

March 1, 1960

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COMBINED FUEL PUMP AND CARBURETOR

Filed June 30, 1958

2 Sheets-Sheet 1

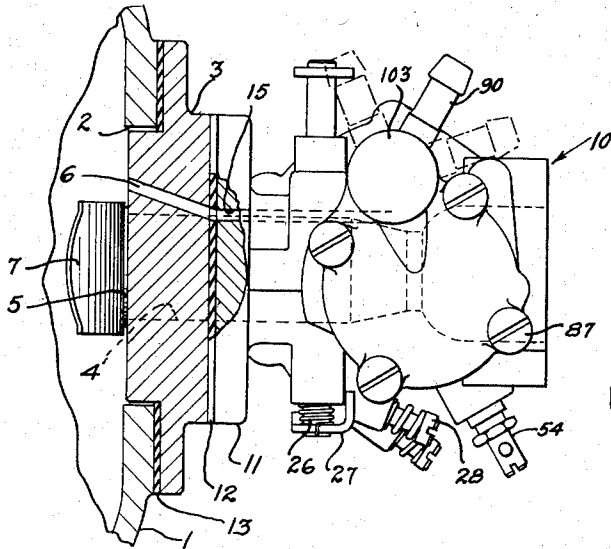


FIG. 1.

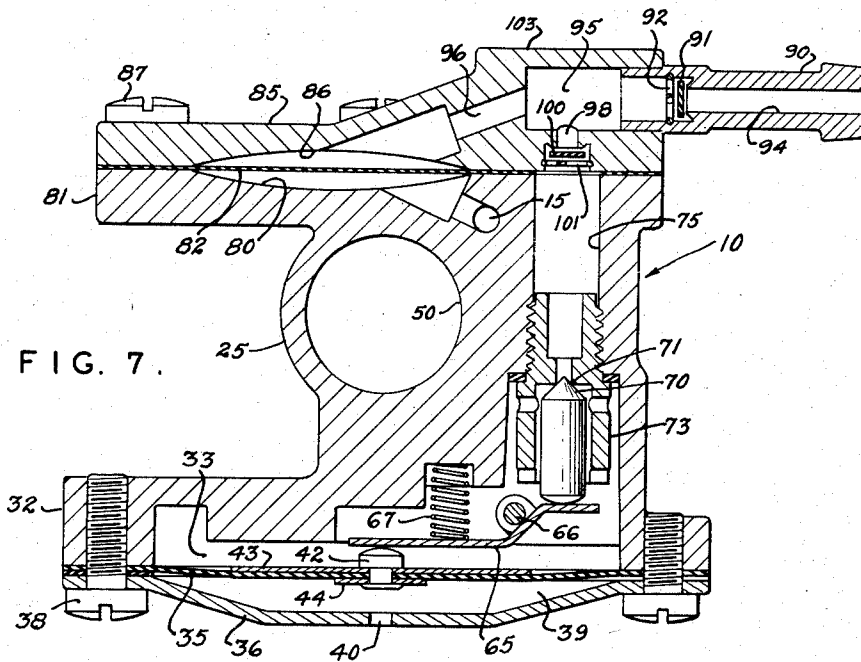


FIG. 7.

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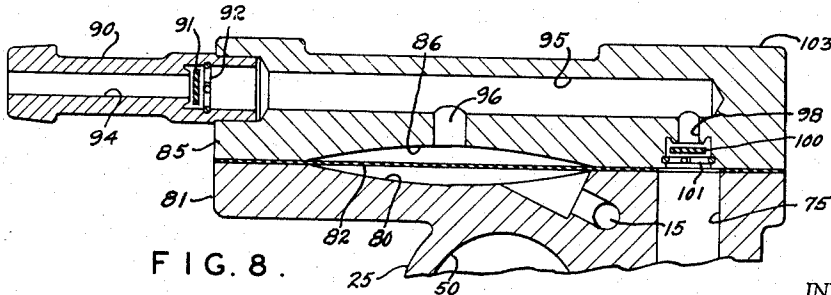
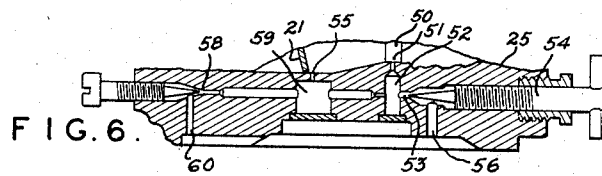
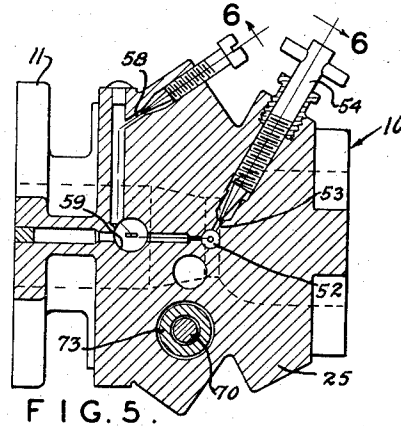
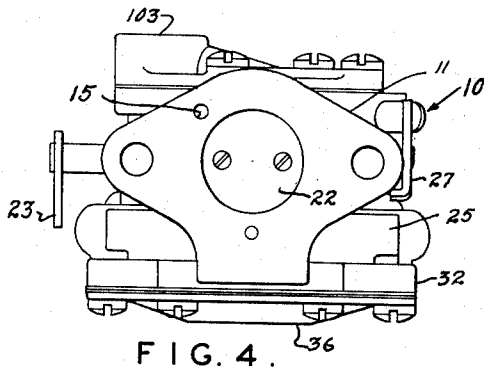
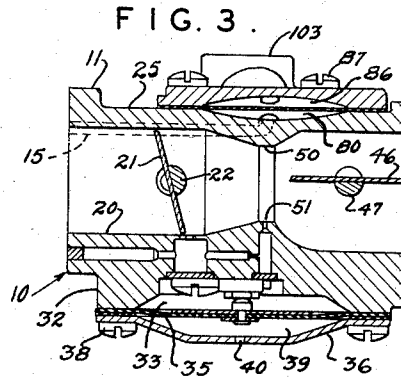
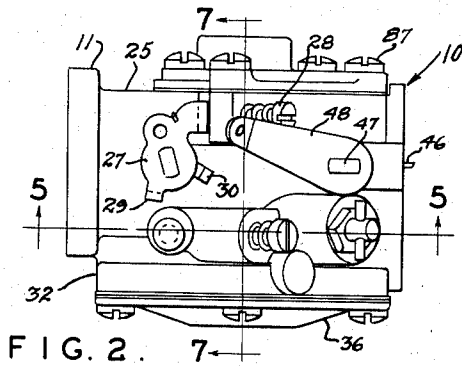
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COMBINED FUEL PUMP AND CARBURETOR

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Application June 30, 1958, Serial No. 745,346

6 Claims. (Cl. 261—37)

This invention relates to carburetors for gasoline engines used to power portable tools and mobile devices, and more specifically to a combination of a carburetor and an engine operated fuel supply pump for the carburetor, which combination has the advantage of operating satisfactorily for any position of the engine and carburetor with respect to the fuel tank containing the fuel supply for the engine.

The invention is particularly useful on engines of portable saws, trimmers, lawn mowers, and other power tools, as well as marine outboard engines. In fact, the invention is useful on gasoline engines which are portable and adapted to be transported from one place to another and often operated at any angle from any position.

A carburetor equipped with a conventional float operated fuel supply valve in the fuel bowl will not operate an engine satisfactorily for any extended period when the engine is at any extreme tilted, or in an inverted, position, and, of course, if the fuel in the tank carried on the tool is, because of the operating angle, below the carburetor fuel bowl level, the time of operation of the engine is limited to the capacity of the fuel bowl. In gasoline engine powered portable equipment which is fed from fuel tanks normally below the carburetor, it is necessary to pressurize the tank in order to raise the fuel up to the bowl inlet of the carburetor. In both of these cases it would be much more convenient to merely drop a hose from the carburetor into a stationary fuel tank, and have the carburetor so modified that fuel is automatically pumped from the tank during engine operation regardless of the relative position of the tank with respect to the engine, whether the engine and carburetor are above or below the fuel tank.

According to this invention, an engine driven pump is combined with the carburetor so that engine operation is possible from tanks located below or above the fuel level in the fuel bowl, or below or above the carburetor itself. The pump is a diaphragm type operated from pulsation in gas pressure in the engine through connections placed in the carburetor body to one side of the diaphragm. The opposite side of the diaphragm is enclosed by a pump casing having a single passage connecting to a carburetor fuel supply passage at a point between an inlet check valve and an outlet check valve. The fuel tank connection is to the opposite side of the inlet check valve, and opposite pulsations acting on the diaphragm cause the fuel to flow from the tank past the inlet check to the pressure regulator valve in the carburetor, which may be a float operated needle valve or a diaphragm operated regulator needle valve, as the case may be, and into a fuel bowl or fuel chamber, respectively, of the carburetor.

In the construction above described, the fuel supply to the carburetor is conveyed through passages in the pump casing which, in turn, is insulated from direct engine heating by conduction through the carburetor body by the gas in the pulsator chamber on one side of the pump, and by the diaphragm of the pump which forms the pulsator

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chamber of the pump, as well as the sealing gasket between the carburetor body and the pump casing.

In this construction, no inlet and outlet valves are needed in the entrance and exit from the pump chamber because the pump contains no part of the fuel supply passages to the carburetor. The pump chamber has a single passage connecting with the fuel supply passage, and its action resembles an hydraulic ram type of pump, rather than a variable displacement type of pump. This difference is one of kind, rather than degree, since ram pump delivery rate is not adversely affected by increasing frequency of pulsations due to increase in engine speed. Fuel pumping capacity matches increased fuel demand at increased engine speed.

It is one of the objects of the invention to provide a single unit including a charge forming device and a pump which may be fixedly attached to the engine by the usual flange screws connecting the carburetor and the manifold, and needs no other connecting tubes or devices in order to function.

It is another object of the invention to provide a diaphragm type of fuel feed pump which operates on a different principle, and is thereby more efficient.

It is another object of the invention to provide a pump of the diaphragm type which is not subject to direct heating by conduction, which seriously affects the efficiency of the pump.

It is another object of the invention to provide a pump operated by pressure pulsations of the engine with a rate of delivery sufficient to supply all of the fuel necessary, regardless of pulsation frequencies.

It is another object of the invention to provide a combined pump and carburetor unit wherein the components are readily and independently separable for replacement purposes.

It is another object of the invention to provide a combined pump and carburetor unit which may be inexpensively produced on a production basis.

It is also an object of this invention to achieve flexibility in design for the combined unit, so that by small, inexpensive changes, it can be readily adapted to different engine fuel tank combinations.

Further objects and advantages will appear from an examination of the following detailed description of the device taken with the accompanying drawings illustrating preferred forms, in which:

Fig. 1 is a top view showing the carburetor on an engine manifold of a two-cycle engine. The manifold is partly in section.

Fig. 2 is a side elevation of the carburetor.

Fig. 3 is a vertical section through the carburetor.

Fig. 4 is an end view of the carburetor showing the face of the carburetor flange.

Fig. 5 is a view in section on the line 5—5 of Fig. 2.

Fig. 6 is a schematic illustration showing the interconnection of the fuel passages shown in Fig. 5. This imaginary sectional view is taken on the line 6—6 of Fig. 5 with the idle screw and main nozzle adjustment screw rotated into a single plane.

Fig. 7 is a transverse section in enlarged scale taken on the line 7—7 of Fig. 2.

Fig. 8 is an enlarged view in transverse section similar to Fig. 7, showing a modification of the invention.

For a more complete understanding of the invention, reference is made hereinafter to the several views of the drawings which illustrate the invention as it is now contemplated, but the form shown may be regarded as only exemplary.

Fig. 1 illustrates a portion of an intake manifold for a two-cycle engine. Where the carburetor is applied to multi-cylinder engines, the manifold construction will differ. A portion of the crank case 1 is apertured at 2

to receive the manifold 3 which contains only a single passage 4 and, in this case, a single reed valve 5 controlling the outlets on the passage. Valve 5 is flexible and responsive to air flow so as to alternately open and close passage 4 in response to pulsations within the crank case of the engine 1, and is limited by the guard 7.

The carburetor 10 has a flange 11 mounted on the intake manifold 3 by suitable studs projecting through the flange 11 into the manifold (not shown). A sealing gasket 12 is interposed between the carburetor flange and the manifold, and a second gasket 13 seals the connection between the intake manifold 3 and the crankcase 1.

Passage 6 in the manifold 3 is a by-pass around the reed valve 5, and registers at one end with an opening in the gasket 12 connecting with a passage 15 extending into the carburetor body 10. The purpose of this passage will be later described in detail.

Turning now to Figs. 2 and 3, the mixture conduit 20 of the carburetor forms an extension of the manifold inlet passage 4, and the outlet of the fuel mixture passage 20 is, in turn, controlled by a throttle valve 21 mounted on a shaft 22 journaled on its ends in the body 25 of the carburetor 10. Shaft 22 is actuated manually by a throttle control lever 23 (see Fig. 4) secured to one end thereof. The throttle valve 21 is normally urged to closed position by means of a torsion spring, shown in Fig. 1 at 26, which has one end in engagement with the carburetor body 25 and the opposite end engaged with a throttle stop lever 27 which, in turn, abuts the end of an idle screw 28 shown in Fig. 2. Full opening of the throttle is limited by inter-engagement between lug 29 on the lever 27 and lug 30 on the carburetor body 25.

The carburetor body 25 has a flange 32 surrounding a fuel chamber 33. One side of the fuel chamber 33 is formed by a flexible pressure sensing diaphragm 35 secured to the chamber 33 on the flange 32 by means of a circular cover plate 36 and cap screws 38 extending through the cover 36 and threaded into engagement with the flange 32. The cover plate 36 is formed cup-shaped to define with the diaphragm 35 an atmospheric chamber 39 which is vented to atmosphere by the aperture 40.

Diaphragm 35 carries a button-headed rivet 42 which, in turn, secures a pair of washers 43 and 44 to opposite sides of the diaphragm 35, all as shown in Fig. 7.

The entrance of the mixture conduit 20 is controlled by a choke valve 46 mounted on a pivoted shaft 47 journaled in the walls of the body of the carburetor 25, all as shown in Fig. 3. One end of the choke shaft 47 carries a choke lever 48 apertured to receive a control means at one end.

Within the mixture conduit 20 is a venturi 50 into which opens a main fuel nozzle 51. This, in turn, is connected by a passage 52 with a jet or restriction 53 controlled by an adjustable main nozzle metering needle 54 screw-threaded in the body 25 of the carburetor, all as shown in Fig. 6. Fuel is supplied from the fuel chamber 33 to the main metering restriction 53 through a restricted cross-passage 56.

Adjacent one edge of the throttle 21 is an idle fuel nozzle 55 supplied with fuel from either the main metering jet 53 through a passage 56 or by fuel through an idle metering restriction 58 connecting with the chamber 59 at the idle port 55 and with the fuel chamber 33 through the passage 60.

The admission of fuel to these passages and to the fuel chamber 33 is under control of a pressure regulator mechanism including diaphragm 35. This pressure regulator mechanism includes a fuel inlet control lever 65, shown in Fig. 7, pivoted at 66 and backed by a spring 67. One end of the fuel inlet control lever 65 is engaged by the button 42 on diaphragm 35 and held against this button by the compression spring 67. The opposite end of the lever 65 beyond the pivot 66 engages a needle valve 70 operated to and from a seat 71 in a suitable needle valve cage generally indicated as 73. The needle

valve cage 73, in turn, is screw-threaded within a fuel supply passage 75 extending from the chamber 33 to the upper surface of the carburetor body 25, and fuel is supplied continuously to the passage 75 by a fuel supply system including a pump operating from pulsations in the crankcase of the engine, all as hereinafter described. So far, the structure described is similar to that shown by an application of Maidwyn E. Jones, Serial No. 694,539 filed November 5, 1957, for "Internal Combustion Engine and Fuel System Therefor."

Carburetor fuel supply system

The upper side of the carburetor body 25 is formed with a shallow circular cavity 80. Surrounding the cavity is a circular flange 81.

One side of the cavity 80 is formed by a flexible diaphragm 82 which extends across the cavity and outwardly to the periphery of the flange 81. The diaphragm 82 is suitably apertured to register with the passage 75, and is secured in place by the pump casing 85 containing the pumping chamber 86. Around the periphery of the pump casing 85 are a series of screws 87 which secure the pump casing to the carburetor body 25.

The force for operating the pump diaphragm 82 to produce the pumping action is applied by changes in pressure within the pulsating chamber 80 communicated to the underside of the diaphragm 82. These pulsations are communicated to the pulsating chamber 80 through passage 15 located within the carburetor body 25 and, as shown in Fig. 1, connected internally of the crankcase 1 by the passage 6 in the intake manifold 3.

As shown in Fig. 7, the pump casing 85 mounts an inlet fitting 90 for connection with a hose (not shown) connecting the fitting with the fuel tank containing the supply of fuel for the engine. Within the fitting is an inlet check 91 loosely retained in place by a spring wire clip 92 seated in an internal groove in the fitting 90. The fitting 90 has an internal passage 94 controlled by the check 91 which in turn communicates with an internal passage 95 within the pump casing 85 branched at 96 to connect with the pumping chamber 86 and with the branch 98 connecting with the passage 75 in the carburetor body. Passage 98 is controlled by an outlet check 100 loosely retained in place by spring wire clip 101.

In the modification shown in Fig. 7, it will be noted that the passage 95, in turn, is formed within a circular boss 103, as indicated in Fig. 1, and that the fitting 90 may be placed in the boss at any angle to extend in any direction required by engine structure so as to be convenient for connection with the fuel supply, regardless of its particular location.

First modification

In case the fuel supply is located on the opposite side of the carburetor from the fitting 90, as shown in Fig. 1, it may be more convenient to form an extension on the boss 103, as shown in Fig. 8. The same reference characters are used to indicate like parts in this modification.

Boss 103 has an extension in the form of a rib, preferably, cast into the fuel pump casing 85 and extending across to its opposite side. This boss contains an extended passage 95 which, in turn, connects with the internal passage 94 in fitting 90. Passage 95 is, in turn, provided with a pair of branches 96 and 98 which in turn connect with the pumping chamber 86 and the fuel passage 75, respectively, formed in the pump casing 85 and in the carburetor body 25.

In all other respects, the modification shown in Fig. 8 is identical with that in Fig. 7.

Operation of modification in Fig. 7 and Fig. 8

During operation of the engine, reciprocation of the engine piston causes alternate pressures and suction within the crankcase 1 which, in turn, are communicated by

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the passages 6 and 15 to the chamber 80, causing the diaphragm to vibrate in timed relation with the pulsation. It should be understood that sufficient slack is provided in the diaphragm 80 for this purpose. This movement of the diaphragm creates a ram pumping action in the chamber 86 of the fuel pump casing, which in turn acts upon the inlet and outlet check valves, respectively, opening and closing the same so that fuel is brought in through the passage 94, 95 to fill the passage 75 within the carburetor body 25.

When the engine is operating, the depression occurring at the edge of the throttle 21 at idle port 55, or at the main nozzle 51 at the throat of the venturi 50, is communicated to the fuel chamber 33 and acts upon the diaphragm 43 to affect the position of the lever 65 to compress spring 67. Thus, the action of suction in the mixture conduit 20 adjusts the degree of opening of the needle 70 on the seat 71, and, in turn, the rate of fuel flow past the needle 70 into the chamber 33 to supply the fuel nozzles with the proper amount of fuel.

The carburetor shown is capable of proper functioning regardless of the angle at which the engine happens to be placed. In other words, if the power tool is inverted, the carburetor will continue to function, as will the pump. However, it is contemplated that the same pump could be applied to a similar carburetor having a float bowl and float controlled needle in place of the needle 70 in the modification shown.

In both modifications, the fuel pump casing and its passages are insulated from heat transmitted by conduction from the carburetor body 25, first by the arrangement of the diaphragm 82 between the fuel pump casing and the carburetor body, and, secondly, by the gases within the pulsating chamber 80, which, of course, are poor conductors of heat.

It is also a feature of this carburetor that the passage for hot gases indicated as 15 passes close to the mixture conduit 20, where there is considerable cooling effect due to the vaporization of the gasoline. The location of the passage 15 is such that it passes in close proximity only to the main inlet passage 75, and at no other point is it located adjacent the fuel in the carburetor.

It is also a feature of this invention that the fuel is not circulated through the pumping chamber 86. While this chamber may be full of fuel during the action of the pump, it does not form a part of a passage between the fuel inlet to the pump and the fuel inlet to the carburetor.

A structure has been described which will fulfill all of the objects of the invention above discussed, but it is contemplated that modifications will occur to those skilled in the art which come within the scope of the appended claims and are regarded as part of this invention.

I claim:

1. In a carburetor, the combination of a carburetor body, a flange on said body with means to secure the face of said flange to the engine, a mixture conduit in said body and extending through said flange, means for controlling the flow of air and fuel through said mixture conduit, fuel nozzles opening into said mixture conduit, a fuel chamber in said carburetor body connected with said fuel nozzles, an inlet to said chamber, means for regulating the head of fuel in said fuel chamber including a valve in said fuel inlet and a fuel pumping means for supplying fuel to said inlet, said fuel pumping means comprising, a fuel pump casing detachably secured to said carburetor body, a pump chamber in said casing, a peripheral flange on said casing surrounding said pump chamber, a fuel passage in said pump casing having a fuel inlet and a fuel outlet connecting with said inlet to said fuel chamber, inlet and outlet check valve means controlling the flow through said fuel passage in said pump casing, a pumping passage in said casing interconnecting

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said pump chamber and said fuel passage between said inlet and outlet check valve means, a flexible diaphragm forming one side of said pump chamber and disposed between said pump casing and the outside of said carburetor body, and means for actuating said diaphragm in said pump chamber including a separate passage through said carburetor from an opening in the face of said flange adjacent said mixture conduit to an opening located between the outside of said carburetor body and said diaphragm whereby during engine operation changes in pressure in said passage operate said diaphragm to produce a fuel flow through said valve means to said fuel chamber when said needle valve opens.

2. In a carburetor, the combination of a carburetor body, a flange on said body including a face on said flange adapted to be secured against said engine, a mixture conduit in said body and extending through said flange, means for controlling the flow of air and fuel through said mixture conduit, fuel nozzles opening into said mixture conduit, a fuel chamber in said carburetor body connected with said fuel nozzles, an inlet to said fuel chamber, means for regulating the head of fuel in said fuel chamber including a valve in said inlet and a fuel pump means for supplying fuel to said inlet, said fuel pump means comprising a pump casing detachably secured to the outside of said carburetor body, a pump chamber in said casing, a peripheral flange on the casing surrounding said pump chamber, a fuel passage in said pump casing having a fuel inlet and a fuel outlet connecting with said inlet to said fuel chamber, check valve means controlling the flow through said fuel passage in said pump casing, a pumping passage in said casing interconnecting said pump chamber and said fuel passage, a flexible diaphragm forming one side of said pump chamber and disposed between said pump casing and the outside of said carburetor body, and means for actuating said diaphragm including a pulsator chamber in the outside of said carburetor body opposite said pump chamber in said pump casing, said diaphragm forming a common wall between said chambers, a separate passage extending through said carburetor adjacent said mixture conduit from an opening in the face of said flange to an opening located in said pulsator chamber between said carburetor body and said diaphragm whereby, during engine operation, changes in pressure in said separate passage operate said diaphragm to produce a fuel flow through said valve means to said fuel chamber when said needle valve opens.

3. In a carburetor, the combination of a carburetor body, a flange on said body adapted to be secured with its face in contact with the face on an engine intake manifold, a mixture conduit in said body and extending through said flange, means for controlling the flow of air and fuel through said mixture conduit, fuel nozzles opening into said mixture conduit, a fuel chamber in said carburetor body connected with said fuel nozzles, an inlet to said chamber, means for regulating the head of fuel in said fuel chamber including a valve in said inlet and a fuel pump means supplying fuel to said inlet, said fuel pump means comprising, a pump casing having a flange adapted to be detachably secured to said carburetor body, a pump chamber in said pump casing, said flange on said casing surrounding said pump chamber, a fuel passage in said pump casing having a fuel inlet and a fuel outlet connecting with said inlet to said fuel chamber, inlet and outlet check valve means controlling the flow through said fuel passage in said pump casing, a pumping passage in said casing interconnecting said pump chamber and said fuel passages between said inlet and outlet check valve means, a pulsator chamber in the outside of said carburetor body opposite said pumping chamber in said pump casing, a diaphragm forming a common wall between said pulsator chamber and said pumping chamber and coextensive with the flange on said pump casing to form an insulating and sealing gasket between said carburetor body and said pump casing, and means

for actuating said diaphragm including a separate passage extending through said carburetor adjacent said mixture conduit from an opening in the face of said carburetor flange to an opening located between the outside of said carburetor body and said diaphragm whereby, during engine operation changes in pressure in said passage operate said diaphragm to produce a fuel flow through said valve means to said fuel chamber of said carburetor when said needle valve opens.

4. In a carburetor, the combination of a carburetor body, a flange having a face adapted to be secured to the face of the engine intake manifold, a mixture conduit in said body and extending through said flange, means for controlling the flow of air and fuel through said mixture conduit, fuel nozzles opening into said mixture conduit, a fuel chamber in said carburetor body connected with said fuel nozzle, an inlet to said fuel chamber, means for regulating the head of fuel in said fuel chamber including a valve in said inlet and a fuel pump means supplying fuel to said inlet, said fuel pump means comprising, a pump casing detachably secured to said carburetor body, an integrally formed cylindrical boss extending outwardly from said pump casing, a pump chamber in said casing, a peripheral flange on said casing surrounding said pump chamber, a fuel passage in said pump casing extending through said flange and through said boss to an inlet, and an outlet from said fuel passage connecting with said inlet to said chamber, an inlet fitting in said boss communicating with said passage and selectively located to project radially from said boss at a convenient angle with respect to the mixture conduit of the carburetor, inlet and outlet check valve means controlling the flow through said fuel passage in said pump casing, a pumping passage in said pump casing interconnecting said pump chamber and said fuel passage between said inlet and outlet check valve means, a flexible diaphragm forming one side of said pump chamber and disposed between said pump casing and the outside of said carburetor body, and means for actuating said diaphragm including a separate passage extending through said carburetor adjacent said mixture conduit from an opening in the face of said carburetor flange to an opening located between the outside of said carburetor body and said diaphragm opposite said pumping chamber in said pump casing whereby, during engine operation, changes in pressure in said separate passage operate said diaphragm to produce a fuel flow through said valve means to said fuel chamber when said needle valve opens.

5. In a carburetor, the combination of a carburetor body, a flange on said body having a face adapted to be secured to the face of the engine intake manifold, a mixture conduit in said body and extending through said flange, means for controlling the flow of air and fuel through said mixture conduit, fuel nozzles opening into said mixture conduit, a fuel chamber in said carburetor body connected with said fuel nozzles, an inlet to said chamber, means for regulating the head of fuel

in said fuel chamber including a valve in said inlet, and a fuel pump means supplying fuel to said inlet, said fuel pump means comprising, a pump casing detachably secured to said carburetor body, a pump chamber in said pump casing, a peripheral flange on said pump casing surrounding said pump chamber, a fuel passage extending across the top of said pump casing having an inlet at one side of said pump casing and an outlet at the other side of said pump casing connecting with said inlet to said chamber, inlet and outlet check valve means controlling the flow through said fuel passage in said pump casing, a pumping passage in said casing interconnecting said pump chamber and said fuel passage between said inlet and outlet check valve means, a flexible diaphragm forming one side of said pump chamber and disposed between said pump casing and the outside of said carburetor body, and means for actuating said diaphragm including a separate passage extending through said carburetor body adjacent said mixture conduit from an opening in the face of said carburetor flange to an opening located between the outside of said carburetor body and said diaphragm whereby, during operation, changes in pressure in said passage operate said diaphragm to produce a fluid flow through said valve means to said fuel chamber when said needle valve opens.

6. In a carburetor, the combination of a carburetor body, a mixture conduit extending through said carburetor body from an open end forming an inlet to an open end forming an outlet, a flange on said carburetor body surrounding the outlet from said mixture conduit, a throttle mounted in said mixture conduit, a main nozzle opening in said mixture conduit, an idle fuel nozzle opening in said mixture conduit, fuel metering systems connected to said nozzles, and means for supplying fuel to said fuel metering systems and to said nozzles, said means for supplying fuel to said fuel metering systems comprising, a pressure regulator on one side of said carburetor body, and a fuel pump on the opposite side of said carburetor body, said pressure regulator and said fuel pump being symmetrically arranged with respect to the axis of said mixture conduit and with respect to each other, a pump casing enclosing said pump, having a fuel inlet connection, a fuel passage connecting with said inlet connection and extending directly to said pressure regulator adjacent to and at right angles to said mixture conduit, valve means in said fuel passage, and a pump passage extending from said fuel pump and connected to said fuel passage between said valve means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,796,838	Phillips	June 25, 1957
2,801,621	Anderson et al.	Aug. 6, 1957
2,823,905	Brown	Feb. 18, 1958
2,841,372	Phillips	July 1, 1958