sides of the closed throttle and through passages **97** and **133** into groove **95** where it meets the solid fuel being forced up passage **109**. This air tends to vaporize the fuel to form an air and fuel mixture or emulsion and also directs this emulsion through the economizer passage **115**, which being of a predetermined cross section meters this air and fuel mixture. Additional low speed air is bled into the low speed system from upstream of the closed throttle through port **99** and passages **91** and **107**. This air strikes the air and fuel mixture coming through the economizer passage **115** to lean the mixture and this keeps the fuel vaporized. This air also accelerates the fuel and air mixture down passage **93** and out the idle port **117**. The screw **121** is adjusted to control the amount of fuel and air mixture required for proper low speed operation. The air bleed port **143** may be used to further lean out the fuel and air mixture in passage **93**, if desired.

As the throttle is opened, in the transition from low speed to high speed operation of the engine, the throttle valve uncovers port **145**. Air sweeping around the edge of the throttle valve is at low pressure and additional accelerating fuel and air mixture is sucked through port **145** to speed up the engine until air flow through the venturi passage **47** can raise fuel into the mixture passage **5**. The potional port **143** also is swept by the throttle **141** as it is opened to provide an additional flow of accelerating fuel and air from passage **93**.

The bowl **1**, cover **3** and tube **5** are the main parts of the carburetor. Bowl **1** and tube **5** can be made of sheet metal and cover **3** of molded plastic. Thus, these are all low-cost parts. Assembly of these parts is relatively simple, involving attaching bowl **1** to cover **3** by threading screw **57** through hole **59** in the bottom of the bowl and attaching tube **5** to stud **29** by threading cap nut **43** on the extension **37** of stud **29**.

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 fuel bowl, a cover on the bowl, a tube constituting a mixture conduit extending across the cover on top of the cover, an upper stud formed integrally with the cover extending upward from the cover through holes in the tube wall at top and bottom, means on the upper end of said upper stud holding the tube in assembly with the cover, said upper stud providing a portion of restricted cross sectional area in the tube constituting a main venturi, said upper stud having an opening therethrough extending lengthwise in relation to the tube constituting a boost venturi, a lower stud extending down from the cover generally in line with the upper stud to the bottom of the bowl, said lower stud having a recess extending up from its lower end, screw means threaded in the lower end of said recess in said lower stud through a hole in the bottom of the bowl and holding the bowl and cover in assembly, the portion of said recess in said lower stud above said screw means constituting a fuel well, a fuel tube extending down from said boost venturi into said fuel well, said screw means being formed for flow of fuel from the bowl to said fuel well, a throttle in said tube downstream from said upper stud, said lower stud having an idle passage extending up from the lower end thereof to idle passage grooving in the top of the cover, said tube overlying said idle passage grooving, said idle passage grooving extending to an idle port in the tube wall downstream from the throttle, and said idle passage in said lower stud being in communication toward its lower end with the bowl.

2. A carburetor as set forth in claim **1** wherein said screw means comprises a tubular screw having a metering orifice at the upper end thereof and a metering valve adjustably threaded in said tubular screw and associated with said orifice.

3. A carburetor as set forth in claim **2** having an idle adjusting screw extending across the tube in line with said idle port, said screw being threaded in a hole in the top of the tube and having its lower end assoicated with the idle port.

4. A carburetor as set forth in claim **3** wherein said idle adjusting screw is engageable by the throttle to determine the full-open position of the throttle.

5. A carburetor comprising a fuel bowl, a cover on the bowl, a tube constituting a mixture conduit extending across the cover, a first stud formed integrally with the cover extending downwardly into the bowl and having an axial recess therein extending the length of the stud to provide a fuel well in communication with the bowl, a second stud formed integrally with the cover extending upwardly from the cover across the tube through aligned holes in the tube wall to provide a portion of restricted cross-sectional area in the tube and having an opening therethrough extending lengthwise in relation to the tube to provide a boost venturi, means associated with the upper end of said second stud for holding the mixture conduit in assembly with the cover, a fuel tube extending from the boost venturi into the fuel well for delivery of fuel to said boost venturi, a tubular screw threaded in the lower end of said recess through a hole in the bottom of the bowl for holding the cover and bowl in assembly and having a metering orifice at its upper end, said fuel well being constituted by the portion of said recess above the upper end of said screw, and valve means adjustable in said screw for metering flow through said metering orifice, said first stud and said screw being formed for flow of fuel from the bowl to said fuel well through said metering orifice under control of said valve means.

6. A carburetor as set forth in claim **5** having an idle system including an idle passage in said first stud extending down to the lower end of said first stud, the lower end of said idle passage being in communication with the bowl.

7. A carburetor comprising a fuel bowl, a cover on the bowl, a tube constituting a mixture conduit extending across the cover on top of the cover, an upper stud formed integrally with the cover extending upward from the cover through holes in the tube wall at top and bottom, means on the upper end of said upper stud holding the tube in assembly with the cover, said upper stud providing a portion of restricted cross sectional area in the tube constituting a main venturi, said upper stud having an opening therethrough extending lengthwise in relation to the tube constituting a boost venturi, a lower stud extending down from the cover generally in line with the upper stud to the bottom of the bowl, said lower stud having a recess extending up from the lower end, screw means threaded in the lower end of said recess in said lower stud through a hole in the bottom of the bowl and holding the bowl and cover in assembly, the portion of said recess in said lower stud above said screw means constituting a fuel well, a fuel tube extending down from said boost venturi into said fuel well, said screw means being formed for flow of fuel from the bowl to said fuel well, a thottle in said tube downstream from said upper stud, said lower stud having an idle passage extending up from the lower end thereof to idle passage grooving in the top of the cover, said tube overlying said idle passage grooving, said idle passage grooving extending to an idle port in the tube wall downstream from the throttle, said idle passage in said lower stud being in communication toward its lower

end with the bowl, a choke in said tube upstream from said upper stud, an air bleed hole in the tube wall and a passage including grooving in the top of the cover for bleeding air from upstream of the choke into the fuel well and the idle passage grooving, an idle air bleed hole in the tube wall for bleeding air into the idle passage grooving from a point upstream of the throttle and downstream from said upper stud, an air bleed hole and a passage including grooving in the top of the cover for bleeding air from a point upstream of said upper stud and downstream from the choke into the idle passage grooving, and an acceleration port in the tube wall providing for communication from said idle passage grooving to the interior of the tube when the throttle is open and blocked by the throttle when at idle.

8. A carburetor comprising a fuel bowl, a cover on the bowl, a tube constituting a mixture conduit extending across the cover, a stud having an upper portion extending upwardly from the cover across the tube through holes in the tube, means associated with the upper end of the stud for holding the tube on the cover, said stud providing a portion of restricted cross sectional area in the tube constituting a main venturi and having an opening therethrough extending lengthwise in relation to the tube constituting a boost venturi, a choke in said tube upstream from said stud, a throttle in said tube downstream from said stud, said stud having a lower portion extending downwardly into the bowl with an axial recess therein forming a fuel well in communication with the bowl, a fuel tube extending from said boost venturi into said fuel well, an idle passage extending from said bowl to an idle port downstream of said throttle and including idle passage grooving in the top of the cover, an air bleed hole in the tube wall and an air passage including grooving in the top of the cover for bleeding air from upstream of the choke into the fuel well and the idle passage grooving, and an idle air bleed hole in the tube wall for bleeding air into the idle passage growing from a point upstream of the throttle and downstream from said upper stud portion.

9. A carburetor as set forth in claim 8 wherein an air bleed hole and an air passage are provided for bleeding air from a point upstream of said upper stud portion and downstream from the choke into the idle passage grooving and including grooving in the top of the cover, and an acceleration port in the tube wall is provided for communication from said idle passage grooving to the interior of the tube when the throttle is open and blocked by the throttle when at idle.

10. A carburetor comprising a fuel bowl, a cover on the bowl, a tube constituting a mixture conduit extending across the cover, a first stud formed integrally with the cover extending down into the bowl, means associated with the lower end of said first stud for holding the cover and bowl in assembly, a second stud formed integrally with the cover extending upward from the cover across the tube through holes in the tube wall and having an opening therethrough extending lengthwise in relation to the tube constituting a boost venturi, means associated with the upper end of said second stud for holding the tube in assembly with the cover, said second stud providing a portion of restricted cross-sectional area in the tube, said first stud having an axial passage for delivery of fuel from the bowl to said boost venturi, the said axial passage in said first stud also providing a fuel well in communication with the bowl, and wherein there is provided a fuel tube extending down from said boost venturi into said fuel well.

11. A carburetor as set forth in claim 10 having an idle system including an idle passage in said first stud.

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