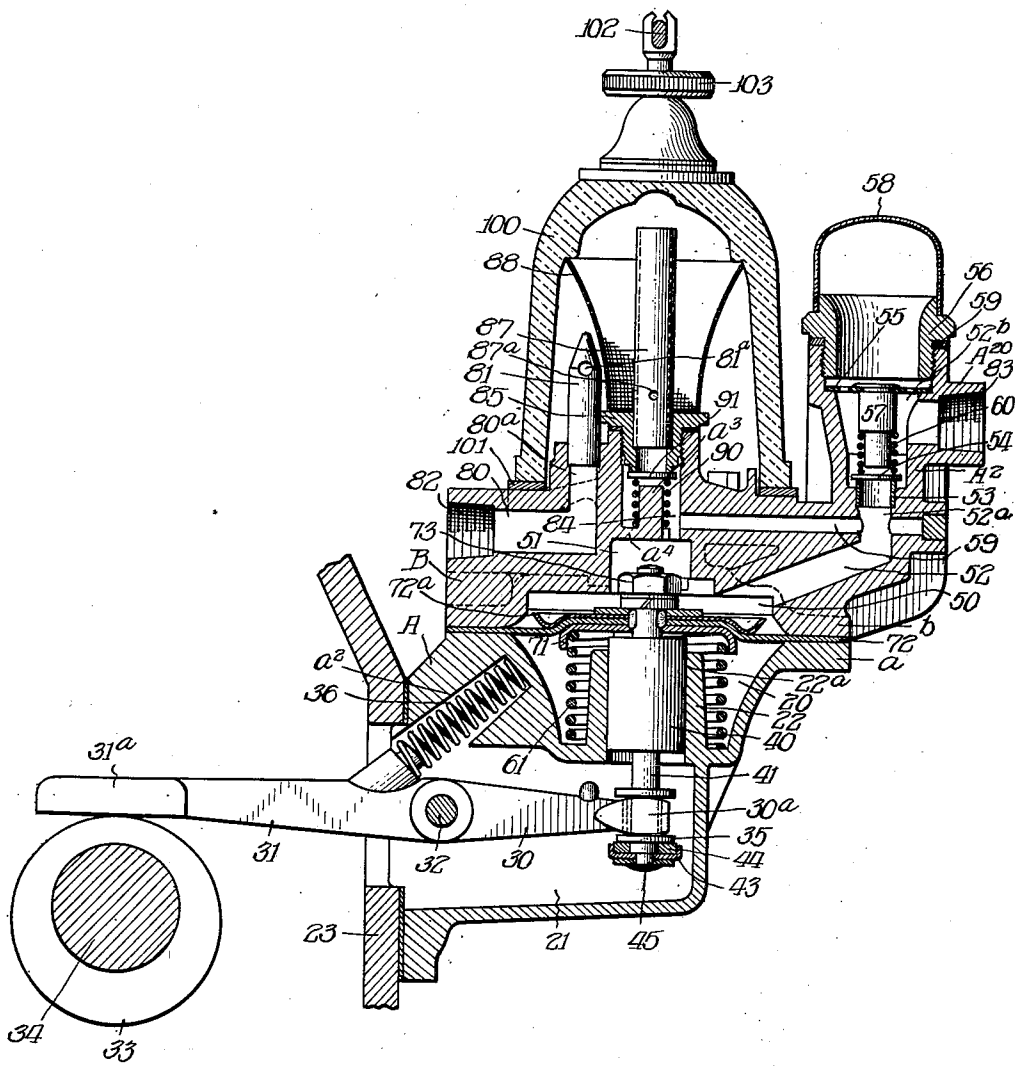
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FUEL PUMP

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FUEL PUMP

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The purpose of this invention is to provide an improved construction of a pump for supplying fuel to an internal combustion engine, adapted for convenient mounting of the pump on the engine casing with minimum protrusion or overhang of the several parts including such as a fuel-receiving and sediment-trapping chamber in the fuel supply line, and a pressure-trapping chamber in the fuel delivery line.

According to the present invention the fuel receiving and inlet trapping chamber is disposed above the pumping chamber and alongside of the outlet trapping chamber.

An advantage of the above arrangement resides in the fact that fuel is trapped on both the inlet and outlet sides of the pump and above the inlet and outlet valves whereby the pump is always primed.

A further improvement consists in the provision of a vapor vent duct between the intake and discharge passages beneath the valves and separated from the main discharge passage from the pumping chamber whereby vapors are scavenged into the trapping chambers.

In the drawing:

Figure 1 is a vertical section of the pump.

Referring to the drawing in general, the construction shown comprises a pump body consisting of two main members, the first arranged for mounting on the engine casing, and the second mounted on the first and having mounted upon it a fuel receiving and sediment-trapping chamber, and parts constituting in conjunction with passages in said body member, a pressure trapping chamber. The first mentioned body member affords mounting for the engine-actuated operating elements for giving the pumping member its intake stroke, and a spring for giving the pumping member its feeding stroke, and a second spring for causing the engine-actuated member to follow the engine cam in the idle phase of the cam cycle.

The second body member contains the feeding chamber with the pumping member consisting of a diaphragm clamped between the two body members and thus forming the lower side of the pumping chamber, said second body member has fuel inflow and delivery passages and intake and discharge valves controlling them for one-way flow.

Referring to the drawing in detail:

A is the first pump body member having a cavity, 21, opening for registration with an opening in the engine casing indicated at 23, said cavity, 21, accommodating an operating lever, 30, 31, fulcrumed on said body member, A, at 32, and extending the arm, 31, into the engine casing for reaching and being actuated by an engine cam indicated at 33 on a shaft, 34. The lever arm, 30, is forked, as seen at 30a, for engaging a flanged sleeve, 35, mounted slidably for lost motion, as hereinafter further pointed out, on the reduced lower end portion, 41, of the stem, 40, of the pumping member hereinafter described.

44 indicates a sound-preventing washer of leather or other suitable cushioning material, seated below the sleeve, 35, in a cup washer, 43, retained on the reduced stem, 41, by a suitable head, 45. 36 is a spring accommodated and retained in an obliquely positioned pocket, a^2, provided for that purpose in the pump body member, A, for reacting on the lever arm, 31, immediately beyond the fulcrum, 32, of the lever, 30, 31, on the engine side, to cause the terminal, 31a, of the lever arm, 31, to follow the cam, 33, in the idle phase of the cam cycle.

The body member, A, at the upper side is formed with a flat face bounded by a horizontal flange, *a*, and mating with a similar flange, *b*, on the mated lower face of the upper casing member, B, as hereinafter more particularly described. Opening at the flat face there is formed in the body member, A, an annular frusto-conical cavity, 20, around an upwardly projecting boss, 22, which has an axial aperture, 22a, opening at the lower end in the cavity, 21, and constituting the guide bearing for the stem, 40, of the pump member consisting of a flexible diaphragm, 72, clamped, as mentioned, between the two pump body members, A and B, said stem being reduced at the lower end portion, 41, for receiving the sliding sleeve, 35, as above described.

The flexible diaphragm, 72, is reenforced at the lower side by a cupped disk, 71, which thus affords seat for the upper end of a coil spring, 61, which at its lower end is seated at the bottom of the frusto-conical cavity, 20, and reacts upwardly on the diaphragm, 72, for giving to the latter, operating as a pumping member, its fuel feeding stroke.

At the upper side the diaphragm is reenforced by a disk, 72a, the diaphragm being clamped at a central area between the disks, 71 and 72a, by a nut, 73, screwed onto the upper reduced and threaded end portion of the stem, 40. The second pump body member, also hereinafter referred to as the upper member, has its lower face mated, as mentioned, with the upper face of the pump body member, A, and bounded by a

flange, *b*, co-operating with the flange, *a*, of the lower member for clamping the margin of the diaphragm when the two members, A and B, are secured together through said mated flanges, and has a recess, **50**, facing the recess, **20**, of the lower member, and extending of suitable depth upwardly in the member, B, to accommodate the upward flexure of the diaphragm member, **70**, in the feeding stroke of the latter, said recess being extended upwardly at the center to accommodate the movement of the nut, **73**.

The inflow passage leading finally to the pumping chamber, as hereinafter described, is shown entering horizontally in the body member, A, at **80**, where it is arranged for pipe connection, **82**, constituting the supply line, leading from the fuel source, not shown. Said inflow passage leading in horizontally as noticed, turns upwardly, as seen at **80a**, then through a tube **81** and emerges at the upper side of the body member, B, within a pre-pump fuel-receiving and sediment-trapping chamber which is formed by an inverted cup member, **100**, mounted on top of the member, B, the latter being formed with an annular seat for the lower open end of the cup member, with a packing gasket, **101**, rendering the junction fluid-tight when the cup member is clamped on the body member, B, by a clamping yoke, **102**, provided for that purpose and furnished with a clamping screw, **103**, the construction in these details being of familiar character easily understood from the drawing, and requiring no further specific description.

This fuel receiving chamber, **100**, constitutes part of the fuel inflow passage to the pumping chamber, as will be more fully hereinafter described. The pump body member, B, contains the fuel delivery passage, as shown at **52**, leading up laterally and obliquely from the marginal portion of chamber **50** and turning directly upward, as seen at **52a**, and leading thence upwardly through an upwardly protruding boss, A^2, said passage being counterbored from the upper end of the boss to form a valve chamber, **52b**, a bushing, **53**, forced into the upper end of the passage **52a**, affording a seat for the discharge valve, **54**. At a point in the counterbore a short distance above the seat of the valve, **54**, the discharge passage leads out horizontally through a boss, A^{20}, threaded for pipe connection **83**, constituting the delivery line, leading to the engine carbureter. Above this pipe connection of the delivery passage, the boss, A^2, is enlarged and counterbored and threaded to receive a bushing, **56**, which is screwed into the boss forming fluid-tight junction, as indicated, by packing gasket, **59**, and the cavity constituting the valve chamber and formed by the counterbore of the boss, A^2, thereabove and the bore of the bushing, is closed at the upper end by a hood, **58**, shown as a sheet metal stamping mounted fluid-tight on the upper end of the bushing, **56**. The cavity above the outleading portion, **58**, of the delivery passage constitutes a pressure trapping chamber, as may be understood from the description.

From the upper side of the pumping chamber and, as shown, from the upper side of the recess, **51**, which accommodates the nut, **73**, a passage, **84**, is formed leading to the upper end of the body member, B, said passage being counterbored and threaded at the upper end to receive a bushing, **85**, screwed into it, and having mounted in it a tube member, **87**, constituting a standpipe extending up centrally with respect to the cup, **100**, and opening at the upper end at the top of the cup cavity. Mounted upon the upper side of the bushing, **85**, there is provided a filter member or strainer, **88**, frusto-conical in form with its larger base and mouth at the upper end at which it is seated snugly against the inner surface of the cup member, **100**. Upon considering this construction, it will be seen that the fuel entering the passage, **80**, and passing up through the upturned branch, **80a** and tube **81**, will occupy the cavity of the inverted cup, **100**, around the upwardly open-mouthed filter member, **88**, and filtering through said filter member, will continue to fill the cavity of the cup, **100**, hereinabove and hereinafter referred to as the fuel-receiving chamber, to the level of the upper open end of the standpipe, **87**, and then passing down through that standpipe, will enter the pumping chamber and be subject to the impulse of the pumping member in its feeding stroke for discharge of the fuel through the delivery passage, **52**, and past the discharge valve, **54**.

The standpipe **87** is further provided with openings **87a** at its lower end immediately above the lower portion of the filter and below the level at which the inlet tube **81** delivers into the trapping chamber. The openings **87a** permit an initial flow of fuel even though the level may be below the upper open end of the standpipe **87** but as the pump operates the flow through the openings **87a** is not sufficient to satisfy the demand the suction at the upper end of the trapping chamber will draw fuel from the supply until the level rises sufficiently to feed fuel into the upper end of the standpipe **87**.

To make provision for the necessary fuel intake-controlling valve, the body member, B, is formed with a slender boss, a^3, centrally positioned in the passage, **84**, leading up from the pumping chamber, as described, and a spring, **90**, coiled around this boss and stopped at the lower end on the shoulder formed by the neck, a^4, which carries said boss rigid with the body member, B, reacts upwardly for holding an intake valve, **91**, which seats upwardly upon the lower end of the bushing, **85**. Desirably, and as shown, there is provided inserted in the upwardly turned portion, **80a**, of the inflow passage, an upwardly extending pipe member, **81**, having delivery orifices, **81a**, from which the inflowing liquid is discharged into the fuel receiving chamber at a sufficiently high point therein so that it is not liable to become clogged with sedimentary matter filtered from the liquid by the filter member **88**.

From the final portion **84** of the fuel inflow passage to the pump chamber, a horizontal duct **59** leads laterally to the upturned portion **52a** of the discharge passage **52**. The purpose of this cross communication between the inflow and discharge passages it will be recognized is to by-pass the pumping chamber, that is, to permit fluid movement from the inflow passage to the delivery passage without passing the fluid through the pumping chamber. This expedient operates to cause the vapor which is liable to be formed from the fuel under conditions when the apparatus is more or less warmed up by proximity to the engine, to separate from the liquid before the latter is drawn into the pumping chamber.

The bushing **56** threaded into the boss A^2 to form the outlet trapping chamber enclosed by hood **58**, serves to retain a perforated diaphragm **55** separating the trapping chamber from the outlet passage and serving as a scavenging means for vapors. The diaphragm **55** has a depending

stem **57** extending towards the outlet valve **54** to act as a stop to limit its opening movement. Around the stem **57** and between a shoulder of the stem and valve **54** is positioned a seating spring **60**. The inlet and outlet valves are both below the normal level in the receiving chamber and therefore fuel is always trapped above the outlet valve in the chamber beyond the scavenging diaphragm.

It is customary in connection with fuel pumping systems to utilize a pressure chamber associated with the delivery from the pump in order to maintain a more nearly constant pressure upon the fuel supplied but a common objection in the ordinary apparatus is the fact that the pressure chambers tend to fill up with fuel and, therefore, become inoperative. It is desirable that some means be employed for maintaining a body of air and vapor in the outlet pressure chamber above the level of the fuel. Furthermore, should the apparatus be left out of operation for some period of time, the pressure chamber is liable to fill up due to the absorption of the vapor into the fuel and it is desirable that the pressure chamber be quickly scavened and substantially emptied of the fuel as the apparatus is again brought into operation. According to the present disclosed construction, should the pump be idle for a long period of time, the level of the trapped fuel can never drop below the top of the intake tube **81** and, therefore, a body of fuel is maintained filling the pump chamber and the valve-controlled passage. Movement of the diaphragm will draw fuel from the intake trap chamber into the restricted openings **81***a* and, in addition, will tend to draw air from the upper part of the intake trap chamber. The mixture of fuel and vapor will be drawn towards the pump chamber but the vapor will be mainly caused to flow through the horizontal passage **59** towards the discharge side of the pump. The mixture of fuel and vapor flowing upwards through the discharge valve and towards the perforated separating plate **55** causes the vapors to be separated and directed into the outlet trapping chamber thus serving to build up a vapor pressure therein. As the pump continues to operate the level in the intake trapping chamber will gradually rise due to the building up of the vacuum at the upper portion of the chamber until the fuel flows through the upper part of the tube **87**.

It will be noted upon considering the construction as a whole that the arrangement of the member containing the pumping chamber, as shown, with respect to the member which is directly mounted on the engine, that is, directly above the latter, and the arrangement for mounting the fuel-receiving chamber and sediment-trapping chamber above the pumping chamber, has the advantage of minimizing the protrusion of the apparatus as a whole from the engine body upon which it is mounted; and that this arrangement leaves only so much of the structure as comprises the relatively small pressure trapping chamber and the correspondingly small support therefor, necessarily extending in a position overhanging the supporting member which is mounted directly on the engine casing. And it will be further observed that the circular form of the two body members, A and B, at the mated faces at which the latter is mounted upon the former for support, makes it possible and convenient to adjust the upper member B, relatively to the lower member A, about the axis of said circular form, so as to position the intake connection and the pressure trapping chamber as may be most convenient for connecting the inflow and outflow pipe lines.

I claim:

1. Fuel feeding apparatus comprising a body member, a recessed fuel pumping chamber in the bottom thereof, a pumping diaphragm sealing the pumping chamber, an inlet connection to said body member for delivering fuel to an intake passage delivering upwardly above the top portion of said body member, a centrally disposed passage communicating with the fuel pumping chamber, an intake valve controlling said central passage and a cup member adapted to be removably secured in sealing engagement with the upper portion of said body member to form an intake trapping chamber in communication with the intake passage and the centrally disposed passage to the fuel pumping chamber.

2. Fuel feeding apparatus comprising a pump casing member having a recessed bottom forming a fuel pumping chamber, inlet and discharge connections to said casing member, a central passage formed in said pump casing member, an intake valve controlling said central passage, a laterally disposed vertical passage formed in said casing member communicating with the delivery connection, an outlet valve controlling said laterally disposed passage, an obliquely disposed passage from said fuel pumping chamber to said lateral discharge passage, an horizontal passage between said central passage and said lateral passage for flow of the fuel without passing through the pumping chamber, a removable trapping chamber secured to the upper side of said casing member and enclosing the central passage and an intake communication from the inlet connection.

3. Fuel feeding apparatus comprising an inlet trapping chamber, a valve-controlled inlet passage from said inlet trapping chamber, a fuel pumping chamber into which the valve-controlled inlet passage delivers, an outlet trapping chamber, a valve-controlled discharge passage in communication with said outlet trapping chamber and separate passages communicating between the valve-controlled inlet and discharge passages and said fuel pumping chamber.

4. A pump for supplying fuel to an internal combustion engine arranged to be actuated from an engine driven part, comprising a pair of upper and lower separable casing parts, a pumping diaphragm clamped therebetween in substantially horizontal position, actuating means mounted in the lower casing part, a pumping chamber on the upper side of the diaphragm, inlet and outlet connections to said upper casing part, a removable cover member secured to the upper side of the upper casing part concentric with the pumping chamber and the diaphragm to form a fuel receiving and sediment trapping chamber, a passage from said inlet connection delivering into said fuel receiving chamber at a level above the bottom thereof, a centrally disposed communication between the top of said fuel receiving chamber and said pumping chamber and an outlet passage from said pumping chamber to said outlet connection.

5. A pump for supplying fuel to an internal combustion engine arranged to be actuated from an engine driven part, comprising a pair of upper and lower separable casing parts, a pumping diaphragm clamped therebetween disposed in

substantially horizontal position, actuating means mounted in the lower casing part, a pumping chamber on the upper side of the diaphragm, an inlet connection to said upper casing part, a removable cover member secured to the upper side of the upper casing part concentric with respect to the pumping chamber and the pumping diaphragm to form a fuel receiving and sediment trapping chamber, an inlet passage delivering fuel from the inlet connection into said fuel receiving and sediment trapping chamber at a level above the bottom thereof, a centrally disposed communication leading downwardly from the top of said fuel receiving and sediment trapping chamber into said pumping chamber, said upper casing part having an upward extension adjacent the removable cover member, an outlet connection to said casing extension and an obliquely disposed outlet passage leading upwardly from said pumping chamber towards said outlet connection.

6. A pump for supplying fuel to an internal combustion engine arranged to be actuated from an engine driven part, comprising a pair of upper and lower separable casing parts, a pumping diaphragm clamped therebetween in substantially horizontal position, actuating means mounted in the lower casing part, a pumping chamber on the upper side of the diaphragm, an inlet connection to said upper casing part, a removable cover member secured to the upper side of the upper casing part concentric with respect to the pumping chamber and the diaphragm to form a fuel receiving and sediment trapping chamber, an inlet passage delivering upwardly from said inlet connection into said fuel receiving and sediment trapping chamber at a level above the bottom thereof, a centrally disposed communication leading downwardly from the top the fuel receiving and sediment trapping chamber into said pumping chamber, an inlet check valve controlling said centrally disposed communication between said chambers, said upper casing part having an upward extension laterally disposed with respect to the removable cover member, an outlet connection to said casing extension, an outlet check valve mounted in said casing extension and an outlet passage leading upwardly and laterally from said pumping chamber towards said outlet check valve.

7. A fuel pump comprising a pumping chamber, a pumping element disposed at the lower side of said pumping chamber, an inlet passage to said pumping chamber, a primary fuel outlet passage from the lower part of said pumping chamber and a secondary vapor outlet passage leading from the top portion of said pumping chamber into communication with said primary outlet passage.

8. A fuel pump comprising a pumping chamber, a pumping element disposed at the lower side of said pumping chamber, an inlet passage to said pumping chamber, a primary fuel outlet passage from said pumping chamber leading laterally and upwardly therefrom and a secondary restricted outlet passage leading from the top portion of said pumping chamber into communication with said primary outlet passage for relieving the accumulation of vapors therein.

9. A fuel pump comprising a pumping chamber, a pumping element disposed at the lower side of said pumping chamber, a centrally disposed inlet passage to said pumping chamber from the upper side thereof, a primary fuel outlet passage from said pumping chamber leading laterally and upwardly therefrom and a secondary restricted vapor passage from said inlet passage to said outlet passage.

10. A fuel pump comprising a pumping chamber, a pumping element disposed at the lower side of said pumping chamber, an inlet passage to said pumping chamber, a check valve controlling the flow through said inlet passage, an outlet passage from said pumping chamber, a check valve controlling said outlet passage and a restricted vapor outlet passage from the top portion of said pumping chamber to said first mentioned outlet passage antecedent to the outlet check valve.

11. A pump for supplying fuel to an internal combustion engine arranged for deriving actuation from an engine-driven part, said pump comprising two body members, one of which is arranged for mounting on the engine casing and has mounted in it a pump actuating part, the other member containing the pumping chamber and intake and discharge passages, said body members being formed with recessed mated faces at which they are secured together, one above the other, a flexible pumping diaphragm clamped between said body members at areas of their said faces marginal with respect to the respective recesses, the recess of the upper of said body member constituting the pumping chamber, whereby the chamber is at the lower side of said member, a pre-pump fuel receiving and sediment trapping chamber above the pumping chamber, a discharge pressure chamber laterally offset with respect to said fuel receiving and sediment trapping chamber, a pumping chamber intake passage extending downwardly from the fuel receiving and sediment trapping chamber into said pumping chamber, a pump intake valve seating upwardly in the intake passage, a pumping chamber discharge passage leading upwardly and laterally therefrom with respect to said intake, a pump discharge valve located in said discharge passage below the pressure trapping chamber and at substantially as high a level as the intake valve, the upper body member having a vapor vent duct leading from the intake at a point between the pump intake valve and the pumping chamber to a connection with the discharge passage at a point below the pump discharge valve.

12. A pump for supplying fuel to an internal combustion engine arranged to be actuated from an engine-driven part, said pump comprising two casing members, one of which is arranged for mounting on the engine casing, a pump actuating part mounted in said last-mentioned casing member, the other casing member containing the pumping chamber and intake and discharge passages, said casing members being formed with recessed mated-faces at which they are secured together, one above the other, a flexible pumping diaphragm clamped between said casing members at areas of their said faces marginal with respect to the respective recesses, the recess of the upper of said casing members constituting the pumping chamber, a cap member secured to said upper casing member forming in cooperation therewith a pre-pump fuel receiving and sediment trapping chamber above the pumping chamber, an intake passage extending downwardly from the fuel receiving and sediment trapping chamber into the pumping chamber, an intake check valve seating upward-

r in the intake passage, a fuel inlet passage extending through said casing for delivery of fuel nto the fuel receiving and sediment trapping hamber at a level substantially above the bottom thereof, an intake passage extension member secured to said upper casing part and extending substantially to the top of the fuel receiving and sediment trapping chamber for receiving fuel therefrom and a filter screen in said uel receiving and sediment trapping chamber or filtering the fuel passing through said chamber from said inlet passage to said intake passage extension member.

13. In a fuel pump, a casing member recessed on its underside to form a pump chamber, a reciprocable diaphragm clamped at its upper side to said casing member, said casing member having an intake passage to said pumping chamber substantially concentric therewith, an intake check valve in said passageway, a spring below said check valve seating on said casing member and reacting upwardly upon said check valve, an intake passageway extension member secured to said casing member forming at its lower end a seat for said check valve and open at its upper end to receive fuel, a cap member removably clamped to the upper side of said casing member forming in cooperation with the upper side of said casing member a fuel receiving and sediment trapping chamber, said casing member having an inlet passage for conducting fuel through said casing and into said fuel receiving chamber at a point above the bottom thereof, a filter screen in said fuel receiving chamber surrounding said intake passageway and seated around its marginal outer edge against said cap member to filter the fuel flowing from said inlet passage towards said intake passage, the open upper end of said intake passage extension member being above said filter screen and above the point at which fuel is discharged from said inlet passage into said fuel receiving chamber.

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