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HYDRAULIC PUMP USING BALLS AS PISTONS

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Fig. 1.

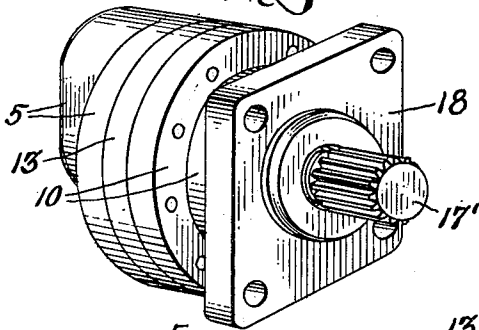


Fig. 2.

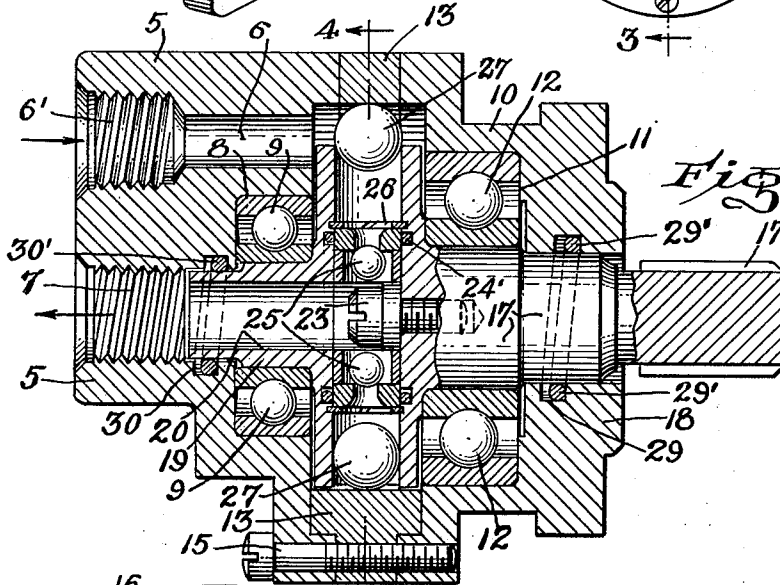
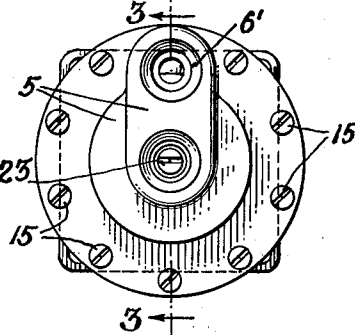


Fig. 3.

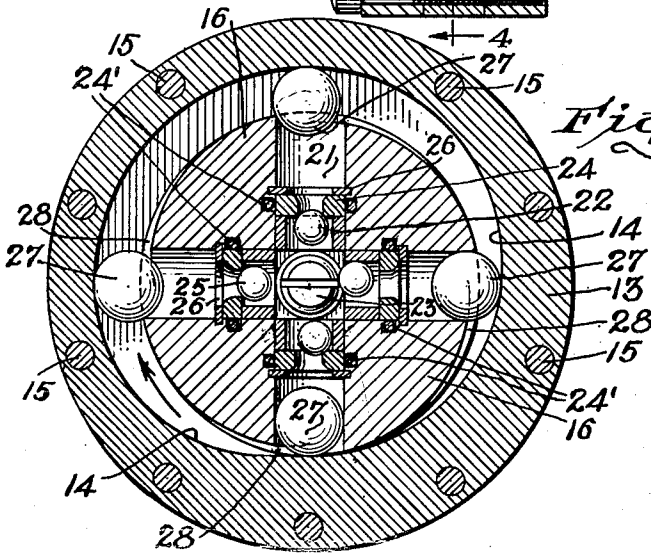


Fig. 4.

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HYDRAULIC PUMP USING BALLS AS PISTONS

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7 Claims. (Cl. 103-161)

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This invention relates to Hydraulic pumps using balls as pistons, and of the character shown and described in my allowed pending patent application having Serial No. 88,185, now Patent No. 2,543,796 issued March 6, 1951, and more particularly to a fluid pumping mechanism in which steel balls function in cylinders as pistons instead of the standard pistons with piston rods.

In the present invention, while I use steel balls as pistons, I have developed and perfected a mechanism in which the use of springs to move said balls is entirely eliminated, and in which centrifugal force is relied upon for moving said balls outwardly in their respective cylinders, and in which an eccentric cam surface is used for moving said balls inwardly on the pumping strokes.

I have also developed in connection therewith ball check valves which are also moved by centrifugal force instead of by means of springs, said ball check valves being seated by centrifugal force as the ball piston associated therewith is moved outwardly in its cylinder.

I accomplished this by providing a casing with a rotor rotatably mounted therein, said rotor having a plurality of radially disposed bores or cylinders therein, open at their outer ends and in communication with the intake connection of said casing, with a check valve seat and ball check valve in the inner end of said bore or cylinder, the check valve end of said cylinder being in communication with the discharge connection of said casing.

In order to fully explain my invention, I have shown on the accompanying sheet of drawings one practical embodiment thereof, which I will now describe. In the drawings:

Figure 1 is a perspective view of a hydraulic pump embodying my invention;

Figure 2 is an end elevation, from the rearward end of Fig. 1;

Figure 3 is a vertical longitudinal sectional view taken on line 3-3 on Fig. 2, and enlarged;

Figure 4 is a cross sectional view taken on the line 4-4 on Fig. 3, Figs. 3 and 4 being substantially full size drawings.

Referring now more in detail to the drawings, the body or casing of the invention, as here illustrated for explanatory purposes, is shown in three parts bolted together. A rearward body part 5 is shown and in which an intake passage or connection 6, is shown threaded in its outer end, as at 6', for connecting a pipe therewith. Said body part 5 also has formed therein an outlet or discharge connection, designated 7, which is also threaded for the connection of an outflow or discharge pipe therewith. Said body part 5 also has formed therein an annular recess, designated 8, to receive a ball-bearing set, designated as a whole 9, and clearly illustrated in Fig. 3.

The opposite body part is designated 10, and is also formed with an annular recess 11 therein to receive a ball-bearing set, designated as a whole 12.

Clamped between said two body parts is a body

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ring member 13, having its opening eccentrically positioned, designated 14, as will be understood by reference to Fig. 4, said body parts 5 and 10, and said body ring 13, being bolted together by screw bolts, as 15.

Rotatably mounted in said body ring 13, and said body parts 5 and 10, is a rotor having a central solid body portion, as 16, with a shaft portion, designated 17, and extended therefrom through the ball-bearing set 12, in the body part 10, and out through a head portion, designated 18. Said shaft portion is shown with two sizes or diameters and is provided on its extended end with gear teeth, as 17', lengthwise thereof, as seen in Fig. 1.

From the opposite side of said rotor body 16 is a second shaft member or portion 19, having a bore 20 therethrough and in end to end alignment with the discharge connection at 7, as clearly shown in Fig. 3. Thus I have a rotor rotatably mounted in an eccentrically positioned chamber formed in the body ring 13, and between the two body parts 5 and 10.

Said solid body portion 16 has four radially disposed bores or cylinders, as 21, 21, formed therein and which intersect at the center of said rotor and communicate with the bore 20, in the shaft portion 19, as seen in Fig. 3.

Four ball check valve mechanisms are seated in the inner ends of said bores or cylinders, 21, 21. Each consists of a ring or collar 22, resting on the head of a screw bolt 23, screwed into the inner end of the shaft portion 17, as clearly seen in Fig. 3, and also in Fig. 4. Said screw bolt head forms an effective and convenient support for said collars.

Resting on said collars, 22, 22, are valve-seat rings or members, as 24, 24, with a ball valve as 25 in the collar 22, to seat in the opening in said valve-seat ring or member, in each place as shown. Said valve-seat mechanisms are held in place by split rings, as 26, set in the wall of each cylinder 21, adjacent the valve-seat ring 24, as seen in Figs. 3 and 4. Said screw bolt 23 also serves to prevent the ball valves 25, 25, from going out with fluid through the discharge connection at 7, as will be understood from Fig. 3.

Around each of said valve-seat rings 24, 24, is an O ring or packing, designated 24' in each place, and shown in section in Figs. 3 and 4.

Four steel balls, as 27, 27, operate in the outer ends of said bores or cylinders 21, 21, as clearly shown, and at their outer sides said balls ride or turn on the eccentric wall 14 of the body ring 13, as indicated in Fig. 4.

By reference to Fig. 4, said four cylinders 21, 21, at their outer ends, and on their advancing sides, are cut away slightly, as indicated at 28, 28. The following side of the open end of each cylinder 21 is full and flush with the circle of said rotor.

Mounted around the shaft portions 17 and 19, in annular grooves 29 and 30, which are slightly tilted, as indicated, are O rings or packed rings, as 29' and 30'. This arrangement makes for better

lubrication as said packing rings bear on said shaft portions as they revolve. This special arrangement also prevents scoring the shaft portions, as there is a wiping or shearing movement thereon as said shaft portions turn therein, and as the mechanism is filled with oil, the lubrication is more effective than if the ring packings were straight instead of tilted.

Thus I have provided what I believe to be a new feature in hydraulic pumps in which balls are used for pistons, and that new feature is the elimination of springs for moving the balls and to provide an arrangement in which the steel ball pistons are moved outwardly by centrifugal force, and are moved inwardly on the pumping stroke by the eccentric cam surface of the chamber in which they revolve. Also, I have provided ball check valves in cooperation with said ball pistons and which are moved by centrifugal force into their seats as said ball pistons are moved outwardly.

In operation, it will be understood that the pump is filled with oil under considerable pressure, and the rotor is power driven. The movement of one of the ball pistons outwardly by centrifugal force tends to create a vacuum in the cylinder and as the ball reaches the outermost position, oil is sucked into the cylinder around the ball piston in the outer open end of the cylinder, the ball check valve closing the valve-seat at the inner end of said cylinder, as seen in Fig. 4, at the top thereof. At the same time, the lower ball piston 27 is being moved into the cylinder by the eccentric wall surface 14, and its check valve is open and the oil is being forced out through the passageway 29 to the discharge connection 7. Thus the ball pistons are successively thrown outwardly in their cylinders by centrifugal force and moved inwardly by the eccentric cam surface 14 of the chamber in which the rotor is driven, this positive movement inwardly being the pumping stroke of the ball piston.

I do not limit my invention to the details of construction and arrangement shown for explanatory purposes, except as I may be limited by a fair interpretation of the claims hereto appended as a part of this specification.

I claim:

1. A pumping mechanism including a casing having intake and discharge connections therefor, a chamber within the casing, passage means connecting said intake with said chamber, a rotor revolvably mounted in said chamber and having a plurality of cylinders radially disposed therein with their outer ends open and in communication with said chamber and with the intake of said casing, and with their inner ends in communication with the discharge connection of said casing, a steel ball in each of said cylinders to function as a piston therein, and movable outwardly by centrifugal force as said rotor is revolved, said casing having as a part thereof a body ring forming an eccentrically positioned part of said chamber in which said rotor revolves, with the open ends of said cylinders moving near the inner surface of said body ring, whereby said ball pistons are moved inwardly in said cylinders by said body ring, on a pumping stroke, as they move on the eccentric wall of said body ring for a portion of its circumference, and check valve mechanism in the inner end of each of said cylinders, and operable to permit outflow from and to prevent back flow to said cylinder, in cooperation with its ball piston.

2. A hydraulic pump as set forth in claim 1 in

which the cylinders in said rotor are open at their outer ends also have the advancing sides of said cylinders cut away slightly around a part of the circle of said rotor forwardly from the advancing side of each cylinder.

3. A pumping mechanism as set forth in claim 1 in which the check valve mechanism includes a valve seat and a ball valve moved by centrifugal force to close said valve seat as its ball piston is moved outwardly by centrifugal force.

4. A hydraulic pump as set forth in claim 3, in which the check valves in the inner ends of said cylinders each includes a collar in the inner end of the cylinder, a valve-seat ring on said collar, and a ball valve in said collar to seat outwardly on the valve-seat ring, said ball valve being seated by centrifugal force.

5. A hydraulic pump as set forth in claim 4, in which a screw bolt head is positioned adjacent the inner ends of said cylinders, in alignment with the exhaust connection, and holds all of said collars in the open inner ends of said cylinders.

6. In a hydraulic pump, a casing having intake and discharge connections, means forming an eccentrically positioned annular chamber in said casing, a rotor revolvably mounted in said chamber and having a plurality of radially disposed cylinders with their outer ends open and in communication with said chamber and with the intake connection to said casing, the inner ends of said cylinders being in communication with the discharge connection of said casing, ball bearing means for said rotor, means for driving said rotor, a steel ball piston in the open end of each cylinder and movable inwardly by the eccentric wall of said chamber for a part of its circumference on a pumping stroke as said rotor is revolved, said ball piston being movable outwardly in said cylinder by centrifugal force, and a ball check valve in the inner end of each cylinder to prevent back flow, as said ball piston is moved outwardly by centrifugal force.

7. In a hydraulic pump: a casing having an annular chamber therein, intake and discharge connections for said casing, said chamber being eccentrically positioned in said casing, a rotor revolvably mounted in said chamber, said rotor having a plurality of radially disposed cylinders therein with their outer ends open and in communication with said chamber and with the intake of said casing, and having their inner ends in communication with the discharge connection from said casing, a ball in each of said cylinders to function as a piston therein and movable outwardly therein as said rotor is revolved, a check valve seat in the inner end of each cylinder, a ball to seat thereon, by centrifugal force, as a check valve, means for driving said rotor, said ball piston being moved inwardly into its cylinder by the eccentric wall of said chamber during a part of its circumference on a pumping stroke, said ball piston and said ball check valve being movable outwardly by centrifugal force.

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