June 12, 1956 E. BAHNIUK 2,749,845

PUMP

Filed April 25, 1955

Fig.1

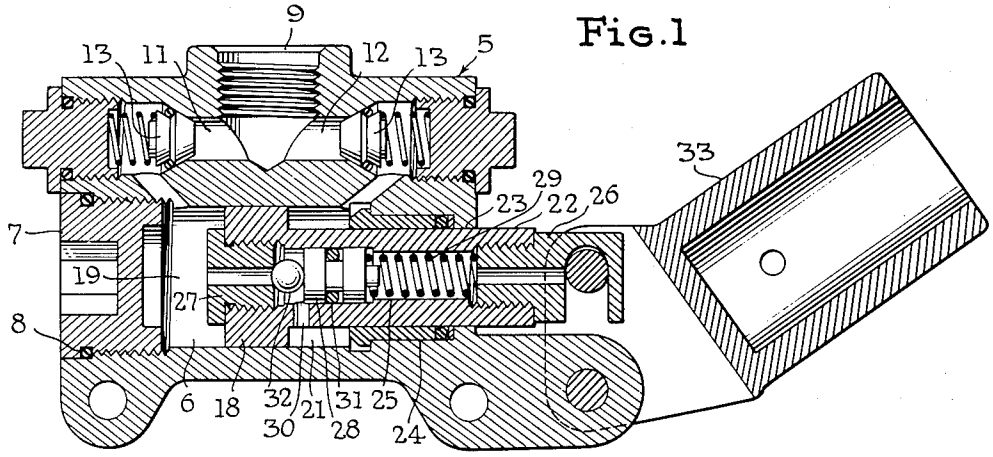


Fig.2

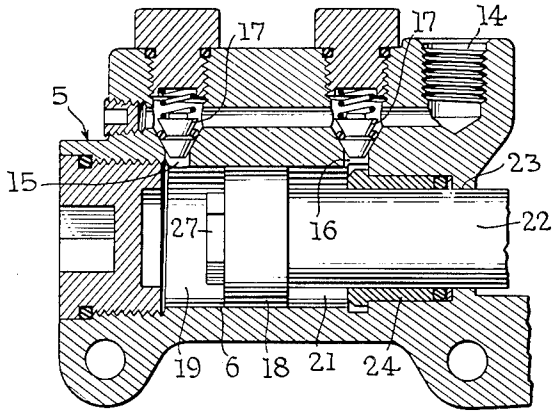
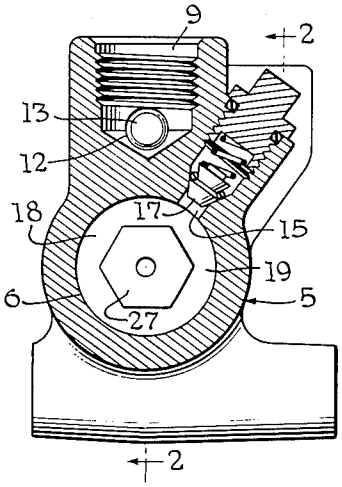


Fig.3



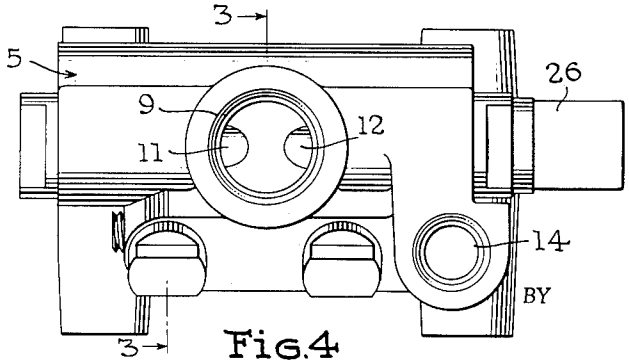


Fig.4

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Eugene Bahniuk, Parma Heights, Ohio, assignor to The New York Air Brake Company, a corporation of New Jersey

Application April 25, 1955, Serial No. 503,454

2 Claims. (Cl. 103—175)

This invention relates to piston pumps. Specifically it relates to a double-acting piston pump for hydraulic liquids.

In hydraulic pumps used to supply liquid to motors such as brake motors, jack motors or the like it is desirable to afford two phases of operation; namely a first phase during which the pump delivers a relatively large amount of liquid at a moderate pressure and a second phase in which the liquid is delivered at a higher pressure and at a lower rate of delivery. Applicant's copending application, Serial No. 370,371, filed July 27, 1953, discloses and claims a single acting pump in which this general objective is realized. According to the present invention a double-acting pump is realized.

This double-acting pump comprises a housing having a pump cylinder. A piston is reciprocable in the pump cylinder and is provided with a stem which projects outward through one of the cylinder heads.

The area of this stem is preferably one half that of the piston face so that the volume swept by the annular portion is half of the volume swept by the entire piston. Valve controlled inlet ports communicate with the cylinder bore at the opposite ends thereof. Similarly, valve controlled discharge ports are placed at each end of the bore. A flow passage extends through the piston and is normally closed by a valve. Means exposed to the pressure in the working spaces is provided and normally serves to bias said valve closed. When the pressure exceeds a predetermined amount the valve is opened so that the working spaces are in communication.

When this normally closed valve is opened the force required to move the piston is the same whether fluid is displaced from the larger or the smaller working space. This gives rise to an even stroke if the pump is manually operated and balanced loads on the prime mover if it is mechanically driven.

A preferred embodiment of the invention will be described having reference to the accompanying drawing in which:

Figure 1 is an axial section of the pump.

Figure 2 is a section on line 2—2 of Figure 3.

Figure 3 is a section taken on line 3—3 of Figure 4.

Figure 4 is a top plan view of the pump.

The pump housing is indicated by the reference numeral 5. A cylinder bore 6 is formed in housing 5. It is closed at one end by screw plug 7. An O ring 8 prevents leakage around the plug.

An inlet connection 9 is formed in the housing and communicates with branches 11 and 12 which connect with opposite ends of the bore 6. An inlet check valve 13 is provided in each branch.

An outlet connection 14 is provided. It communicates with opposite ends of the bore 6 through ports 15 and 16. Ports 15 and 16 each has a check valve 17 therein which permits outward flow and inhibits reverse flow.

A piston 18 is reciprocable in the bore 6 and defines therein two working spaces 19 and 21. A stem 22 extends outward from piston 18 through an aperture 23.

A suitable packing 24 is provided to prevent leakage along the stem 22.

An axial bore 25 is provided through the piston 18 and stem 22. Its outer end is closed by a plug 26. A valve seat bushing 27 is screwed into the other end of the bore 25. An abutment 28 is reciprocable in the bore 25 and is biased toward the seat 27 by the spring 29. A suitable packing 31 is provided on the abutment. A ball valve 32 is urged against seat 27 by the abutment 28. A side port 30 extends from bore 25 to working space 21.

A handle receiving socket 33 is connected so as to cause reciprocation of the piston 18.

During initial operation of the pump the discharge pressure is below a predetermined value and the valve 32 is seated. During this phase of the operation liquid is drawn into space 19 and 21 in alternation and discharged through the connection 14. When discharge pressure reaches a predetermined value, the valve 32 will be unseated and abutment 28 exposed to the pressure existing in space 19. The area of abutment 28 is larger than that of the valve seat 27, thus the valve 32 will not be reseated thereby until the discharge pressure drops below this predetermined value.

During operation with valve 32 unseated, movement of the piston 18 to the left as shown in Figure 1 results in liquid flowing from space 19 through the port 30 into space 21.

The displacement from space 21 being smaller than that from space 19, results in the balance of the liquid being displaced through port 15 to the discharge 14. During motion to the right, the ball valve 32 acts as a check valve and is reseated. Liquid is therefore displaced through the port 16. As the piston 18 moves to the right, liquid is drawn into the space 19 from the inlet 9.

It will be apparent that the total displacement during each to and fro movement of the piston is reduced when the predetermined value of discharge pressure has been reached or is exceeded. Preferably the area of the piston 18 is twice the area of stem 22. In this way the effective area of the piston is one half of its total area regardless of its direction of motion. This means that the stroke is balanced and gives rise to even operation which is advantageous whether the pump is manually or power driven.

The two to one ratio of these areas can be varied, particularly if greater pressure multiplication than two to one is desired between first phase and second phase operation.

What is claimed is:

1. A double-acting reciprocating piston pump comprising a housing having a closed cylinder bore therein, said housing having an aperture through one end wall of said bore; a piston and piston stem assembly reciprocable in said bore and defining therein a first and second working space, said piston stem extending outward through said aperture; means affording a valve controlled inlet connected to both working spaces; means affording a valve-controlled discharge connection from each working space, said piston having an opening extending axially through said assembly; check valve means controlling flow through said opening and arranged to inhibit flow from the smaller to the larger working space; a motor carried by the assembly and biased to close said valve and urged by discharge pressure toward a position in which said valve may open to permit flow from the larger to the smaller working space.

2. The combination defined in claim 1 in which the area of said piston is twice that of the piston stem.

No references cited.