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LEVER ACTUATED FUEL SUPPLY PUMP, PARTICULARLY FOR INTERNAL COMBUSTION ENGINES

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FIG. 2

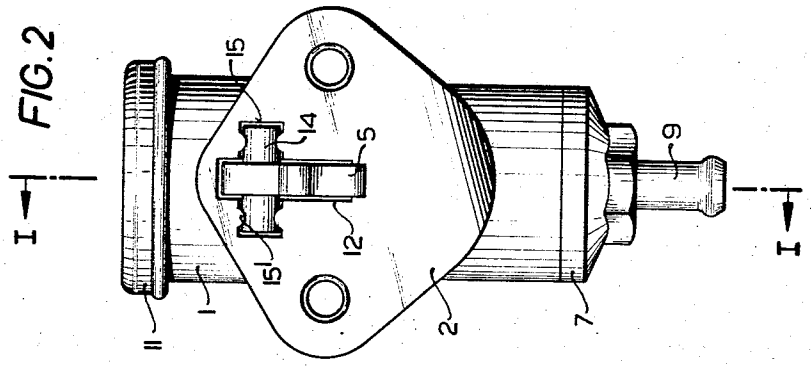
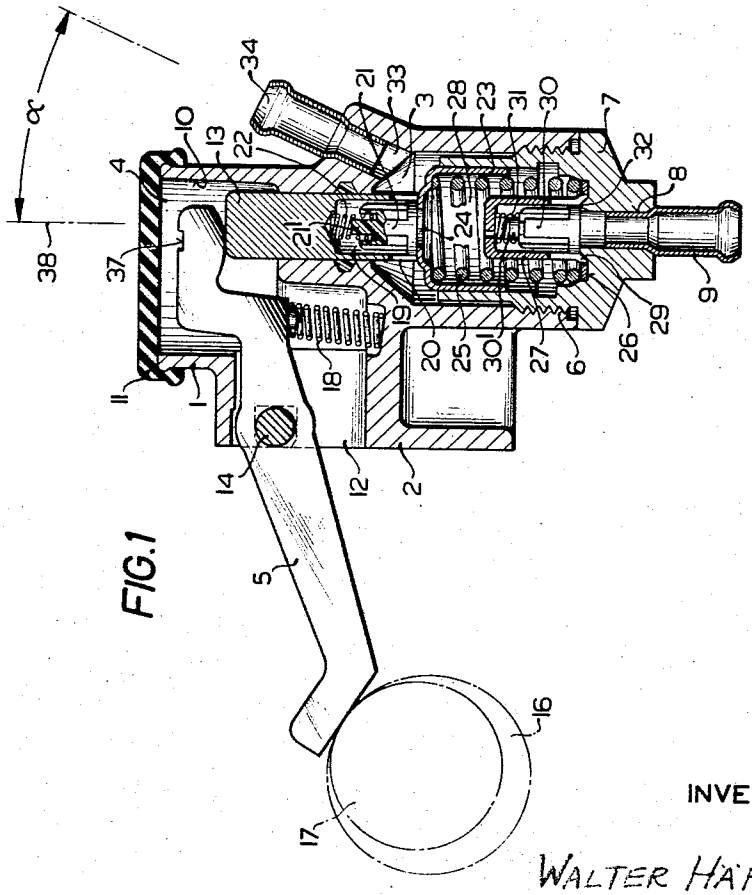


FIG. 1



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LEVER ACTUATED FUEL SUPPLY PUMP, PARTICULARLY FOR INTERNAL COMBUSTION ENGINES

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2 Claims. (Cl. 103—178)

ABSTRACT OF THE DISCLOSURE

A co-axial fuel supply pump having valve member formed as hollow shells (or blind bores within a plunger) co-axially assembled for unidirectional fluid through-put.

The present invention relates to a lever actuated fuel supply pump, particularly to a piston pump to supply fuel to internal combustion engines, and having a pressure valve and a suction or inlet valve.

It is an object of the present invention to provide a lever operated fuel pump which is so constructed that it is as small as possible, is built up of few parts and can readily be sealed to prevent leakage of fuel, and which is arranged so that, in case of emergency, it can be operated by hand to pump fuel, even though the driving engine may not operate. Further, the pump is arranged in such a mnaner that the fuel flowing therethrough flows essentially in the same sense, that is, does not experience a reversal of direction of flow within the pump unit.

Briefly, in accordance with the present invention, a cylindrical piston is provided which has a fluid bypass opening in an end face thereof. The piston is not solid, but a hollow shell and movable longitudinally within a housing. A plunger bears against the end face of the piston, moving it downwardly, with the return motion being provided by a strong spring located inside of the shell of the piston. A pressure valve, having a movable pressure valve element, seals a fluid bypass opening in the end face of the piston; an inlet valve is arranged within the housing in such a manner that it projects within the space formed by the open shell of the piston. Above the end face of the piston, a pump chamber is formed within the housing. The outlet opening can be taken off at a small, acute angle from the pump chamber, so that the fuel flowing through the pump, and being pumped thereby, flows essentially in the same direction from the inlet, through the shell of the piston, through the bypass opening and without substantial change in direction, out through the pressure outlet. The angle of the outlet opening itself can readily be formed to be 60 degrees or less with respect to the axes of the piston.

The plunger operating the piston extends through a bore in the housing. The housing itself, at the end of the plunger removed from the piston, is formed with a large opening which can be closed by a plastic or rubber cap, which is removable so that the plunger, operating the piston, can be operated up and down to pump fuel manually, for example by pressing against the plunger with a screw driver. In normal operation, an operating lever contacts the plunger, which operating lever bears against a cam or eccentric drive to move the plunger down against the pressure of the spring.

The structure, organization and operation of the invention will now be described more specifically in the following detailed description with reference to the accompanying drawings, in which:

FIG. 1 is a longitudinal section through the pump along lines I—I of FIG. 2; and

FIG. 2 is a side view of the housing of the pump, seen from the drive shaft.

Referring now to the drawings: The housing is formed of two portions 1, 7. Housing part 1 has a mounting flange 2, a pump chamber 3 and a space to provide for operation of the operating lever 5. Housing part 1, at its lower end, has an inner thread 6 into which the other housing part 7, arranged to guide piston 23, is screwed. The inlet or suction connection 9 is connected to the lower housing part, for example by means of an adhesive or, in case of metal, by sweating.

The upper chamber 4 of housing part 1 is open at the top as shown at 10, and closed by means of a plastic, or rubber cap so that the operating part of operating lever 5 is accessible from the outside. The side of part 1 is formed with a slit 12 in the region of flange 2, to permit the lever 5 to extend to the outside of the pump unit. A transverse slit is formed in the flange of the housing, and a bolt 14 is placed therein, passing through operating lever 5 and forming a fulcrum therefor. The transverse slit 15 is deep enough to accommodate the entire, or practically the entire cross sectional area of bolt 14, as seen in FIG. 1. The material of the flange 2 is deformed, for example by a punch as seen at 15' in order to prevent removal of the bolt 14 after the operating lever has been assembled into the housing. A spring 18, schematically shown in FIG. 1, urges the operating lever 5 into the position shown in FIG. 1, and to retain it in contact with an excenter disc 16 secured to a drive shaft 17, in order to provide up and down motion of the lever 5.

Upper housing part 1 has a central bore, coaxial with the part 7 and inlet or suction connection 9. A plunger 13 is mounted within the bore, and slidable up and down (FIG. 1) when depressed by the operating lever 5. Operating lever 5 has a notch 37 on its upper surface, so that the plunger 13 can be moved up and down by engagement, for example of the screw driver, with the operating lever after removal of cap 11, and thus permit manual operation of the pump even though the shaft 17 is not operating.

The small size of the unit is achieved by the arrangement of the piston, the pressure valve and the inlet or suction valve. Plunger 13 has a central, blind bore 19 at its lower end and several openings 20, which may be slits in the side wall, communicating with the pump chamber 3. An O-ring 35 seals the plunger in the housing. Within the bore 19 is the pressure valve having an element 21 which is movable, and is retained in its position against a matching valve seat formed on piston 23 by means of a spring 22. Valve element 21, and its matching seat seal a bypass opening 24 within the top of the end face of piston 23. Movement of the valve element 21 is limited by means of a stem 21'.

Piston 23 is formed as a shell, having a hollow interior and is generally cup shaped with cylindrical side walls. It is maintained in the position shown in FIG. 1 by means of a spring 25, which is inserted in the inside thereof. The other side of spring 25 bears against a flange of another shell shaped part 27, forming the inlet valve to the pump. Simultaneously, the spring 25 seals valve part 27 against the housing part 7. Housing part 7 has cylindrical walls, as seen in FIG. 1, which serve as guides for piston 23. The inlet valve 27 has a plurality of side openings or slits 29, communicating with space 28 in the interior of the cylinder shell. A valve element 30 forms the movable part of the inlet valve 27, and is retained in the position shown in FIG. 1 by means of a spring 31. It cooperates with a valve seat 32, formed on the housing portion 7, which communicates with inlet connection 8 to which inlet stub

9 is secured. Motion of the inlet valve unit 30 is limited by stem 30'.

Pump chamber 3 is in communication with a pressure outlet 33, arranged such that the axis of the pressure outlet 33 forms an acute angle, α, which is less than 60 degrees, with respect to the axis of the plunger 13, piston 23, and valve 27, as schematically shown by line 38. A pressure connecting stub is inserted in the outlet opening as shown at 34.

The major housing portion of the pump can be made as an aluminum casting. Part 7, which acts as a cylinder and guide for the piston 23 is preferably made of pressed steel. Piston 23, and valve part 27 is preferably made of sheet metal.

In operation, movement of the lever 5 in clockwise direction depresses plunger 13 and with it piston 23 downwardly, in FIG. 1. The valve element 21 of the pressure valve is lifted off its seat, and any fluid previously in the space 28 formed by the hollow shell is pressed into the pump chamber 3 through bypass opening 24 in the piston, and side slits 20 in the plunger 13. Movement of the plunger further supplies some of the fluid already in the pump chamber to the pressure outlet 33. As the operating lever 5 swings back under pressure of spring 18, piston 23 and plunger 13 are moved upwardly by return of spring 25. Fluid within the pump chamber is moved out of the pressure opening 33, while simultaneously the upward movement of piston 23 provides suction to the inlet valve, valve element 30 moves upwardly and permits fluid to enter from inlet 8 through side slits 29 in the valve 27, to pass in the space 28 below the shell of piston 23.

Manual operation will be obvious, up and down motion against plunger 13 as transmitted for example by inserting a screw driver in slot 37 pumping fluid from inlet stub 9 to outlet 34.

While the pump has been illustrated in connection with a fuel pump, particularly for internal combustion engine, it can of course be used for any purposes. Operating lever 5 may take any form, and the plunger 13 may be moved up and down by any suitable operating means.

We claim:

1. Fuel supply pump comprising

a housing (17);

a pump operating lever (5);

a pressure valve having a movable pressure valve element (21);

a cylindrical piston (23) formed as a hollow shell having a fluid bypass opening (24) in an end face thereof located within said housing (1, 7);

a plunger (13) bearing against said end face of said piston and operatively associated with said operating lever (5) to be moved longitudinally thereby, said plunger (13) being formed with a blind bore (19);

said pressure valve element (21) being located within said bore (19) and bearing against said fluid bypass opening (24);

an inlet valve extending into the interior of the shell of said piston (23) and including a movable inlet valve element (27, 30) seating against said housing;

a piston return spring (25) located in the interior of the shell of said piston (23) bearing against the inner surface of the face thereof at one end and bearing against said inlet valve on the other to urge the piston against the plunger and the inlet valve against the housing;

said housing being formed of a pair of separable parts, one of said parts (1) guiding said plunger (13) and being formed with a pressure fluid outlet (33), and the other part (7) guiding said piston (23) and having said inlet valve mounted therein;

and said inlet valve, said piston (23) and said plunger (13) being mounted coaxially, the axis of said pressure outlet and the axis of said inlet valve being arranged to include an acute angle of less than 60°.

2. Pump as claimed in claim 1 wherein said operating lever is mounted in said housing to bear against said plunger; and said housing is formed with a closable opening exposing the region of contact of said operating lever and said plunger.

References Cited

UNITED STATES PATENTS

1,247,892	11/1917	Stewart	103—151
2,064,750	12/1936	Hurst	103—37
2,069,076	1/1937	Majewski	103—211
2,094,171	9/1937	Hoffer	103—37
3,141,417	7/1964	Norberg	103—215

FOREIGN PATENTS

592,694	9/1947	Great Britain.
661,107	11/1951	Great Britain.

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