March 22, 1960 G. W. HARRY 2,929,333

FUEL PUMP WITH PULSATOR

Filed Oct. 18, 1954 2 Sheets-Sheet 1

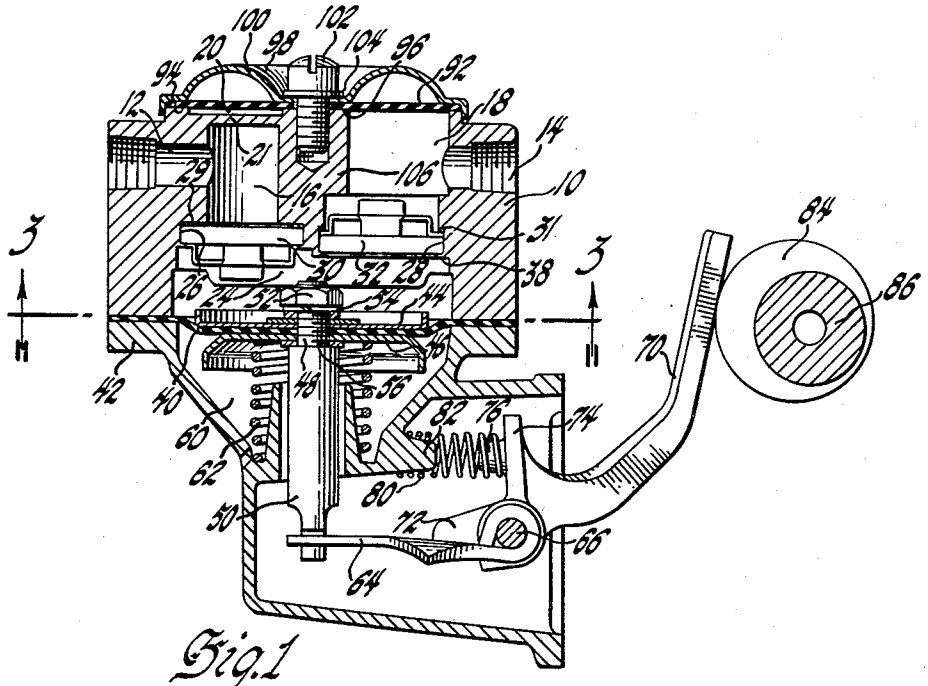


Fig. 1

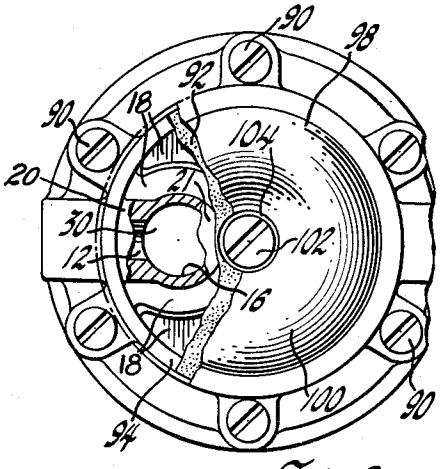


Fig. 2

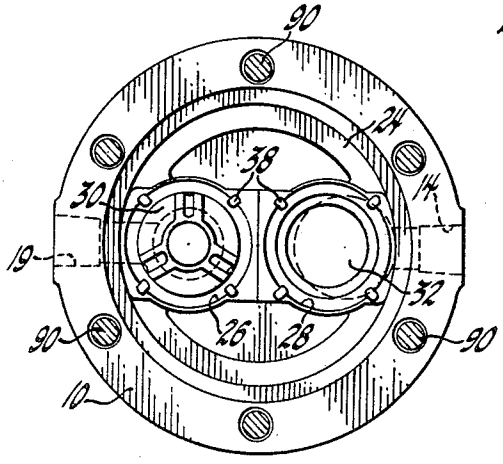


Fig. 3

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FUEL PUMP WITH PULSATOR

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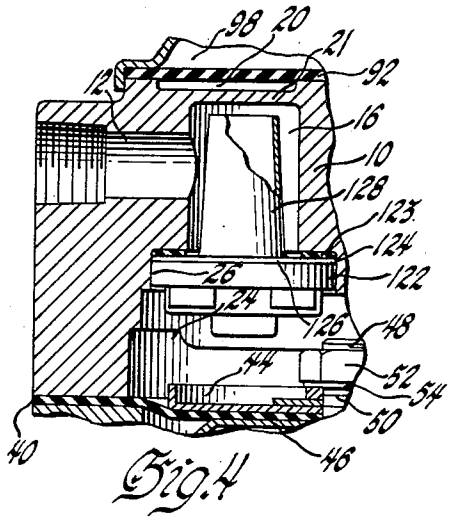


Fig. 4

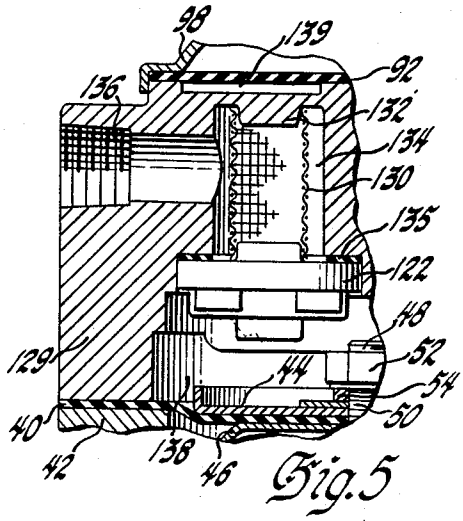


Fig. 5

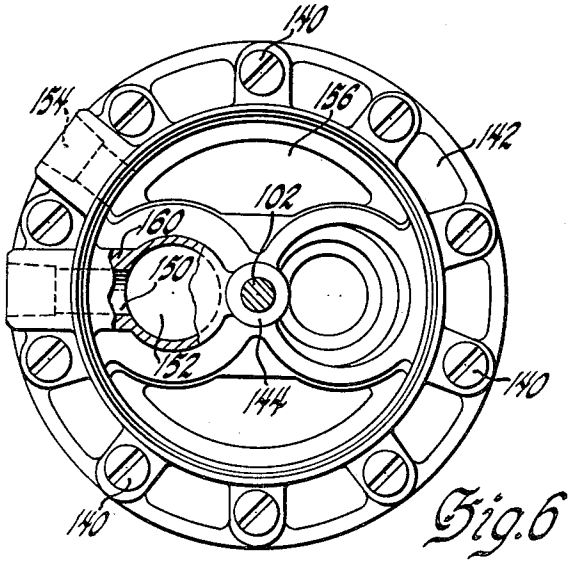


Fig. 6

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FUEL PUMP WITH PULSATOR

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4 Claims. (Cl. 103—150)

This invention relates to pumps and more particularly to fuel pumps for internal combustion engines.

An object of the invention is to provide a simplified fuel pump employing a pulsator to stabilize the pump discharge.

Another object of the invention is to provide a fluid pump having a pulsator and which is of compact construction.

A feature of the invention resides in a main pump body having three chambers arranged in series with a pulsator diaphragm forming the wall of one of said chambers and a recessed cover holding the diaphragm in place.

Another feature is a main fuel pump body having an annular chamber forming a portion of a passage through which fluid is caused to flow and a pulsator diaphragm associated with or partially defining said annular chamber and held in place by means of a cover attached to the main body by means of a centrally located fastening.

Another feature of the invention is an improved pulsator pump having three chambers arranged in series and one of these chambers being the smallest and having a shield therein for creating an air chamber to supplement the stabilizing effect of the pulsator on the fluid flow.

Another feature is an improved pulsator pump having a small inlet chamber in which a filtering device is provided for removing impurities from the fluid.

These and other important features of the invention will now be described in detail in the specification and then pointed out more particularly in the appended claims.

In the drawings:

Fig. 1 is a sectional elevational view of a pump embodying features of the present invention;

Fig. 2 is a plan view of the pump shown in Fig. 1 with portions broken away to show the details of construction;

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 1 and looking in the direction of the arrows;

Fig. 4 is an enlarged view of a portion of the structure shown in Fig. 1 with an additional detail;

Fig. 5 is similar to that of Fig. 4 showing an alternative detail; and

Fig. 6 is a plan view similar to that of Fig. 2 but showing a different embodiment and with the cover removed.

The pump illustrated in Fig. 1 of the drawings comprises a main body 10 having a threaded inlet 12 and a threaded outlet 14 communicating with inlet and outlet chambers 16 and 18, respectively. It will be noted that the outlet chamber 18 is annular in form as it extends above and by the chamber 16 which is the smallest chamber of the pump. The chamber 18, however, is substantially U-shaped except for a reduced or restricted portion 20 which is separated from the chamber 16 by a thin wall or partition 21.

Beneath chambers 16 and 18 and formed in the body 10 is a third chamber 24. Chamber 24 is a pumping chamber which communicates with the chambers 16 and 18 by means of ports 26 and 28, respectively. These

ports are controlled by conventional one-way valves 30 and 32 which are fixed in position in the ports and held there by upsetting the metal at spaced points 38 in the body 10 as seen in Fig. 3. Sealing washers 29 and 31 are employed against which the valves are seated.

The pumping chamber 24 is partially defined by a pumping diaphragm 40, the margin of which is clamped between a lower body portion 42 and the main body 10 of the pump. The central portion of the diaphragm 40 is clamped between two discs 44 and 46 which are held together by means of the threaded portion 48 of a vertical shaft 50. A nut 52 and suitable washers 54 act to hold the two discs 44 and 46 in clamping relation and with respect to a shoulder 56 on the shaft 50. A chamber 60 is formed in the lower body 42 to accommodate the disc 46 and a helical spring 62. The latter is relied upon to move the diaphragm 40 upwardly or during its pumping stroke. Loosely connected to the lower end of the shaft 50 is one end of a lever 64. This lever is pivoted to a shaft 66 mounted in the sides of the body 42. A second lever 70 is pivoted on the shaft 66 and has an arm 72 adapted to bear on the upper surface of the lever 64 and a second arm 74 having a protuberance 76 directed toward the shaft 50. A spring 80 is centered on the protuberance 76 and also on a protuberance 82 formed on the body 42. The spring 80 serves resiliently to press the free end of the lever 70 against a cam 84 which is adapted to be rotated by a cam shaft 86 which is part of the internal combustion engine to be served by the pump. As the cam 84 rotates, the springs 62 and 80 cooperate therewith so that the diaphragm 40 is flexed upwardly and then downwardly to cause the pumping action or pressure pulsation of each operative pump cycle in the fluid being pumped. The details of the pump mechanism within the lower body portion 42 need not be further described herein as they are conventional.

The main body 10 is held to the outer flange of the lower body portion 42 by means of bolts 90 which pass down through the main body 10 and are threaded into the lower body portion 42.

Enclosing the annular substantially U-shaped chamber 18 is a pulsator diaphragm 92 which is placed on the top concentric surfaces of the main body 10. These surfaces comprise an annular surface 94 and a central surface 96. A cap 98 is located over the diaphragm 92 and is formed with an annular recess 100 which corresponds in contour with the annular contour of the chamber 18. A screw 102, with the aid of a washer 104, serves to hold the cap and diaphragm in assembled relation with the main body 10, the screw passing through central portions of the cap and the diaphragm and being threaded into the central portion 106 of the body.

In Fig. 4 the structure is the same as that shown in Fig. 1, but in this case the chamber 16 is provided with a device for trapping a small quantity of air. The outlet port 26 is fitted with a one-way valve 122 and a sealing washer 123. A shoulder 124 is so formed on the body 10 as to constitute an annular seat for the washer 123. Interposed between the sealing washer and the valve 122 is an annular flange 126 of an upwardly directed and tubular shield 128. It will be noted that this shield is of such size that there is an annular space around it and that clearance is provided between the wall 21 and the open end of the shield.

Fig. 5 shows essentially the same structure as is shown in Fig. 4, but in this case the main body 129 is slightly altered, the tubular shield 128 is omitted and a tubular filter or screen member 130 is substituted. In order to insure proper anchoring of the tubular filter 130, a cylindrical protuberance 132 is integrally formed on the upper wall of the inlet chamber 134. A sealing washer

135 is interposed between the valve 122 and the body 129. The arrangement in this case is such that fluid entering at the threaded connection 136 will surround and penetrate the tubular filter 130 on its way to discharge through the valve 122 to the pumping chamber 138. A reduced portion 139 of the outlet chamber separates the diaphragm 92 from the upper wall of the inlet chamber.

In the modification shown in Fig. 6 a larger pump is depicted which utilizes a greater number of bolts 140 for holding a pump main body 142 to a lower body, not shown, but similar to that illustrated in Fig. 1. As in Fig. 1, a screw 102 is used to hold a recessed cap (not shown) down and in contact with a pulsator diaphragm covering an annular chamber 156 which is generally of U-shaped construction and extends substantially around the central portion 144 of the body 10. The main difference between this device as shown in Fig. 6 and that shown in the other figures is that an inlet port 150 which communicates with an inlet chamber 152 is arcuately spaced only a short distance from an outlet port 154 communicating with the outlet chamber 156.

The diaphragms 40 and 92 are made from resin impregnated fibrous material as commonly used in pumps of this type.

In the operation of the pump shown in Fig. 1, fuel enters the port 12 and passes through the body 10 by way of the smallest chamber 16, the pumping chamber 24, the larger chamber 18 and the outlet port 14. The pulsations induced by the pumping diaphragm 40 ordinarily would create an uneven discharge of the fuel, but the pulsator diaphragm 92 resiliently yields during that portion of the pumping cycle when the fluid pressure is the highest so that the air entrapped in the recess 100 tends to exert a stabilizing effect on the pump discharge pressure and flow.

It will be noted that the inlet 12 and outlet 14 communicate with the chambers 16 and 18 at points intermediate the heights of the latter. When the pump is installed with the cover 98 uppermost, air pockets are formed in the upper portions of the chambers 16 and 18. The trapped air assists or supplements the stabilizing action of the pulsator diaphragm.

In the modification of Fig. 4 the incoming flow of fluid to the pump is somewhat stabilized by the distributive action of the sleeve 128. The desired effect of the shield is appreciably increased if the pump is installed for use in the inverted position—i.e. with the cover 98 at the bottom instead of at the top. In such an installation, air will be trapped around the shield 128 and adjacent the flange 126. This air will be alternately compressed and relieved by the action of the pump and the force of the air on the fuel will aid to level off the surges.

In the modification of Fig. 5 the filter or screen member 130 is so placed as to prevent foreign matter from entering the inlet valve 122 and other parts of the pump, fuel line or carburetor.

In the modification of Fig. 6 the illustration clearly shows the extent of the arcuate or U-shaped chamber 156 in which the discharge port 154 may be located to suit a given installation. This is a great convenience in many cases where the conduits to be connected to the pump may come from almost any direction. It will be noted that the portion of the chamber 156 which is of substantial depth is such as to extend around the central portion 106 except for the thin wall portion 160 in which the inlet 150 to the chamber 152 is formed. The relative angular positioning of the ports 150 and 154 is limited or determined only by the size or angular extent of the chamber 156.

It will be appreciated that in the modification of either Fig. 1 or Fig. 6 the direction of fluid flow may be reversed by reversing the position of each of the one-way valves. Such reversal is contemplated by the present invention. If chamber 18 is used as the inlet chamber instead of as the outlet chamber and is subjected to the pulsator action of the diaphragm 92, then the capacity of the pump is increased by eliminating surges in the inlet line.

I claim:

1. A fuel pump comprising a main body with a flow passage extending through the latter, said flow passage comprising a first chamber, a pumping chamber and an annular second chamber of irregular configuration connected in that order, said second chamber overlying said first chamber, a pumping diaphragm partially defining said pumping chamber, one-way valves in said main body and arranged to control flow through the said flow passage into and away from said pumping chamber, a yieldable pulsator diaphragm forming a wall of said second chamber, a cover fixed to said main body and defining an annular dead air space at one side of said pulsator diaphragm, and means for actuating said pumping diaphragm.

2. A pump having a main body formed with a flow passage leading therethrough and including an inlet chamber, a pumping chamber and an outlet chamber connected in that order by ports, said outlet chamber being larger than said inlet chamber and overlying the latter, a cap fixed to said main body and having a recess facing the latter, a pulsator diaphragm of yieldable material interposed between said main body and cap and sealing and partially defining said outlet chamber and said recess, pressure actuated one-way valves arranged to control said ports, and reciprocable means in said pump for effecting pressure surges in said pumping chamber and a consequent flow through said pump.

3. A pump having a main body with a flow passage therein comprising a small chamber, a pumping chamber, and a larger chamber overlying said pumping chamber, one-way valved ports connecting the latter to the said small and larger chambers, said small chamber being between a portion of said larger chamber and said pumping chamber, a cover fixed to said main body and having a recess in substantial registry with said larger chamber, a yieldable pulsator diaphragm interposed between said cover and main body and sealing said larger chamber and recess, means extending through the said cover and pulsator diaphragm and retaining the latter in position on said main body, and means for effecting pressure surges in said pumping chamber and a consequent flow through said flow passage while subject to the pressure modulating action of said yieldable pulsator diaphragm.

4. A fuel pump of the diaphragm type including a main body with a continuous flow passage leading therethrough, said passage constituting inlet and outlet ports in the outside wall of said main body, a large chamber, a pumping chamber and a smaller chamber, ports with one-way valves connecting said pumping chamber to said large and smaller chambers, said large chamber having a portion overlying said smaller chamber, a cover overlying said large chamber, an annular recess in said cover substantially in registry with said large chamber, a yieldable diaphragm interposed between said main body and cover and sealing said annular recess and large chamber, a pumping diaphragm closing said pumping chamber, and means for actuating said pumping diaphragm.

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