Oct. 1, 1957 F. PAULSMEIER ET AL 2,808,006

OSCILLATING PISTON PUMP

Filed Dec. 17, 1952 2 Sheets-Sheet 1

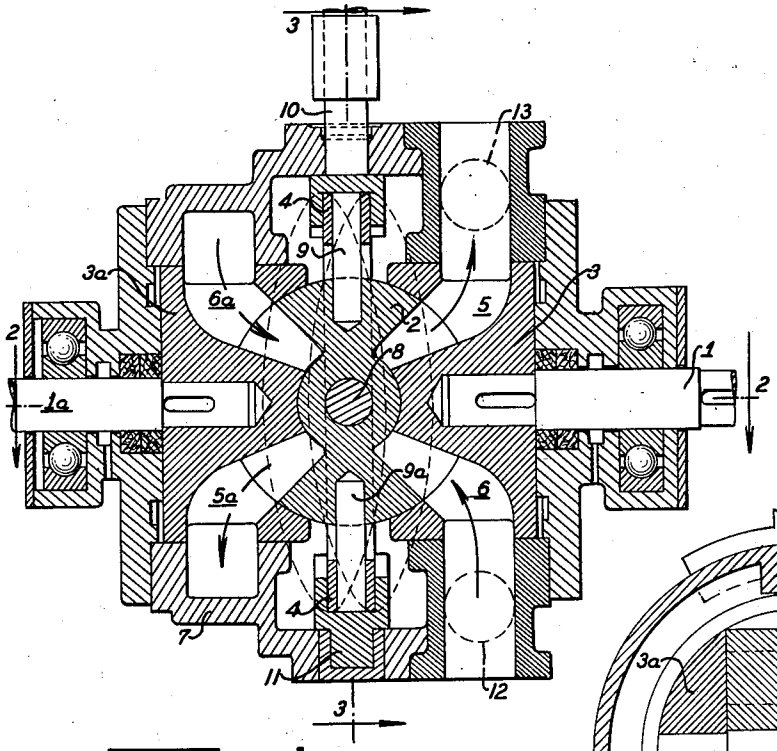


FIG. 1

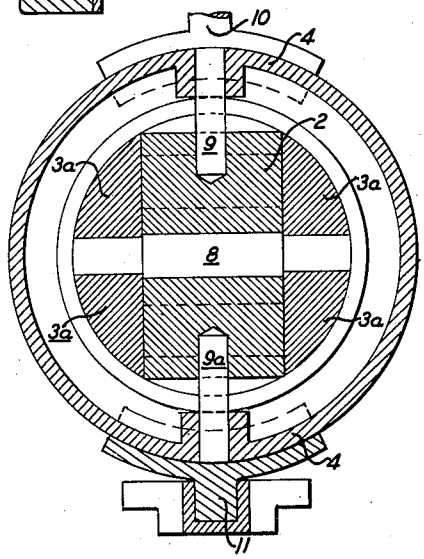


FIG. 2

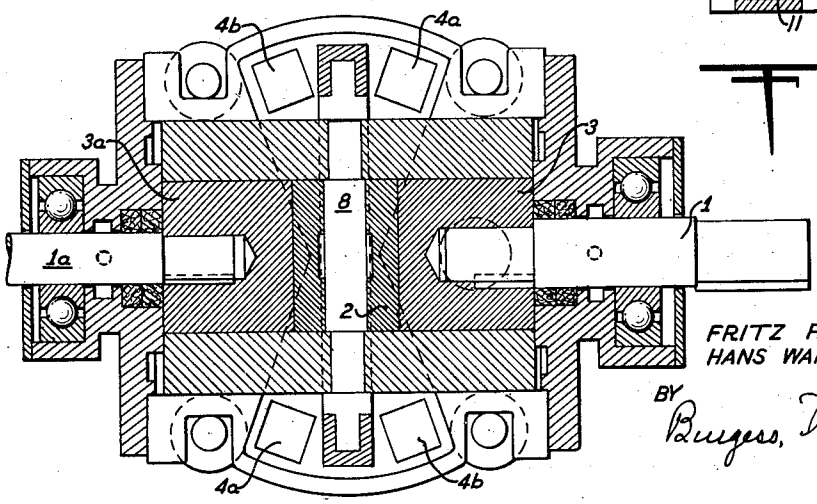


FIG. 3

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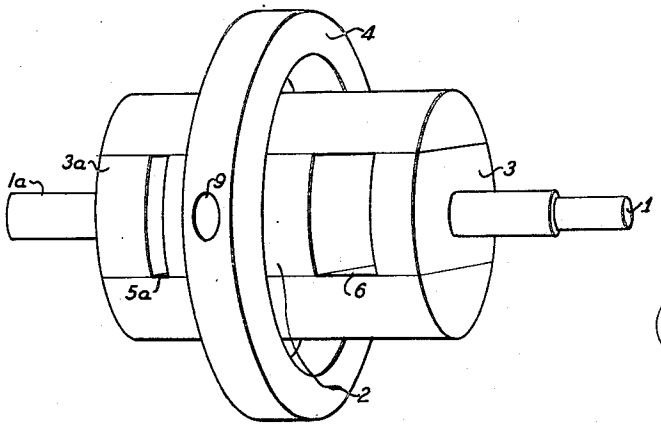


FIG. 4

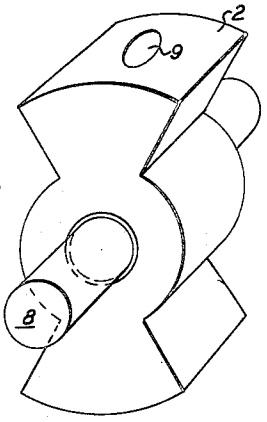


FIG. 5

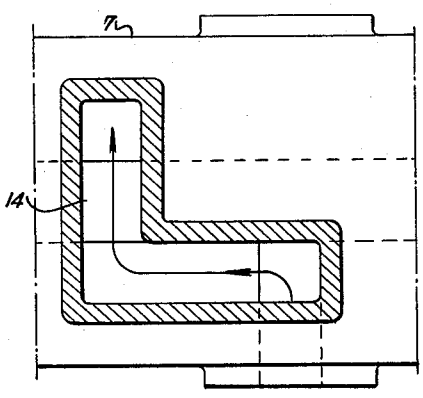


FIG. 7

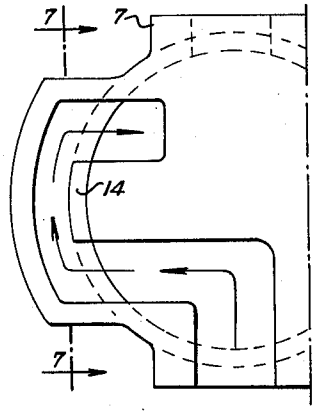


FIG. 6

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OSCILLATING PISTON PUMP

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2 Claims. (Cl. 103—117)

This invenion relates to an oscillating piston pump. It more particularly relates to a new cylindrical oscillating piston pump having a symmetrical inlet and discharge action.

Rotary universal-joint pumps having a rotary central member with an oscillating displacement piston are well known.

These conventional universal-joint oscillating piston pumps have the marked disadvantage that the liquid being conveyed will exert a unilateral unsymmetrical force on the rotor and its components. These unsymmetrical forces due to the high pressures per unit area exert extensive wear on the moving parts of the pump and cause high stresses of the rotary shafts and their bearings.

The extremely high values that these stresses reach when the pump is in operation conveying liquids is shown in the following table and indicates average values for pumps of four different sizes:

Delivery in m.³/hr.	Av. Size of the area of pressure in cm.²	At 5 atm. guage in kg.	At 10 atm. guage in kg.	At 20 atm. guage in kg.	At 50 atm. guage in kg.
5	40	200	400	800	2,000
50	200	1,000	2,000	4,000	10,000
100	450	2,250	4,500	9,000	22,500
200	700	3,500	7,000	14,000	35,000

These pressures are still further increased by the effect of the suction head formed during the pumping operation.

One object of this invention is a new cylindrical oscillating piston pump which has a symmetrical inlet and discharge action and therefore will eliminate the stresses caused by the unilateral forces of the liquid being conveyed. This and still further objects will become apparent from the following description read in conjunction with the drawing in which:

Fig. 1 is a longitudinal section of an embodiment of a pump in accordance with the invention,

Fig. 2 is a cross-section of the pump shown in Fig. 1 in the plane 2—2,

Fig. 3 is a cross-section of the pump shown in Fig. 1 through the plane 3—3,

Fig. 4 is a diagrammatic perspective view of the rotor 3—3*a*,

Fig. 5 is a diagrammatic perspective view of the piston 2,

Fig. 6 is a diagrammatic view of the housing showing the inlet and discharge passages, and

Fig. 7 is a diagrammatic sectional view taken on the line 7—7 of Fig. 6.

The new pump in accordance with the invention eliminates the stresses which occurred in the prior known pumps by effecting the suction and delivery symmetrically so that the forces produced will completely cancel out each other and the high stresses and wear caused by these stresses will be eliminated.

The symmetrical conveying of a pump in accordance with the invention will additionally eliminate the strong loads of the conveying liquid occurring in the axial direction of the drive shaft and the deflection shaft which occurred in the prior known pumps due to the unilateral conveying of the liquids.

The invention will be described in detail with reference to the embodiments shown in the drawings.

The pump rotor has two symmetrical sides 3 and 3*a* and rotates on the drive shaft 1 and the shaft 1*a* axially aligned with the drive shaft. The central portion of the rotor is hollow and is fitted with the oscillating piston 2. The piston 2 rotates with the rotor 3—3*a* and oscillates within the hollow interior of the rotor around the axis of the shaft 8. The symmetrical oscillating piston positioned for oscillatory motion around the axis of the shaft 8 within the symmetrical hollow interior of the rotor 2 forms four chambers 5, 5*a*, 6 and 6*a*. The chambers 5 and 5*a* are diagonally opposed to each other and symmetrically positioned in relation to each other on opposite sides of the axis of rotation of the rotor. The chambers 6 and 6*a* are also symmetrical in relation to each other and diagonally oppose on opposite sides of the axis of rotation of the rotor.

A guide ring 4 is positioned circumferentially around the oscillating piston 2. The plane of the guide ring 4 is inclined to the plane of rotation of the rotor as shown by the dotted lines in Fig. 1. The ring 4, as shown in Fig. 2, will, therefore, either assume the position 4*a* or 4*b*.

The ends of the oscillating piston 2 are guided in the guide ring 4 by means of the studs 9 and 9*a* which ride in the ring 4. Due to the inclined position of the guide ring 4 in relation to the plane of rotation of the rotor, the oscillating piston 2 is caused to oscillate back and forth as the shaft 1 and the rotor 3—3*a* rotate.

If the tilting of the guide ring 4 is made adjustable by means of the shaft 10 and bearing 11, then the degree of pumping action and the direction of pumping may be controlled by mere adjustment of the degree of tilting of the ring. As shown in Fig. 2 the guide ring 4 is tiltable between a position 4*a* and 4*b*. In the position 4*a*, the pump will pump in one direction to the maximum amount and in the position 4*b*, the pump will pump in the opposite direction to the maximum amount. The tilting of the guide ring 4 thus adjusts the amount that the oscillating piston 2 oscillates and the direction in which the oscillation is effected in relation to the rotation of the drive shaft 1 and rotor 3—3*a*.

Since the oscillation of the oscillating piston is controlled by the guide ring 4, it is possible to support the rotor at both ends, i. e. at the end of the driving shaft 1 and in the support shaft 1*a*.

The housing 7 which supports the rotor piston and the other parts defines the liquid inlet of the pump on the suction side 12 and the liquid outlet from the pump on the discharge side 13. The housing also defines the suction and discharge passages in communication with the chambers 5*a* and 6*a* in the hollow interior of the rotor.

In operation, the drive shaft 1 is rotated with the guide ring 4 positioned in the desired tilted position. The rotor 3—3*a* will rotate rotating the oscillating piston 2 therewith. The ends of the oscillating piston 2 carry the studs 9—9*a* which are guided in the guide ring and travel around in the guide ring. As the rotor 3—3*a* and the piston 2 thus rotate, the traveling of the studs 9 in the guide ring will cause the piston to oscillate back and forth within the hollow interior of the rotor causing pumping action in the conventional manner.

On the suction side of the pump as the piston oscillates liquid will be drawn into the chamber 6 and at the same time into the diametrically opposed chamber 6*a* as shown

by the arrows in Fig. 1. At the discharge side of the pump, liquid will be forced out of the chamber **5** and at the same time out of the diametrically opposed chamber **5***a* in the direction of the arrows. Thus all the forces of the liquid caused by the pumping will counteract each other and no undesirable and wear causing stresses will be formed as was the case in the prior known pumps.

It can be plainly seen from Fig. 1 that thus a portion of the delivery chamber lies about the plane C—D while an equal portion lies below the same plane. The same is true with the inlet chamber with equal portions lying on each side of the plane C—D. The corresponding portions of the inlet and delivery chambers are also diametrically opposed to each other. Thus for each suction or discharge action of one of these parts of the suction or discharge chambers respectively, there is a precisely diametrically opposed action of the other part. This, of course, will cause all the individual forces to cancel each other. In this manner, the injurious effects of the former unilateral loads in the known universal-joint pumps are eliminated and the new pump may be built without difficulty for the highest pressures and with the largest dimensions.

The pump may be used for the conveying of any fluids including liquids and gases. If it is desired that the pump be used as a prime mover, it is only necessary to force a fluid therethrough and utilize the rotation of the drive shaft **1** as desired.

Though the invention has been described with reference to a specific embodiment, many modifications and variations will become apparent to the skilled artisan within the spirit thereof.

Thus, the cylindrical oscillating piston pump of the applicant essentially comprises a pump housing with a rotor mounted for rotation in the housing. The rotor defines in the interior thereof a piston chamber. This piston chamber has substantially symmetrical opposed portions on opposite sides of the axis of rotation of the rotor. An oscillatory piston is positioned in the chamber defined in the interior of the rotor. The piston rotates with the rotor and oscillates on an axis which is transverse to the axis of rotation of the rotor and passes through the axis of rotation. The piston has opposed substantially symmetrical members on opposite sides of its axis of oscillation. One of these members is positioned in each of the opposed symmetrical portions of the piston chamber. The piston thus defines in the chamber symmetrical pairs of suction and discharge chambers. Each member of each pair of chambers is positioned on diametrically opposite sides of the axis of rotation of the rotor. A stationary guide ring is circumferentially positioned about the piston in a plane tilted to the plane of rotation of the rotor in guiding engagement with at least one end of the piston for causing oscillation of the piston as the rotor rotates. The pump housing defines fluid inlet and fluid outlet passages in communication with the suction and discharge chambers defined within the rotor. The rotor of the pump is connected to a drive shaft for rotation therewith.

Fig. 4 shows the cylindrical rotor **3**—**3***a* with the oscillating piston **2** with the engaged guide ring. The suction chambers **5***a* and **6** are shown dark. Whilst the contents of chamber **5***a* are discharged the chamber **6** is filled. This applies as well for the chambers **5** and **6***a* positioned on the opposite side, which are not seen in the perspective.

The shafts **1** and **1***a* show in this sketch that the rotor **3**—**3***a* is supported on two sides. By this method not only high one sided loads are avoided but also each one sided thrust due to couples of forces.

Fig. 5 shows the oscillating piston **2** with the shaft **8** and the engaging bore **9**.

Fig. 6 shows a circulation of the liquid conveyable from the flow flange **12** or the chamber **6** respectively to the chamber **6***a* positioned on a diametrically opposite side or from the flow flange **13** or the chamber **5** respectively to the chamber **5***a* positioned on a diametrically opposite side or vice versa, if the ring **4** is guided e. g. from **4***a* to **4***b* over zero-point at the same turning direction of the driving engine.

Outside of the housing **7** is the connecting- or circulating-channel guiding around the tightening zone **14**.

Fig. 6 shows the channel as per the section line *g*—*h* of Fig. 7.

We claim:

1. Cylindrical oscillating piston pump comprising a pump housing, a rotor rotationally mounted within said housing, said rotor defining in the interior thereof a piston chamber having substantially symmetrical opposed portions on opposite sides of the axis of rotation of the rotor, an oscillatory piston positioned in said chamber for rotation with said rotor and oscillation about an axis substantially transverse to said axis of rotation and passing therethrough, said piston having opposed substantially symmetrical members positioned in said opposed portions of the piston chamber to define in said chamber substantially symmetrical pairs of suction and discharge chambers, each chamber of each pair being positioned on a diametrically opposite side of said axis of rotation to the other chamber, a stationary guide ring circumferentially positioned about said piston in a plane tilted to the plane of rotation of the rotor in guiding engagement with at least one end of said piston, said guide ring being adjustably positioned in said housing for adjusting the angle of tilt thereof in relation to the plane of rotation of said rotor, said housing defining inlet and discharge passages in communication with said suction and discharge chambers, and a drive shaft connected for rotation with said rotor.

2. Pump according to claim 1 in which the ends of said opposed members of said piston are positioned in guiding engagement with said guide ring.

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