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2,974,601

FREE PISTON FLUID PUMPS

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2 Sheets-Sheet 1

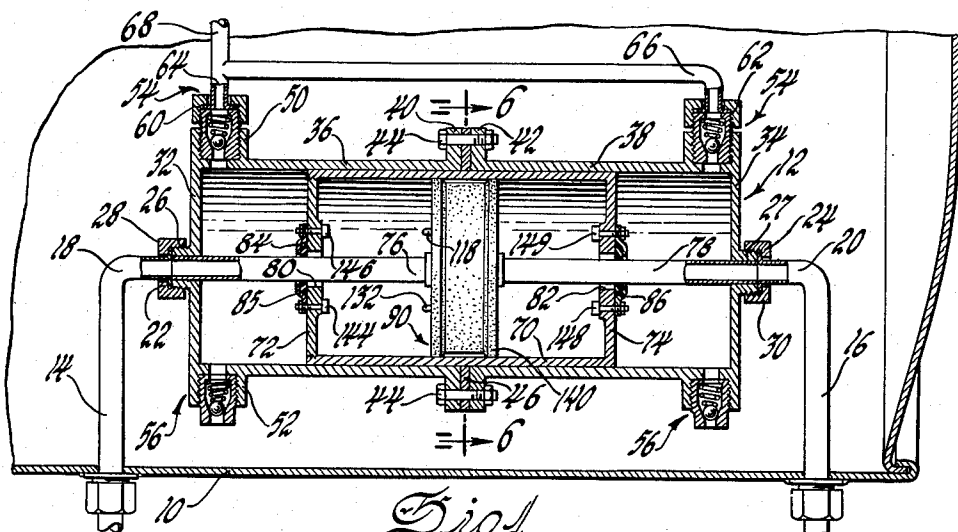


Fig. 1

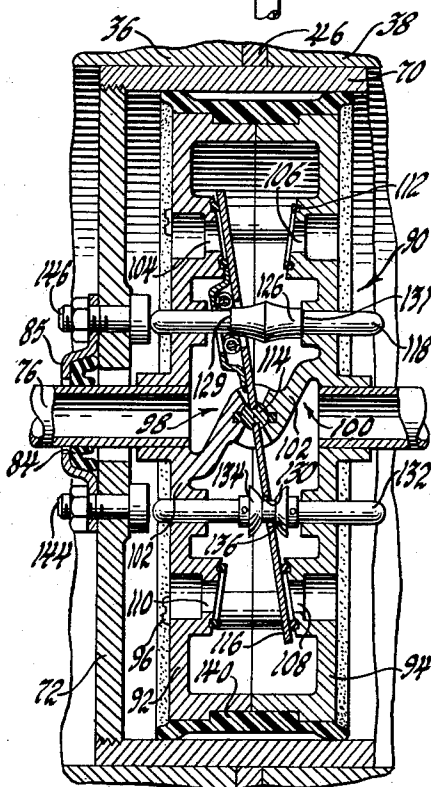
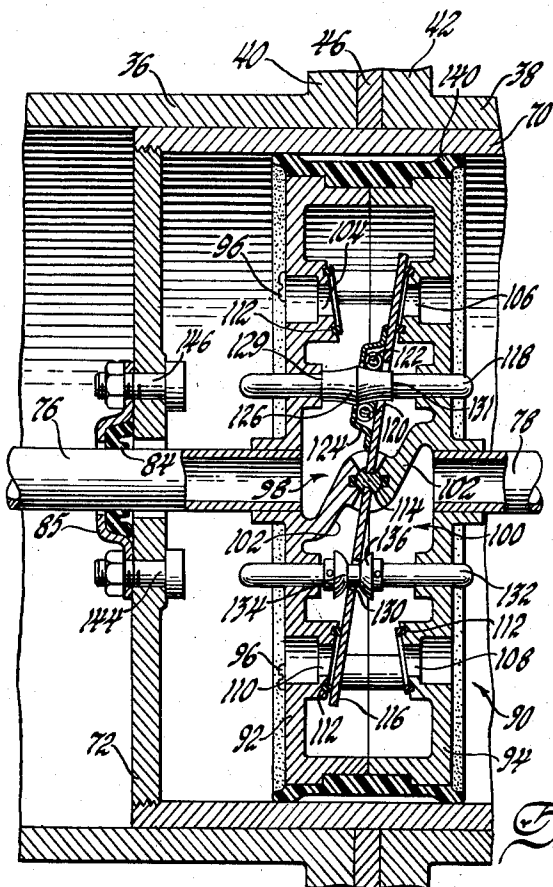


Fig. 3
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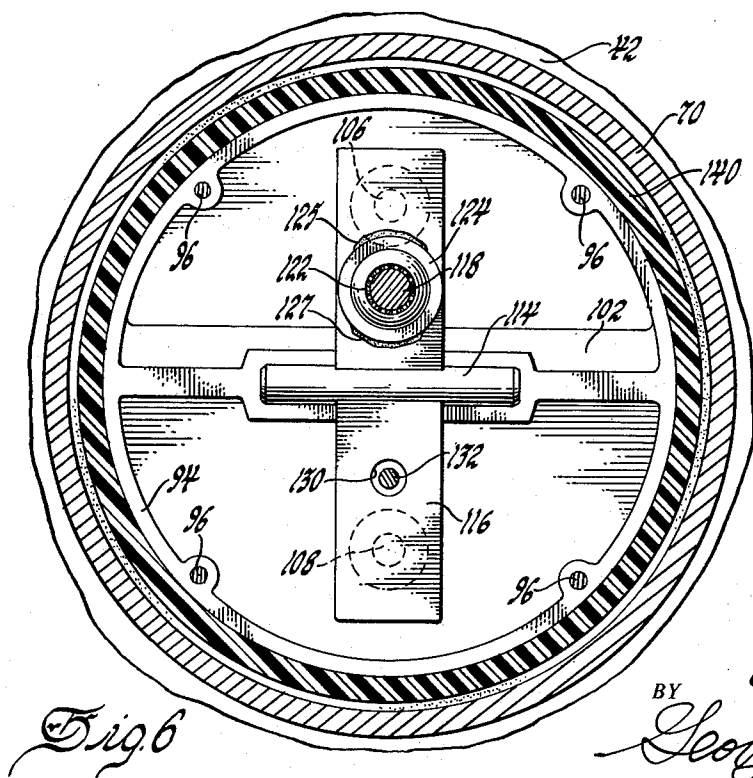
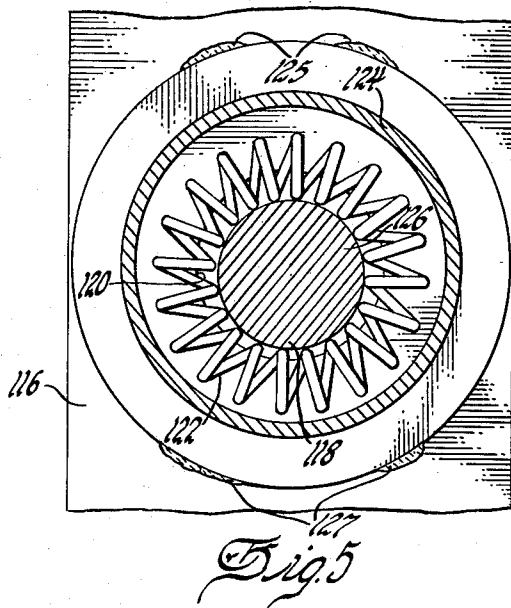
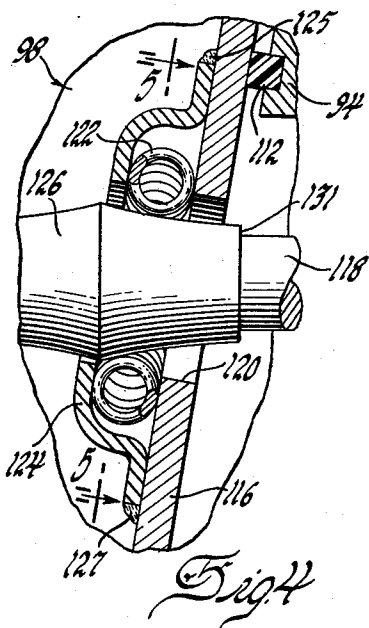
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FREE PISTON FLUID PUMPS

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2 Claims. (Cl. 103—52)

This invention relates to pumps and more particularly to pumps for handling liquids such as fuel for internal combustion engines, the pumps being actuated by any fluid under pressure which may be available.

Pumps in which pressure fluid directly moves a pumping plunger have been known for many years and it has also been well known to design such pumps in order that they may be immersed in the fluid pumped.

The object of the present invention is to provide an improved pump of simplified construction which is readily adapted for use while submerged in a fluid to be pumped and which is of low cost construction.

A feature of the present invention is a free piston enclosed within a pumping cylinder to bring about pumping action in cooperation with the latter, a fixed power piston being located within the free piston and containing valved ports for controlling the flow of fluid under pressure to effect operation independent of the pumping cylinder wall. Another feature is a fluid pump having a free piston for effecting the pumping action, the free piston being reciprocable on a stationary conduit acting as a piston rod through which pressure fluid is conducted under mechanical control as the power transfer medium.

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 view through a portion of a gasoline tank and along the axis of a free piston pump embodying the principles of the present invention;

Fig. 2 is a sectional view through a fixed piston and other portions of the assembly of Fig. 1, the view being drawn to an enlarged scale;

Fig. 3 is a view similar to that of Fig. 2, but with a valve plate in a different position;

Fig. 4 is a view of details shown in Fig. 2, the view being drawn to a still larger scale;

Fig. 5 is a view looking in the direction of the arrows 5—5 in Fig. 4; and

Fig. 6 is a sectional view looking in the direction of the arrows 6—6 in Fig. 1 and drawn to the same scale as utilized in Figs. 2 and 3.

In the drawings, Fig. 1 illustrates a portion of a gasoline tank 10 which encloses a free piston pump generally indicated at 12. Two vertical conduits 14 and 16 are so connected to the tank 10 that they extend upwardly through the bottom of the tank and in spaced relation along the length of the tank. The upper ends of these conduits 14 and 16 are bent at right angles as at 18 and 20 and carry opposed flanges 22 and 24 which are held in sealed relation to hubs 26 and 27 by means of couplings 28 and 30. The hubs 26 and 27 are integral with end plates 32 and 34, respectively, and these end plates form the closed ends of two pumping cylinder portions 36 and 38. The latter bear annular flanges 40 and 42 which are held together by bolts 44

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and between the flanges a ring 46 is interposed. The cylinder portions 36 and 38 are similar in construction in that the closed ends thereof have inlet and exhaust valves. The pumping portion 36 has two bosses 50 and 52 and these accommodate ball check valve assemblies shown at 54 and 56. Similar reference numerals are given to the ball check assemblies of cylinder portion 38. Couplings 60 and 62 are utilized to connect the outlet valve assemblies 54 to branches 64 and 66 of a fuel line 68 which in time is arranged to conduct fuel discharged by the pump to the engine or other point of use.

Slidably arranged within the pumping cylinder portions 36 and 38 is a cylindrical free piston 70 having ends closed by two discs 72 and 74 to define a power cylinder. Two conduits 76 and 78 extend from the bosses 26 and 27, respectively, and these conduits pass through two openings 80 and 82 made in the end plates 72 and 74. A sealing washer 84 is held by suitable means 85 to the end plate 72 to form a tight seal around the conduit 76. A sealing washer 86 is similarly employed with respect to the conduit 78.

Within the free piston 70 is located a piston 90 which is fixed in position by the supporting conduits 14 and 16. This piston is composed of two generally cylindrical castings 92 and 94 which are held together by means of four bolts 96. These two castings define two chambers 98 and 100 separated by aligned cross webs 102. Bosses are formed within the fixed piston 90 to accommodate four ports 104, 106, 108 and 110. It will be noted that the inner faces of these bosses are slanted with respect to the plane of the interface of the two castings 92 and 94 to present surfaces in which grooves are formed for retaining annular seat members 112.

A pivot shaft 114 is mounted in the webs 102 and carries a valve plate 116 which is rectangular and of such size as to be adapted to engage the valve seat rings 112.

A tripping mechanism includes a rod 118 journaled for linear and endwise movement in the castings 92 and 94. An opening 120 is formed in the valve plate 116 permitting relative motion of the rod 118 with respect to the valve plate. An annular coil spring 122 is loosely retained close to the opening 120 by means of an annular spring retainer 124. The latter is welded as at 125 and 127 to the plate 116. The rod 118 has an enlarged ridge portion 126 which is encircled by the spring 122. The ridge portion has shoulders 129 and 131.

Diametrically opposite from the rod 118 and on the other side of the pivot shaft 114 is an opening 130 in the plate 116 through which extends a rod 132, the opposite ends of which are journaled in the castings 92 and 94. This rod has fixed to it two stop members 134 and 136 which abut opposite sides of the plate 116 with merely sufficient clearance to permit relative motion of the plate 116 and the rod 132 as the plate is rotated in either direction about the pivot shaft 114.

Surrounding the two castings 92 and 94 is a ring 140 of suitable material such as synthetic rubber or a plastic which is capable of effecting a two-way lip seal between the inner wall of the free piston 70 and the fixed piston 90.

Bolts 144 and 146 are fixed to the end disc 72 in alignment with the rods 132 and 118, respectively, and the heads of these bolts serve as stop means as will further appear.

With the parts positioned as shown in Fig. 2, it will be understood that pressure fluid being introduced through the conduits 14 and 76 will pass into the chamber 98 and through the port 104 into the left-hand end of the interior of the free piston 70. The resulting build-up of fluid pressure will cause the latter to move to the

left, as viewed in Fig. 1, and the pressure fluid previously admitted to the right of the fixed piston 90 would simultaneously be exhausted by way of the port 108, the chamber 100 and the conduits 78 and 16. Gasoline previously admitted into the pumping cylinder portion 36 by way of the left-hand check valve 56 will be forced upwardly through the left-hand check valve 54 to the discharge line 68. At this time the rod 118 will have its shoulder 129 abutting the casting 92.

When the free piston 70 reaches the end of its stroke to the left, the rod 132 will strike the stop bolt 144 and positively break contact of the valve plate 116 with its seats. When the plate 116 is thus pried loose, the tripping mechanism comprising the spring 122 and the ridged portion 126 takes over and quickly completes the cycle by a snap-over action to position the valve plate 116 as shown in Fig. 3 and to press the shoulder 131 against the casting 94. When this takes place, the flow of the pressure fluid again supplied through the conduit 76 will be reversed in that the fluid will be introduced to the opposite end of the interior of the free piston 70. The coil spring 122 maintains a positive seating of the plate 116 against the port seats as a result of its constricting or squeezing action on the ridge portion 126.

The reciprocation of the free piston continues by virtue of the stop action of two bolts 148 and 149 fixed to the disc 74. These bolts act as do the bolts 144 and 146 at the other end of the stroke. As a result, gasoline from the tank 10 will alternately be drawn into opposite ends of the pump 12 by way of the valves 56 and alternately discharged by way of the valves 54.

I claim:

1. A pump comprising a fixed casing defining a pumping chamber, a reciprocable free piston in said pumping chamber and defining a power cylinder, stop means on each end of said free piston, a power piston in said power cylinder and fixed relative to said casing, conduit means connected to said power piston from the exterior of said pumping chamber and slidably engaged with said free piston, ports in said fixed piston and communicating with opposite end zones of said power cylinder,

valve means controlling said ports, said conduit means being adapted to supply and exhaust power fluid alternately from said end zones by way of said valved ports, mechanism on said fixed piston and free of said fixed pumping chamber casing for automatically tripping said valve means to effect power actuation of said free piston, the said tripping mechanism including a reciprocable rod with a quick action over-center spring arrangement, and a valve plate pivoted in said fixed power piston and adapted to open and close said ports upon contact of said stop means with said reciprocable rod.

2. A pump comprising a fixed casing defining a pumping chamber, a reciprocable free piston in said pumping chamber and defining a power cylinder, stop means on each end of said free piston, a power piston in said power cylinder and fixed relative to said casing, conduit means connected to said power piston from the exterior of said pumping chamber and slidably engaged with said free piston, ports in said fixed piston and communicating with opposite end zones of said power cylinder, valve means controlling said ports, said conduit means being adapted to supply and exhaust power fluid alternately from said end zones by way of said valved ports, mechanism on said fixed piston and free of said fixed pumping chamber casing for automatically tripping said valve means to effect power actuation of said free piston, the said tripping mechanism including a reciprocable rod with a quick action over-center spring arrangement associated therewith, a valve plate pivoted in said fixed power piston and adapted alternately to open and close said ports upon contact of said stop means with said reciprocable rod at each end of said free piston, a second rod reciprocable in said power piston and adapted to contact said stop means for initially unseating said valve plate upon reversal of motion of said free piston.

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