Sept. 5, 1950 W. H. MacPHERSON 2,521,236

ROTARY PUMP

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Fig. 1.

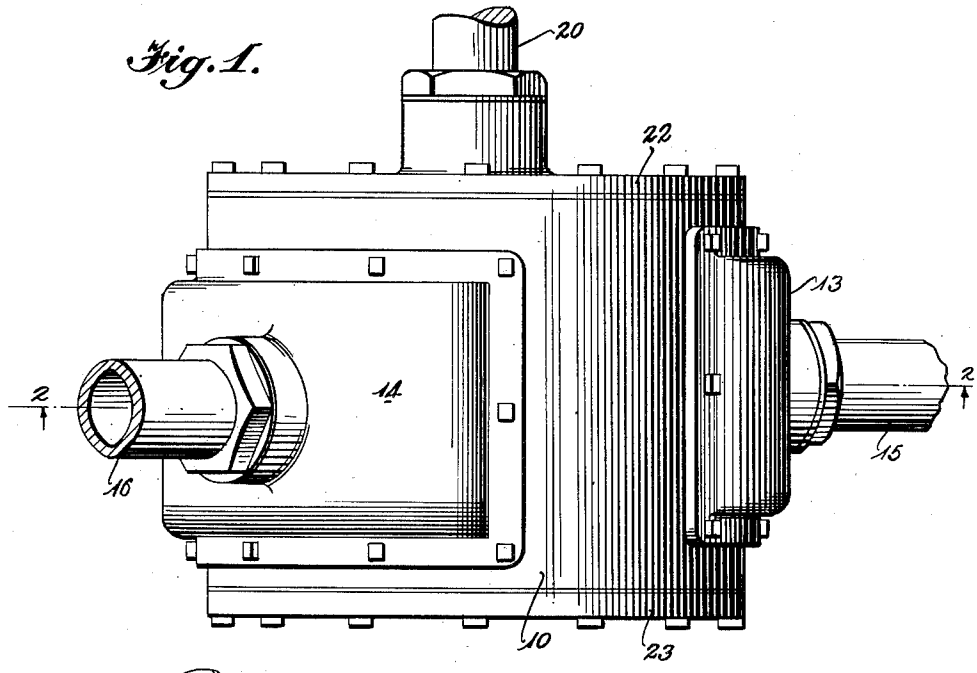
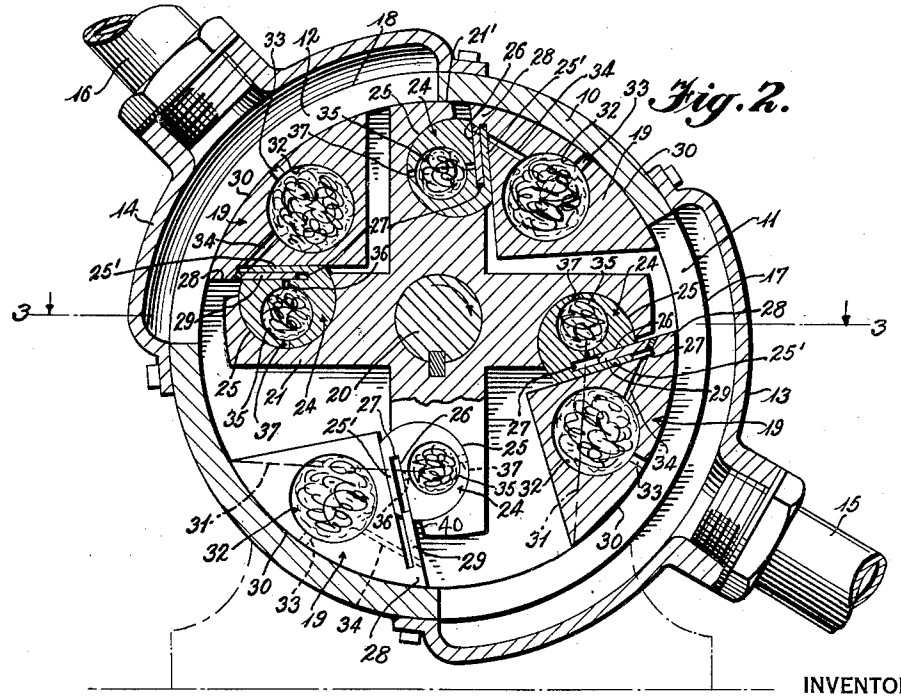


Fig. 2.



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Fig. 3.

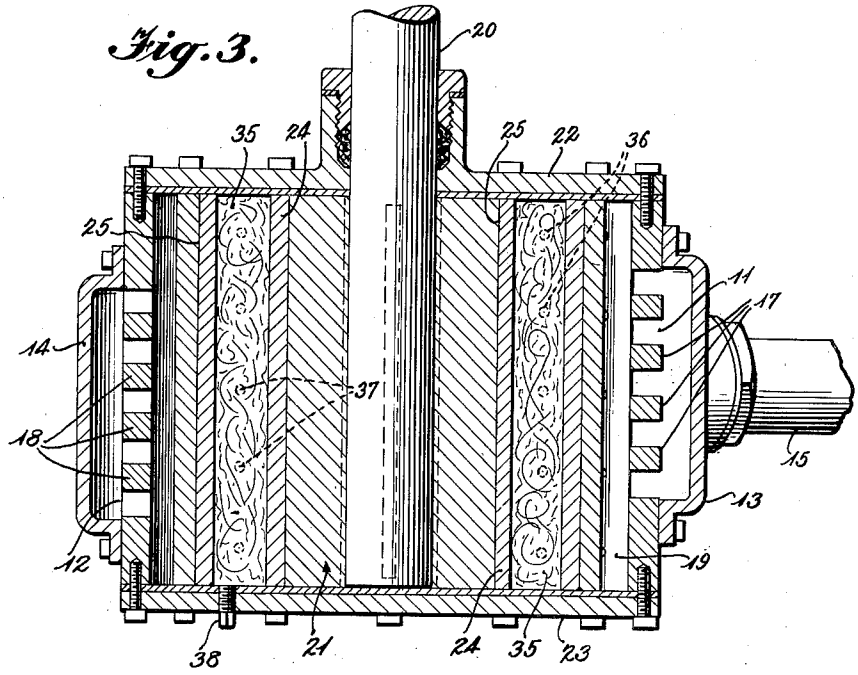


Fig. 4.

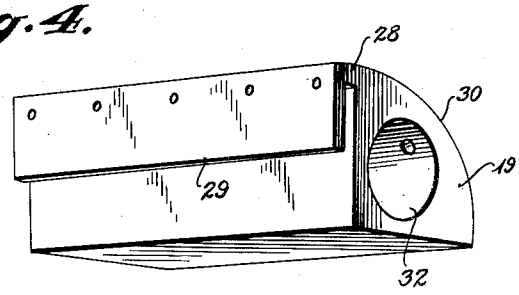
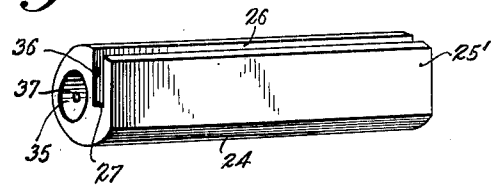


Fig. 5.



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UNITED STATES PATENT OFFICE

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ROTARY PUMP

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Application November 21, 1945, Serial No. 629,965

5 Claims. (Cl. 103—140)

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The invention relates to rotary pumps of the type formed with a rotor revolving in a pump cylinder eccentrically therewith.

It is an object of the invention to provide a pump having a revoluble rotor formed with radiating arms and means to isolate the spaces between said arms to form closed expansible and contractable chambers therebetween.

It is a further object of the invention to provide a rotary pump of the eccentric type having movable vanes formed with extended bearing surfaces in contact with the interior of a pump cylinder.

It is a further object to provide a pump having a rotor formed with radiating arms and vane means oscillatably and slidably associated with said arms with means to seal the joint between the vanes and the arms.

Further objects will appear from the following description when read in connection with the accompanying drawings, wherein:

Figure 1 is a plan view;

Fig. 2 is a transverse section on line 2—2 of Figure 1;

Fig. 3 is a longitudinal section on line 3—3 of Fig. 2;

Fig. 4 is a perspective view of one of the vanes, and

Fig. 5 is a perspective view of one of the bearings of a vane upon the arm.

As shown the device comprises a pump cylinder 10 formed with inlet ports 11 and outlet ports 12 having casings 13, 14 provided with connections for an inlet pipe 15 and an outlet pipe 16 respectively. The inlet and outlet ports are shown as formed with arcuate ribs 17 and 18, the inner surfaces of the ribs coincident with the inner surface of the cylinder, said ribs acting to provide surfaces against which the vanes 19 bear as they cross the ports.

Journaled in the cylinder 10 and eccentric with the axis of the cylinder, there is shown a drive shaft 20 which is secured to a rotor 21 formed with radiating arms shown as four in number. It will be obvious that more or less than four arms may be provided. The arms are shown as having a radial extent sufficient to cause their ends to revolve closely adjacent the inner surface of the cylinder at the position of nearest approach thereto at the point 21', Fig. 2.

The axial extent of the rotor is desirably such as to have a close clearance with the inner surface of the cylinder heads 22, 23, as clearly shown in Fig. 3, but a less axial extent can be utilized if sealing means of a suitable character are provided upon the ends of the arms.

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To isolate the space between the arms to form expansible and contractable chambers therebetween there is shown a vane 19 oscillatably and slidably associated with each arm so formed as to provide a seal to prevent fluid from escaping from one chamber to the next. In the embodiment shown, the bearings between the vanes and the arms are in the form of cylinders 24 mounted in an arcuate recess 25 in each arm. Each cylinder 24 is shown as formed with a flange 25' offset from a flattened surface 26 formed on the cylinder 24 to provide a recess 27 and each vane 19 is formed with a projection 28 upon which is secured a flange 29 entering the recess 27. As the rotor revolves, centrifugal force will hold the outer arcuate surface 30 of the vane in contact with the inner surface of the pump cylinder. The arcuate surface of the vanes is formed upon a radius equal to the radius of the pump cylinder.

By provision of the extended arcuate surface of the vanes bearing upon the inner surface of the pump cylinder, leakage past the vane is effectually prevented.

The ends of the arms 21 are shown as cut away at 40, Fig. 2, to permit of the oscillation of the vanes. The arms therefore push the vanes around during revolution of the rotor and the angle between a line 31 drawn from the center of the bearing cylinder 24 to the point of the vane as indicated in Fig. 2, will be an obtuse angle with a tangent to the interior of the pump cylinder to lessen friction.

The reducing size of the isolated chambers between the arms and the vanes as the pump revolves is plainly shown in Fig. 2, whereby fluid entering the inlet pipe 15 at the maximum size of the isolated chamber will be expelled through the outlet ports 12 as the contracting chambers reach the outlet.

Leakage from each chamber to the next in the rear thereof is prevented by the extended surface of the bearing cylinders 24 in the recesses 25 and by the overlapping flanges 25' and 29.

Leakage is also prevented, or at least minimized, by the extended surface contact of the arcuate surface of the vanes 30 with the inner surface of the cylinder 10. This surface contact is made possible by the sliding movement of the vanes with respect to the rotor. Without this sliding movement the outer edges of the vanes would have one line of contact with the pump cylinder. The sliding motion results in bringing the trailing edges of the vanes into contact to effect at least two lines of contact. The struc-

ture shown in the drawings is preferred. Should the curvature of the surface of the vane be less, i. e., on a longer radius, than that of the inner surface of the cylinder, two lines of contact of each vane with the cylinder would result, thus securing added security against leakage over the prior art construction, by virtue of the bodily sliding movement of the vanes relative to the rotor.

To lubricate the bearing surfaces of the vane, of the bearing cylinders **24**, and of the overlapping flanges therebetween the vanes are shown as formed with cylindrical chambers **32** formed with passages **33** to the arcuate surface of the vane and passages **34** to the outer surface of flanges **25'**. The bearing cylinders **24** are shown as formed with cylindrical chambers **35** formed with passages **36** to lubricate the flattened surfaces **26** and passages **37** to lubricate the arcuate recesses **25**. The said lubricating chambers **32** and **35** may be filled with absorbent material to carry a supply of lubricant. Lubricant may be supplied to the absorbent material in the chamber when the pump is not running, by removal of a plug **38** shown in Fig. 3 and revolution of the rotor to positions to bring each of the chambers **32** and **35** opposite the opening thus provided. The plug **38** when inserted will prevent leakage of fluid when the pump is running.

It will be noted that the intake ports **11** extend over a greater arc than do the outlet ports **12**. As a result the chamber between a shoe or vane **19** and the preceding arm **21** will begin to contract before the outlet ports open. Since liquids are imcompressible, the arrangement of ports shown is very nearly the maximum lead which the closing of the inlet port can be given over the opening of the outlet ports.

For use as a gas compressor the length of the outlet ports may be considerably less than shown. The contraction of the volume of the chambers is less per degree of arc of rotation at the bottom of the casing than at the quarters and therefrom the arrangement shown will not result in excessive pressures in liquid and is a fair compromise for use both as a liquid pump and a gas compressor.

It is obvious that a bearing may be provided for the free end of the drive shaft if desired.

Minor changes may be made in the physical embodiments of the invention within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. A rotary pump comprising, in combination: a pump cylinder formed with inlet and outlet ports; a shaft journaled to revolve in said cylinder eccentric therewith; a rotor secured on said shaft formed with radiating arms; each of said arms formed adjacent its end with an arcuate recess comprising in excess of 180°; a bearing cylinder oscillatably mounted in each recess; and a vane slidably mounted on each bearing cylinder, revolving with the stator and in contact with the inner surface of the pump cylinder upon at least two lines parallel with said shaft.

2. The structure of claim 1 with said vanes each formed with a lubricant chamber in communication with the bearing surfaces of the vane.

3. The structure of claim 1 with each vane and each bearing cylinder formed with a lubricant chamber in communication with the respective bearing surfaces of the bearing cylinder and of the vane.

4. The structure of claim 1 with each of said bearing cylinders formed with a flattened plane surface parallel with the axis of the cylinder and with a recess parallel with said plane surface defining a flange; and with each vane formed with a flange slidably mounted in said last named recess.

5. The structure of claim 1 wherein the outer surfaces of said vanes are curved upon radii substantially the same as that of the inner surface of the pump cylinder and are at all times in substantially full surface contact with said inner surface as a result of their sliding and oscillating motion relative to the rotor caused by centrifugal force.

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