PUSH-PULL PUMP
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5 Claims. (Cl. 103—175)
The invention relates to a push-pull pump, and more particularly to a reciprocating hand-pump of double action type.
Previous pumps of the general nature here involved have been relatively expensive to manufacture and maintain. Many of the pump parts moved during operation, causing substantial wear and frequent breakdowns.
The present invention is directed to a structure which solves these and other problems, and which is capable of relatively large output capacity for its size.
The accompanying drawings illustrate the best mode presently contemplated by the inventor for carrying out the invention.
In the drawings:
FIG. 1 is a vertical central section of a pump constructed in accordance with the invention; and
FIG. 2 is a vertical section taken on line 2—2 of FIGURE 1.
As shown in the drawings, the main pump body or housing comprises an annular head 1 which closes one end of the pump. Head 1 is provided with an annular flange 2 having a radially outwardly extending rim 3 on its outer edge. The other end of the pump is closed by a cap 4 having a flared base 5 which is secured to rim 3 as by a clamp ring 6. A suitable gasket 7 may be interposed between rim 3 and base 5 to prevent leakage of fluid through the joint.
A central hub 8 is integral with and extends inwardly from head 1 and provides the support for a fixed piston having a pair of axially spaced end members 9 and 10 joined by inner and outer concentric circumferential walls 11 and 12. End member 9 is inner wall 11 and end member 10 is outer wall 12. Circumferential in extent, while end member 10 and inner wall 11 are discontinuous to form a pair of diametrically opposed generally rectangular upper and lower housings.
Hub 8 also serves to receive an axial reciprocable pump actuating shaft 13 therethrough. The outer end of the shaft passes through a packing and may be connected to any suitable mechanism, such as a linkage including a hand lever 14. The inner end of shaft 13 is secured to a dome-like pump cylinder 15 of a configuration somewhat similar to but smaller than cap 4. Cylinder 15 has a transversely extending closed outer end which merges into an annular side wall, the latter being sealed to piston end member 10 by a suitable piston ring 16.
Diametrically opposed radial pipe connection passages 17 and 18 are formed in head 1 and provide the inlet and outlet, respectively, for the pump.
Passage 17 communicates through an axially facing port 19 in head 1 into a valve inlet chamber 20 defined by the lower generally rectangular housing. If desired, a screen 21 may be disposed in port 19 to filter out impurities in the incoming liquid. A pair of radially facing opposed ports 22 and 23 are disposed in walls 11 and 12 respectively of the lower housing. These ports are shaped to provide seats for valves 24 and 25 which are connected by a tension spring 26. The spring urges the valves toward each other and against their respective seats.
Similarly, outlet passage 18 communicates through an axially facing port 27 in head 1 into a valve outlet chamber 28 diametrically opposed from chamber 20 and defined by the upper generally rectangular housing. A pair of radially facing opposed ports 29 and 30 are disposed in walls 11 and 12 respectively of the upper housing. These ports are also shaped to provide seats for valves 31 and 32 which are connected by a compression spring 33. The spring urges the valves apart and against their respective seats.
Valve 25 provides radial communication between inlet chamber 20 and a relatively large dome-shaped outer pump chamber 34 confined between cylinder 15—wall 12 and the housing formed by cap 4—flange 2. Outer chamber 34, in turn communicates through valve 32 radially to outlet chamber 28. Similarly, valve 24 provides radial communication from inlet chamber 20 to fill a central chamber 35 in the piston and a pump chamber 36 confined between cylinder 15 and member 10. Central chamber 35, in turn, communicates through valve 31 into outlet chamber 28.
It is thus apparent that the pump includes two valve chambers 20, 28 including associated valve mechanism, and two main chambers 34, 36 which are separated by the movable dome-like cylinder 15 and connected to the valve chambers.
In operation of the device, as hand lever 14 is moved to the left with a resulting leftward movement of shaft 13 and cylinder 15, valve 24 opens to draw fluid from inlet passage 17 and through port 19, valve chamber 20, and into chambers 35 and 36. At the same time, valve 32 opens so that fluid in outer pump chamber 34 discharges through port 27 and outlet passage 18. Valves 25 and 31 remain closed. As shaft 13 and cylinder 15 are moved rightwardly, valve 25 opens to draw fluid through port 19, chamber 20 and into outer pump chamber 34. At the same time, valve 31 opens so that fluid in chambers 35 and 36 discharge through chamber 28, port 27 and outlet passage 18. Valves 24 and 32 remain closed.
The pump is thus double acting, and provides a construction wherein generally concentric main chambers alternately and in opposite sequence fill and discharge in response to reciprocating movement of the cylinder which separates them. Pump intake and discharge is relatively continuous.
The utilization of a fixed piston which carries the valve mechanism substantially reduces maintenance problems caused by shocks and vibrations on moving piston-valve structures. The parts of the device are easily manufactured by die casting and press forming techniques, eliminating the necessity of extensive machining.
With the pump of the present invention, mechanical motion is limited to the displacement cylinder and its connecting shaft only, thereby eliminating shock and abuses to components that might otherwise reciprocate as the pump is actuated. Normal life expectancy is extended considerably by means of the axially disposed concentric cylinder and shaft assembly which is easily revolved 180°. This feature contributes towards uniform wear distribution, whereas ordinary pumps tend to wear excessively from abrasive particles settling in the lower portion of the cylinder.
In addition, a relatively large pump output is obtainable. For example, with a pump having about 16 cu. in. displacement and a bore and stroke of a little over 1 inch each, the pump capacity is about 18 gallons per 100 strokes.
Various modes of carrying out the invention are contemplated as being within the scope of the following claims and particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.
1. A pump comprising:
(a) an enclosed housing,
(b) a fixed piston disposed within said housing,
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(c) an axially movable cylinder disposed within said housing and sealingly engaging said piston, said cylinder being of a configuration to separate the space therein into generally concentric confined inner and outer pump chambers,

(d) inlet and outlet port means for said pump,

(e) means for reciprocating said cylinder,

(f) and valve means disposed in said piston and between said chambers and said port means to cause alternate filling and discharge of said chambers in opposite sequence upon reciprocation of said cylinder.

2. A pump comprising:

(a) an enclosed housing,

(b) a fixed piston disposed within said housing,

(c) a reciprocable cylinder sealingly engaged with the exterior of said piston and extending to adjacent one end of said housing,

(1) said cylinder having a similar configuration as the said one end of the housing and separating the space between the housing and piston into inner and outer generally concentric pump chambers,

(d) means for reciprocating said cylinder,

(e) and means to cause alternate filling and discharge of said chambers in opposite sequence upon reciprocation of said cylinder relative to said housing and piston.

3. A pump comprising:

(a) an enclosed housing,

(b) a fixed piston disposed within said housing and adjacent one end thereof,

(c) an axially movable cylinder disposed within said housing and adjacent the other end thereof and in sealing engagement with said piston,

(d) said housing, piston and cylinder forming:

(1) an outer pump chamber confined generally between said housing and said cylinder,

(2) and an inner pump chamber confined generally between said cylinder and said piston,

(e) fluid inlet and outlet means communicating with said piston,

(f) and valve means communicating between the chambers of said pump.

9. (g) and means connected to said cylinder to reciprocate the latter.

4. A pump comprising:

(a) an enclosed housing,

(b) a fixed piston disposed at one end of said housing, said piston forming an inlet valve chamber and an outlet valve chamber,

(c) inlet and outlet port means in said housing and communicating with the said valve respective chambers,

(d) a reciprocable cylinder sealingly engaged with the exterior of said piston and extending to adjacent the other end of said housing,

(1) said cylinder having a similar configuration as the said one end of the housing and separating the space between the housing and piston into inner and outer generally concentric pump chambers,

(e) fluid flow control valve means in said valve chambers and communicating between the latter and said pump chambers,

(f) and means to reciprocate said cylinder within said housing so that said valve means causes alternate filling and discharge of said pump chambers in opposite sequence with relatively continuous intake and discharge of fluid through said inlet and outlet port means.

5. A double-action pump comprising:

(a) an enclosed housing,

(b) a fixed piston disposed at one end of said housing, said piston forming an inlet valve chamber and an outlet valve chamber,

(c) axially facing inlet and outlet ports in said housing and communicating with the said respective valve chambers,

(d) a central axial shaft extending through said piston from outside said housing,

(e) a reciprocable cylinder secured to the inner end of said shaft sealingly engaged with the exterior of said piston and extending to adjacent one end of said housing,

(f) said cylinder having a similar configuration as the said one end of the housing and separating the space between the housing and piston into inner and outer generally concentric pump chambers,

(g) a central chamber in said piston and connecting said inner pump chamber with the other of each said pair of radially facing ports,

(h) valve means disposed at each port in each valve chamber,

(i) tension means biasing the valve means in said inlet valve chamber to closed position,

(j) compression means biasing the valve means in said outlet valve chamber to closed position,

(k) and means to reciprocate said shaft and cylinder so that said valve means causes alternate filling and discharge of said pump chambers in opposite sequence with relatively continuous intake and discharge of fluid through said inlet and outlet ports.

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