April 18, 1961 J. E. SMITH ET AL 2,980,023

FLUID PUMPS

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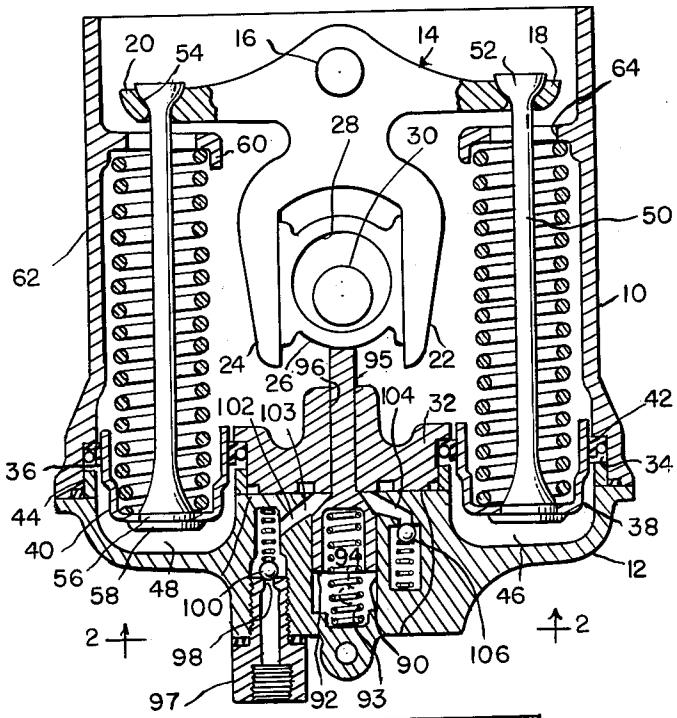


FIG.1.

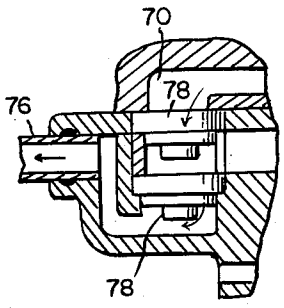


FIG.3.

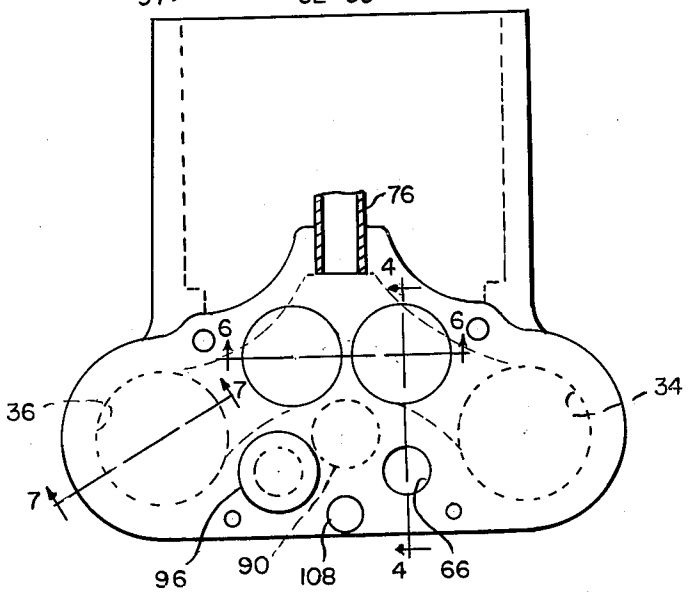


FIG.2.

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FIG.8.

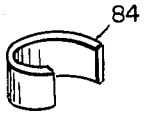
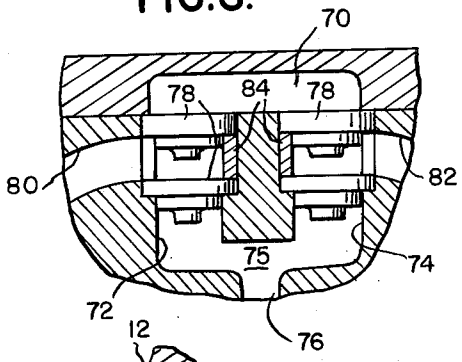


FIG.6.



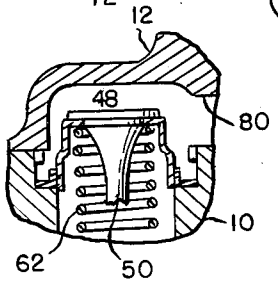
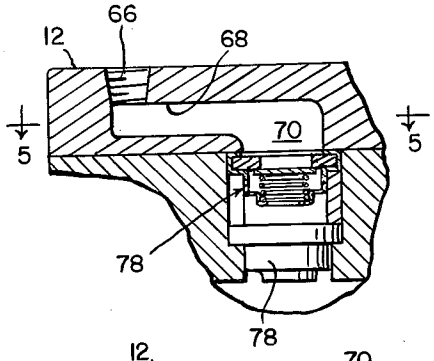


FIG.7.

FIG.4.



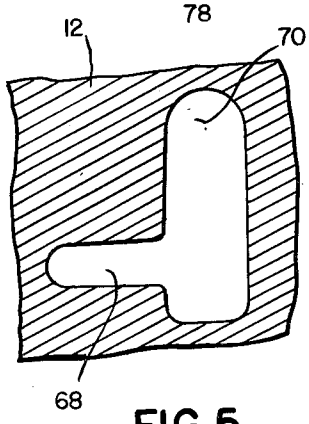


FIG.5.

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FLUID PUMPS

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12 Claims. (Cl. 103—6)

The present invention relates to fluid pumps, and more specifically to a pump capable of simultaneously delivering more than one type of fluid at different pressures.

It is an object of the present invention to provide a combination fluid pump characterized by its simplicity, the economy with which it may be produced, and the efficiency with which it operates.

More specifically, it is an object of the present invention to provide a fluid pump capable of maintaining a supply of fluid at a predetermined pressure and of delivering this fluid only on demand.

Still more specifically, it is an object of the present invention to provide a pump of the type described in the preceding paragraph characterized by an arrangement in which a pair of pistons are sequentially operable in cylinders in communication with a pumping chamber, and in which the actuating means for the pistons are such as to require a fluid seal only between the pistons and cylinders.

Still more specifically, it is an object of the present invention to provide a pump of the character described including oscillating means for maintaining a pair of pumping elements under continuous spring bias to establish a predetermined pressure in a pumping chamber with which both of said elements communicate, in combination with a third pumping chamber having inlet and outlet check valves and a pumping piston movable therein, in combination with a drive shaft having an eccentric portion and means associated therewith for effecting oscillation of said oscillating means and reciprocation of said pumping piston.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, illustrating a preferred embodiment of the invention, wherein:

Figure 1 is a substantially central vertical section through the pump, a portion thereof in another plane being rotated into view.

Figure 2 is an end view looking substantially in the direction of the arrows 2—2, Figure 1.

Figure 3 is a more or less diagrammatic sectional view illustrating the fluid flow through the pump.

Figure 4 is a fragmentary enlarged sectional view on the line 4—4, Figure 2.

Figure 5 is an enlarged sectional view on the line 5—5, Figure 4.

Figure 6 is an enlarged sectional view on the line 6—6, Figure 2.

Figure 7 is an enlarged fragmentary sectional view on the line 7—7, Figure 2.

Figure 8 is an elevational view of an element of the construction.

The pump comprises a casing 10 and an end closure 12 provided with ports and passages as will presently be described. Mounted for oscillation in the casing 10 is a yoke or driver indicated generally at 14, the yoke being mounted on a pivot support 16 and having laterally

extending arms 18 and 20. The yoke is also provided with downwardly extending laterally spaced arms 22 and 24 between which is slidably mounted a block 26 having a central opening 28 which receives an eccentric mounted on a drive shaft 30. The bottom of the casing 10 is provided with a transverse wall structure 32 having therein pumping means comprising a pair of openings or cylinders 34 and 36 in which cup-like pistons 38 and 40 are reciprocable. The pistons are provided with seals 42 which bear against the walls of the pistons 38 and 40. Seal retainer rings 44 retain the seals 42 in place.

Means are provided to interconnect the yoke 14 and the pistons 38 and 40 so as to maintain the pistons spring loaded in a direction to establish pressure in pumping chambers 46 and 48 with which the pistons 38 and 40 respectively are in communication. This connecting means comprises rods 50 provided with spherically or cylindrically formed head portions 52 received in correspondingly shaped seats 54 provided adjacent outer ends of the arms 18 and 20. The lower ends of the rods have one-way connection with said pistons provided by enlarged head portions 56 received in openings in the transverse wall of the pistons 38 and 40 and are provided with radially extending flange portions 58 engaging the lower side of the pistons. Extending inwardly from the sides of the casing 10 are projections 60 forming seats for compression springs 62, the lower ends of which engage within the interior of the cup-like pistons 38 and 40. The projections 60 are provided with enlarged openings 64 through which the rods 50 extend.

The end closure 12, as best seen in Figure 4, is provided with a port 66 into which fuel is admitted, the port communicating with a passage 68 which in turn communicates with a manifold 70. The manifold 70, as best seen in Figure 6, is provided with passages 72 and 74 which join to provide a common outlet chamber 75, and this in turn communicates with fuel outlet passage 76. A pair of check valves 78 is provided in each of the passages 72 and 74. The upper check valves 78 as seen in Figure 6 include inlet fluid passages leading to the pumping chambers formed by openings 34, 36 and the lower check valves 78 include fluid outlet passages connecting the pumping chambers to outlet chamber 75. Intermediate the check valves in the passage 72 there is provided a passage 80 leading to the pumping chamber 48 at one side of the pump. In like manner, intermediate the check valves 78 and the passage 74 is a passage 82 leading to the pumping chamber 46 at the other side of the pump. The check valves 78 in each of the passages 72 and 74 are separated by a partial ring 84 shown in perspective in Figure 8, the open sides of the rings being in communication with the passages 80 and 82.

From the foregoing description it will be apparent that as the shaft 30 is revolved, the block 26 is moved back and forth and oscillation is imparted to the yoke 14. This in turn results in effecting upward lifting movement applied to the headed ends 52 of the rods 50, thus lifting pistons 38 and 40 to the upper extreme of their strokes at each rotation of the shaft 30. However, the connection between the arms 18 and 20 of the yoke and the rods 50 connected to the pistons 38 and 40 is a one-way connection. In effect therefore, oscillation of the yoke keeps the pistons adjacent the upper end of the stroke at which point they are urged downwardly by compression of springs 62. These springs, as will be observed, are relatively long and hence are operable to maintain substantially uniform pressure in the pumping chambers 46 and 48.

The pump as so far described is useful as a fuel pump for an internal combustion engine and is operable as above described to maintain a supply of fuel under pres-

sure available on demand. It will be appreciated that during the major portion of rotation of the shaft 30, both of the rods 50 are free and the springs 62 are therefore effective to urge both of the pistons 38 and 40 downwardly to maintain pressure in the respective chambers 46 and 48. When however, one of the rods 50 is raised by the associated arm of the yoke 14, the pressure in the connected pumping chamber 46 or 48 falls and fluid will be drawn into the chamber past the inlet check valve 78. At this time fluid in the other pumping chamber maintains the supply of fluid under pressure in the distributing chamber 75 which connects to the outlet 76.

In addition to the pumping apparatus as above described, a second pump independent of the first is provided. The end closure 12 is provided with a pumping cylinder 90 in which a piston 92 is reciprocable. The piston 92 is urged upwardly, as seen in Figure 1, by a compression spring 93. Alternatively, a fluid passage may connect the interior of the chamber 90 to the outlet chamber 75 of the previously described pump to apply fluid pressure urging the piston 92 upwardly, the end of the passage for such connection being illustrated at 94. The piston 92 has an elongated stem 95 extending upwardly through an opening 96 provided in the transverse wall structure 32 of the casing 10. The upper end of the stem 95 engages the lower end of the block 26 and is thus positively driven against the spring 93 during rotation of the shaft 30. When the block 26 is moved upwardly by continued rotation of the shaft 30, the spring 93 biases the piston upwardly and establishes a predetermined pressure in the fluid pumped thereby. An inlet fitting 97 is provided having a valve seat 98 on which a spring pressed check valve 100 is seated. Fluid passing the check valve 100 flows through a passage 102 to a space 103 surrounding the upper end of the piston and in communication with the upper end of the cylinder 90 when the piston is depressed. This space communicates by an outlet passage 104 and past an outlet check valve 106 to an outlet port 108, as seen in Figure 2.

It is thus seen that the simple construction illustrated provides two independent pumping systems which may be connected to pump two different fluids. Moreover, the pumping system which includes the pistons 38 and 40 operates to maintain a supply of one fluid always available on demand at a specified pressure. The pumping means including the piston 92 on the other hand, operates at a pressure determined by the spring 93, or as described above, by this spring pressure plus a fluid pressure provided by the connection of the outlet chamber 75 to the interior of the cylinder 90 at a different substantially constant pressure.

In a practical embodiment of the present invention pistons 38 and 40 may be employed to pump fuel and the piston 92 may operate to pump oil.

It will be observed that the present construction is extremely simple in that the only fluid seals required are the seals 42 provided between the pistons 38 and 40 and the associated cylinders. The mechanical actuating means and the spring biasing means for these pistons is contained in the casing 10 and thus the use of a multiplicity of seals is avoided. Moreover, the construction is characterized by the use of the headed rods 50 which are thus positively interconnected by the rocker yoke 14 and the pistons 38 and 40.

The drawings and the foregoing specification constitute a description of the improved fluid pumps in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What we claim as our invention is:

1. A pump comprising an oscillating driver, a pair of pumping means each comprising a piston and cylinder, a fluid inlet manifold, a fluid outlet chamber, a pair of fluid passages extending from said manifold to said fluid outlet chamber, a pair of check valves in each of said passages, a passage connecting each of said fluid passages to one of said cylinders, pull rods connecting each of said pistons to said driver, said rods having a one-way connection with said driver, springs connected to said pistons and urging said pistons in pumping direction, and means connected to said driver for actuating the pull rods alternately to produce suction strokes of said pistons.

2. A pump comprising a hollow casing having an end portion provided with a plurality of openings, a piston mounted in each of said openings, a closure member secured to said casing having recesses in alignment with said openings and forming pumping chambers therewith, check valve controlled inlet and outlet passages leading to said chambers, said casing having within its hollow interior a plurality of inwardly projecting apertured spring seats, a driver member mounted for oscillation in said casing, pull rods connected to said pistons and having one-way connections with said driver member, compression springs surrounding said pull rods and extending between said spring seats and said pistons to actuate said pistons in pumping strokes, and means connected to said driver for actuating the pull rods alternately to produce suction strokes of said pistons.

3. A pump comprising a hollow casing having an end portion provided with a plurality of openings, a piston mounted in each of said openings, a closure member secured to said casing having recesses in alignment with said openings and forming pumping chambers therewith, check valve controlled inlet and outlet passages leading to said chambers, said casing having within its hollow interior a plurality of inwardly projecting apertured spring seats, a drive shaft having an eccentric portion rotatable in said casing, an oscillating drive member pivoted in said casing and having a parallel sided drive slot, a block slidable in said slot and having an opening receiving the eccentric shaft portion, pull rods connected to said pistons and having one-way connections with said drive member, compression springs surrounding said pull rods and extending between said spring seats and said pistons, a separate pump connected to said casing and having a stem in engagement with said block for actuation thereby.

4. A pump comprising a hollow casing having an end portion provided with a plurality of openings, a piston mounted in each of said openings, a closure member secured to said casing having recesses in alignment with said openings and forming pumping chambers therewith, check valve controlled inlet and outlet passages leading to said chambers, said casing having within its hollow interior a plurality of inwardly projecting apertured spring seats, a drive shaft having an eccentric portion rotatable in said casing, an oscillating drive member pivoted in said casing and having a parallel sided drive slot, a block sldable in said slot and having an opening receiving the eccentric shaft portion, pull rods connected to said pistons and having one-way connections with said drive member, compression springs surrounding said pull rods and extending between said spring seats and said pistons, a separate pump connected to said casing and having an actuating stem, a spring connected to said stem and urging said stem into engagement with said block.

5. A proportioning pump combination comprising an oscillating drive member, pivot means mounting said member for oscillation about the axis thereof, said drive member having a pair of spaced arms having guide surfaces parallel to a line radial of said pivot means, a block slidable between said arms, eccentric drive means connected to said block, a pair of arms on said drive member extending generally radially from the pivot axis thereof, pumping means operatively connected to said arms, a separate pump, and drive means therefor operatively connected to said block.

6. Structure as defined in claim 5 in which the means connecting said pumping means and said separate pump

to said arms and block respectively are one-way connections operable to drive only on suction strokes, and resilient means operably connected to said pumping means and separate pump to drive on delivery strokes.

7. A combination pump comprising housing structure forming a pair of pump cylinders, check valves controlling flow of fluid to said cylinders, an outlet chamber for delivery of fluid at constant pressure, outlet passages connecting said cylinders to said chamber, check valves in said outlet passages, pumping pistons in said cylinders, means for applying constant force to said pistons on pumping strokes to maintain constant pressure in said chamber, an additional pump comprising a piston and cylinder, and means for reciprocating said last named piston in pumping and suction strokes comprising positive one-way drive means for moving said last named piston on suction strokes and means for admitting fluid from said chamber to said last named cylinder to apply constant pressure thereto in pumping strokes.

8. A pump combination comprising first and second pump cylinders, first and second pump pistons movable therein in pumping and suction strokes, positive drive means having a one-way drive connection with both of said pistons to drive them in suction strokes, resilient means connected to said first piston to drive it in pumping strokes to deliver fluid at a constant pressure, a fluid passage connecting said second cylinder to the discharge side of said first cylinder at the side of the piston therein to communicate the discharge pressure of said first piston to aid in driving said second piston during pumping strokes.

9. A pump combination comprising first and second pump cylinders, first and second pump pistons movable therein in pumping and suction strokes, positive drive means including a rotary shaft having a one-way drive connection with both of said pistons to drive them in suction strokes, resilient means connected to said first piston to drive it in pumping strokes to deliver fluid at a constant pressure, a fluid passage connecting said second cylinder to the discharge side of said first cylinder at the side of the piston therein to communicate the discharge pressure of said first piston to aid in driving said second piston during pumping strokes.

10. A pump combination comprising first and second pump cylinders, first and second pump pistons movable therein in pumping and suction strokes, positive drive means having a one-way drive connection with both of said pistons to drive them in suction strokes, resilient means connected to said first piston to drive it in pumping strokes to deliver fluid at a constant pressure, a fluid passage connecting said second cylinder to the discharge side of said first cylinder at the side of the piston therein to communicate the discharge pressure of said first piston to aid in driving said second piston during pumping strokes, and resilient means operatively connected to said second piston to apply a substantially constant force thereto in pumping direction.

11. A pump combination comprising a pair of expansible and contractable pumping chambers, a rotary drive member having a one-way drive connection to both of said chambers to expand them in suction strokes, resilient means connected to one of said chambers to apply a force to contract said one chamber in a pumping stroke to deliver fluid at substantially constant pressure, and means including a passage connected to the delivery side of said one chamber for applying a force derived from the substantially constant pressure delivery of said one chamber to aid in contracting the other chamber in a pumping stroke.

12. A pump combination comprising a pair of independently operable, expansible and contractable pumping chambers, a rotary drive member having a one-way drive connection to both of said chambers to expand them in suction strokes, resilient means connected to one of said chambers to apply a force to contract said one chamber in a pumping stroke to deliver fluid at substantially constant pressure, means including a passage connected to the delivery side of said one chamber for applying a force derived from the substantially constant pressure delivery of said one chamber to contract the other chamber in a pumping stroke, and resilient means operatively connected to said second chamber to apply a substantially constant contracting force thereto.

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