Nov. 27, 1951 W. B. ESLEY 2,576,175

ROTARY PISTON PUMP

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Fig. 1.

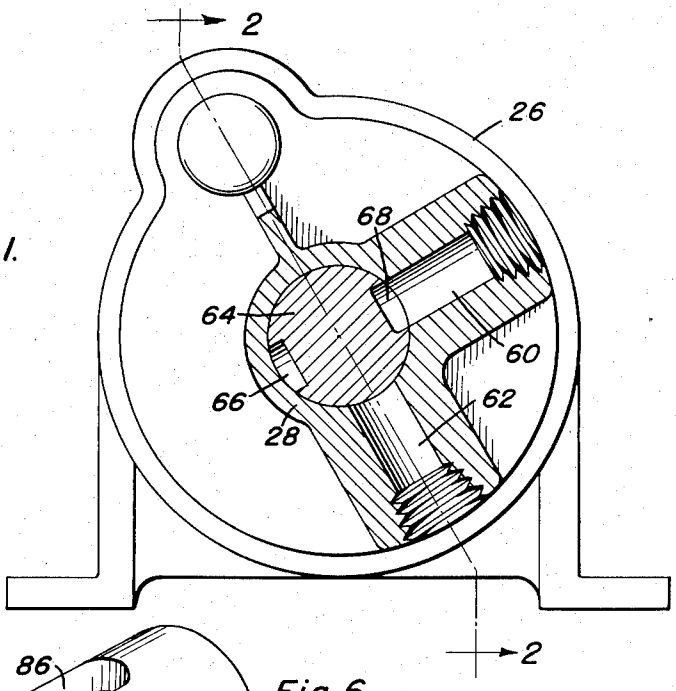
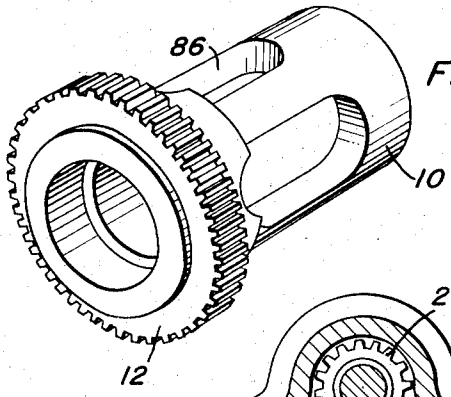


Fig. 6.



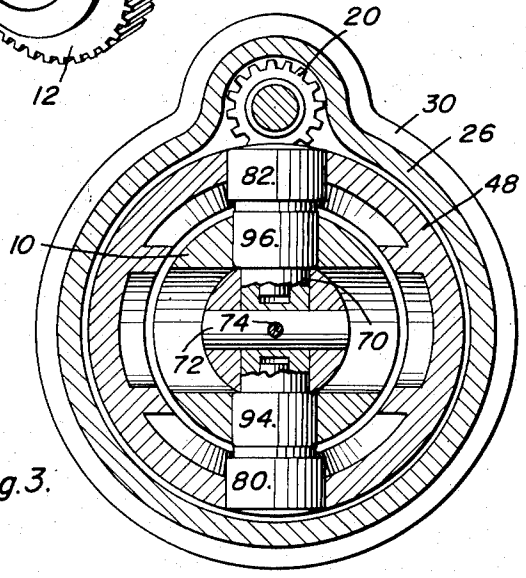


Fig. 3.

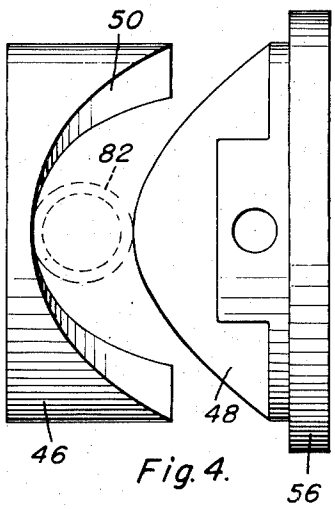


Fig. 4.

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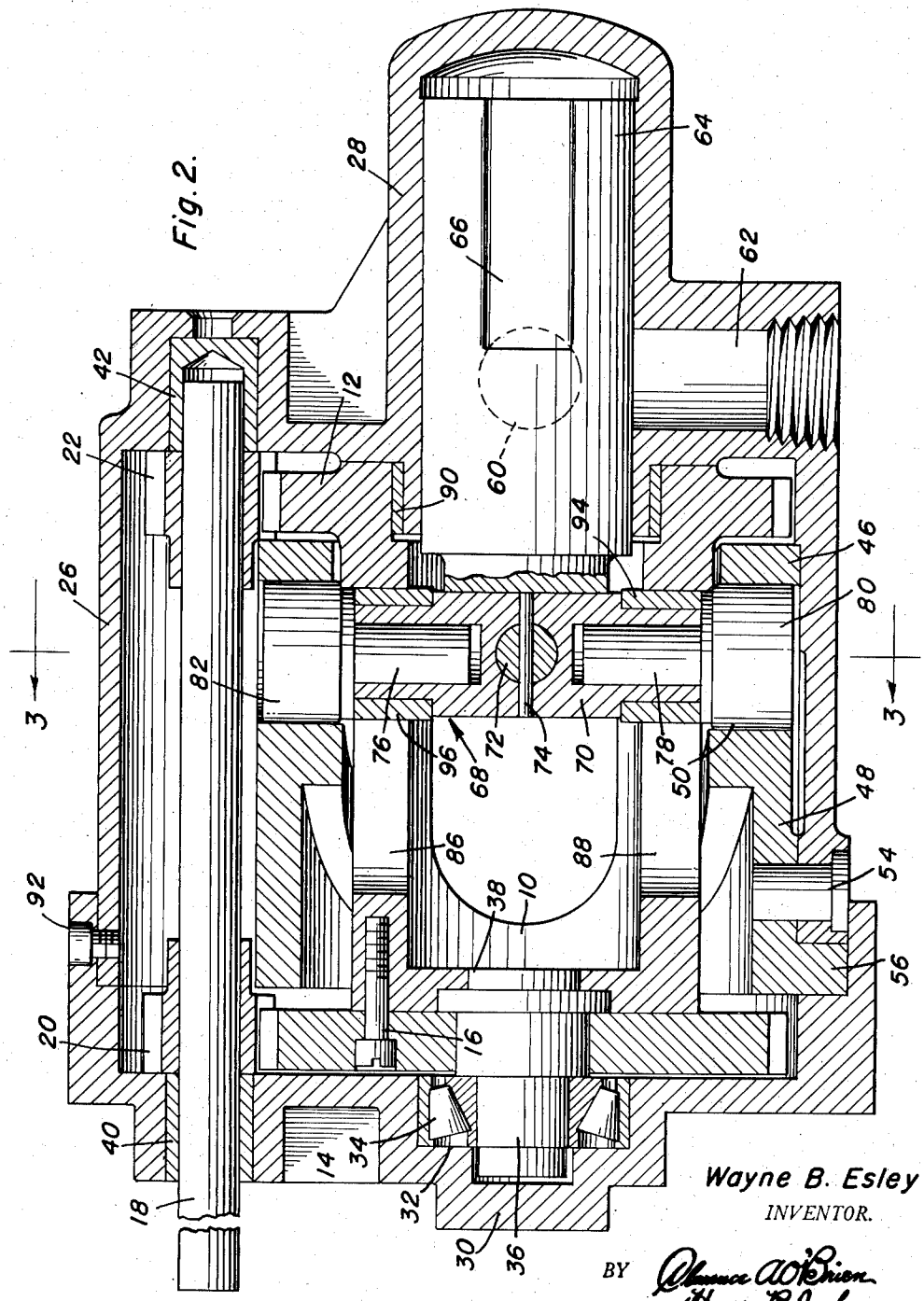
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Fig. 2.



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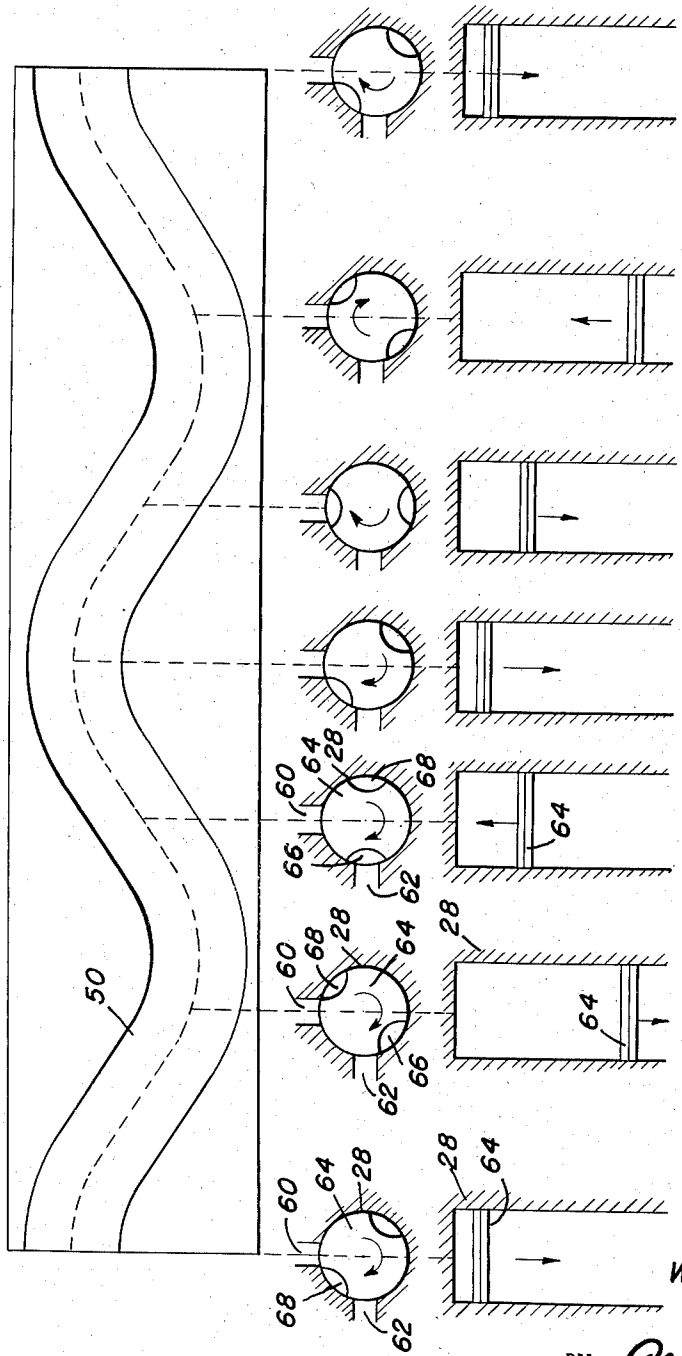


Fig. 5.

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UNITED STATES PATENT OFFICE

2,576,175

ROTARY PISTON PUMP

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Application August 11, 1949, Serial No. 109,729

2 Claims. (Cl. 103—157)

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This invention relates to novel and useful improvements in pumps.

An object of this invention is to pump a fluid into and out of a pump chamber by means of a combination piston and valve which is rotatively and reciprocatively mounted in the pump chamber, the piston having a pair of pockets or ports therein which communicate progressively with the inlet and the outlet of the pump chamber to transfer the lifted fluid from the inlet to the outlet.

Another object of this invention is to operate a piston in a pump barrel or cylinder by means of an operating shaft which has a pair of pinions spaced from each other and fixed thereto, the pinions being enmeshed with a pair of gears which are carried by and fixedly secured to a cage, the cage being rotatively mounted within the pump housing or case together with means for causing the piston to rotate and reciprocate while rotating.

A further object of this invention is to lift fluid by a pumping action, which action includes the reciprocatory movement of a piston together with full 360 degree rotation of the piston while it is being reciprocated, the pump housing having a cylinder within which the piston operates and suitable inlet and outlet members to conduct the fluid. One of the features of such an arrangement is the smoothness of operation. The means for imparting such movement to the piston includes a stationary member having a cam track so that a cam follower rides in a path substantially defined as a sinusoidal wave, and the means also includes a rotary cage which is disposed in the pump housing having a pair of longitudinal slots therein so as to guide the cam follower and also so as to impart rotary movement to the cam follower.

Another feature of the invention is the operation of the cage (rotative movement) from the torque of the operating shaft which is delivered to the cage at two spaced positions, preferably at the front and rear of the cage thereby minimizing the torsional load in the cage and tending to cause a smoother operation of the cage.

Ancillary objects and features of novelty will become apparent in following the description of the preferred form of the invention, illustrated in the accompanying drawings, wherein:

Figure 1 is a sectional view showing particularly the shape of the housing, the inlet and outlet communicating with the cylinder which has the piston disposed therein;

Figure 2 is a sectional view taken on the line 2—2 of Figure 1 and in the direction of the arrows;

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Figure 3 is a transverse sectional view taken substantially on the line 3—3 of Figure 2 and in the direction of the arrows;

Figure 4 is a plan view of the cam track which is formed in the structural member disposed within the pump housing for the purpose of providing such a cam track;

Figure 5 is a schematic view showing a flat development of the cam track together with related piston positions and valve port or pocket positions;

Figure 6 is a perspective view of the cage which is rotatively disposed within the housing and which is used for imparting rotative movement to the cam follower which is, in turn, reflected in rotative movement of the piston.

Various types of pumps are well known in the art. There are pumps which use the principle of reciprocating a piston by means of cam action, the reciprocation taking place while the piston is rotating.

The present invention improves the structure and hence, the operation of such pumps by the inclusion of the drive member which is termed a cage 10 having the gear 12 fixed at one end and the gear 14 fixed at the other end thereof as by means of screws 16. The gear 12 is preferably integral with the cage 10, while the other gear 14 is detachable. By the utility of such an arrangement the torque of the operating shaft 18 is transferred to rotative movement of the cage 10 through the pinions 20 and 22 at two spaced positions thereby providing a positive drive and thereby applying the torsional load in the cage 10 at two spaced points so that it will not be concentrated. This obviously lessens the tendency for exceeding the allowable shear in the cage.

The housing or case 26 for the pump has a barrel or cylinder 28 formed integrally with one end thereof and includes an end plate 30. The end plate 30 has a bearing seat 32 therein accommodating the conventional anti-friction thrust bearing 34. This thrust bearing supports the shaft 36 which is secured within the end 38 of the cage 10.

The shaft 18 is mounted in a bearing 40 which is disposed in a suitable opening in the end plate 30 and also in a bearing 42 having a closed end, which is carried by the housing 26.

The pinions 20 and 22 are fixed to the shaft 18 in such position as to be enmeshed with the said gears 14 and 12. The longitudinal axis of the

shaft 18 and the longitudinal axis of the cage 10 are parallel to each other.

Fixed within and to the casing 26 is a pair of members 46 and 48 (Figure 4) which forms a cam track 50. The cam track is of such shape as to simulate a sinusoidal wave when developed or laid out on a plane surface (Figure 5). At the two points of highest amplitude of the wave, which are 180 degrees of rotation away from each other, a condition exists within the pump structure corresponding to full exhaust in an ordinary reciprocation type pump.

The members 46 and 48 may be fixed within the housing 26 by any suitable means, as the dowel pin 54 illustrated in Figure 2. The peripheral flange 56 abutting an end portion of the housing 26 assists in maintaining the members 48 in firm locked position within the housing 26.

An inlet 60 communicates with the cylinder 28 forming the pump chamber and an outlet 62 disposed at substantially 90 degrees with respect thereto also communicates with the pump chamber. The piston 64 is a combination piston and valve, since it is used in the capacity of a piston and it is also used for opening and closing the inlet and outlet 60 and 62, respectively. Longitudinal pockets or ports 66 and 68 are formed in the wall of the piston 64 and they communicate successively with the inlet and outlet.

Means for reciprocating and for rotating the piston 64 is provided. This means consists of a cam follower generally indicated at 68 and consisting specifically of an arm 70 having the pin 72 passed therethrough and also through the inner end of the piston 64. A locking dowel type pin 74 is passed through the arm 70 and also the pin 72.

Studs 76 and 78, respectively, are disposed in bores provided in the arm 70 and have rollers 80 and 82, respectively, carried thereby. These rollers are disposed in the cam track 50 and are passed through longitudinal slots 86 and 88 which are formed in the cage 10.

Aside from various bearing inserts, as the insert 90 for the gear 12, the essential portions of the structure have been described. It is obvious that the end plate 30 is fixed to the housing 26 by means of bolts 92 or other equivalent members. It is also apparent that the entire mechanism exclusive of that involved in the pump chamber, may be sealed in a suitable lubricant.

In operation, torque is applied to the operating shaft 18 which is transferred through the gears to the cage 10. This cage is in alignment with the longitudinal axis of the cylinder 28 and is parallel to the shaft 18. Upon rotation of the cage 10 the arm 70 is rotated since the sleeves 94 and 96 are disposed in the slots 86 and 88, respectively. The arm 70 being fixed to the piston 64 causes the piston to rotate.

However, since the rollers 82 and 80 are disposed in the cam track 50, as the arm 70 rotates it is also reciprocated in accordance with the shape of the cam track. This shape has been described as substantially sinusoidal when developed on a plane surface. Since the pockets 66 and 68 are disposed at 180 degrees from each other and the inlet and outlet for the pump chamber are disposed at 90 degrees with respect to each other, one pocket is used for one complete operation while the second pocket follows the first one for a second fully independent operation, during the reciprocation of the piston.

Referring to Figure 5, the piston 64 is shown in the substantially fully extended position. In this condition of operation the arm 70 would have its rollers disposed substantially at the apex of each rise in the sinusoidal wave. At this time the pocket 68 is ready to become communicated with the inlet 60. As the piston rotates and is drawn inwardly of the cylinder 28, the pocket 68 passes the inlet 60 so that the fluid in the pocket 66 may be discharged through the outlet 62. This actual discharge takes place at the bottom portion of the sine wave or, when the rollers 82 and 80 are disposed at the innermost part of the cam track 50. The second stage shown in Figure 5 indicates a condition just prior to discharge of the fluid in the pocket 66.

Reference to the third stage shown in Figure 5 illustrates that the piston 64 is returning forcing the fluid which was trapped in the pocket 68.

The other stages of operation are repetitious of the previously described ones.

Having described the invention, what is claimed as new is:

1. A pump comprising a housing having a cylinder with a piston therein, an operating shaft mounted for rotation in said housing, spaced pinions fixed to said shaft, a cage rotatively mounted in bearings in said housing and being substantially parallel with said cylinder, spaced gears secured to said cage and enmeshed with said pinions whereby said cage is rotated as a result of rotation of said operating shaft, longitudinal slots in said cage, a member fixed to said housing in concentric relationship with said cage and having a cam track therein, a cam follower secured to said piston and passed through said slots and disposed in said cam track so as to impart reciprocatory movement to said piston while it is being rotated by engagement of said cam follower in the longitudinal slots of the cage, valve pockets in said piston, and an inlet and an outlet in said cylinder progressively in communication with said pockets when said piston is rotated and reciprocated.

2. A pump comprising a housing having a cylinder, a piston disposed in said cylinder, an operating shaft mounted for rotation in said housing, a gear fixed to said shaft, a cage disposed in said housing and having a longitudinal axis coaxial with the longitudinal axis of said cylinder, a gear secured to said cage and enmeshed with said first mentioned gear so that said cage is rotated in response to rotation of said operating shaft, said cage having at least one longitudinal slot therein, a member secured within said housing and having a cam track, a cam follower secured to said piston and passed through said slot and disposed in said cam track to impart reciprocatory movement to said piston while it is being rotated by engagement of said cam follower in said longitudinal slot, valve pockets in said piston, and an inlet and an outlet in said cylinder progressively in communication with said pockets when said piston is rotated and reciprocated.

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