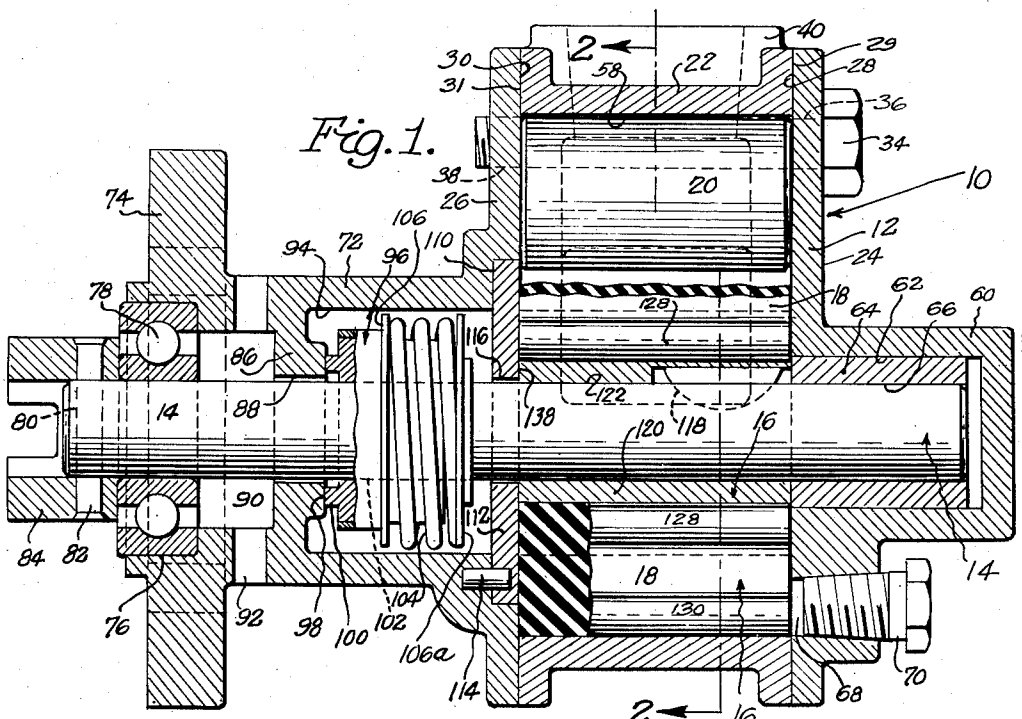
July 15, 1958 D. SHERWOOD 2,843,049

RESILIENT ROTOR PUMP OR MOTOR

Filed Jan. 29, 1954

Fig. 1.



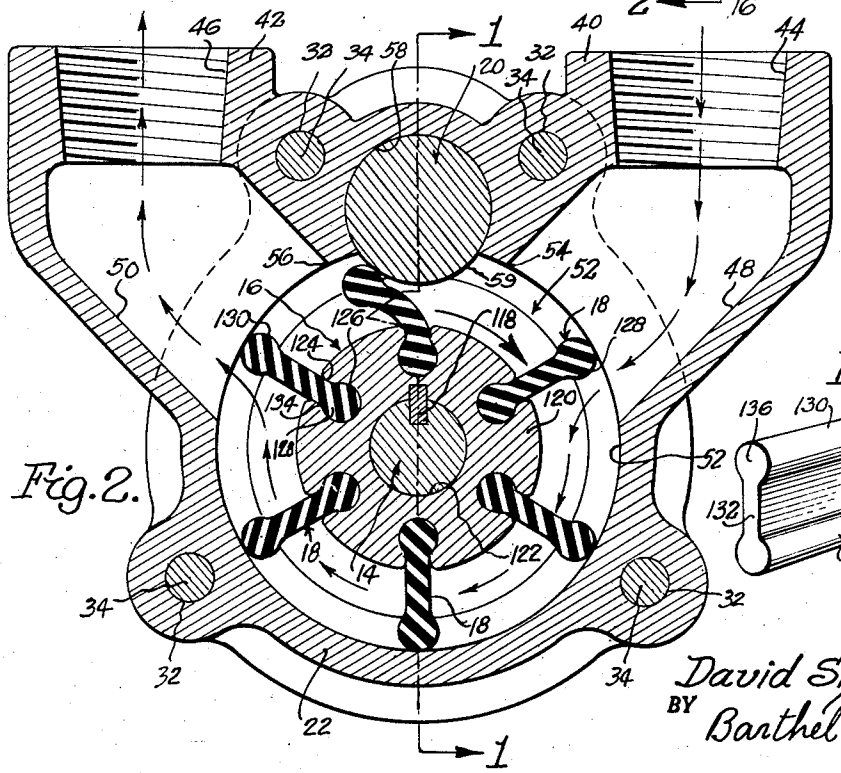
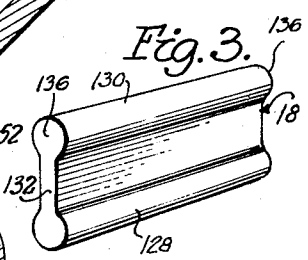


Fig. 2.

Fig. 3.



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RESILIENT ROTOR PUMP OR MOTOR

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1 Claim. (Cl. 103—117)

This invention relates to hydraulic pumps and, in particular, to hydraulic pumps or motors with resilient rotors.

One object of this invention is to provide a hydraulic pump or motor having a rotor with renewable vanes or blades, whereby any vanes or blades which show wear or breakage can be quickly and easily removed and replaced without the necessity of replacing the entire rotor.

Another object is to provide a hydraulic pump or motor as set forth in the preceding object, wherein the rotor vanes or blades are double-ended and preferably bulbous at the opposite ends, so that one end is inserted in a correspondingly-slotted rotor hub and the other end engages the inner wall of the pump casing or the barrier between the suction and discharge ports of the pump, as the rotor rotates.

Another object is to provide a hydraulic pump or motor having a rotor with resilient vanes or blades rotatable within a rotor chamber having suction and discharge ports separated from one another by a rotary barrier in the form of a roller which rotates as it flexes the vanes or blades passing by it, whereby the suction and pressure sides of the pump are effectively separated from one another while at the same time the blades exert the minimum of friction, noise and wear upon the roller barrier and are flexed with the maximum ease and efficiency.

Other objects and advantages of the invention will become apparent during the course of the following description of the accompanying drawing, wherein:

Figure 1 is a central vertical section through a resilient rotor hydraulic pump, according to one form of the invention, taken along the line 1—1 in Figure 2, with the shaft seal in side elevation;

Figure 2 is a vertical cross-section taken along the line 2—2 of Figure 1; and

Figure 3 is a perspective view of one of the replaceable double-ended rotor vanes or blades of the pump shown in Figures 1 and 2.

Referring to the drawings in detail, Figures 1 and 2 show a rotary hydraulic pump or motor, generally designated 10, according to one form of the invention, as consisting generally of a casing 12 within which a shaft 14 carrying a rotor 16 which resilient blades 18 is rotatably mounted and engageable with a rotary barrier 20 which separates the suction and pressure sides of the pump, as discussed more fully below.

The casing 12 is in three parts, namely a hollow central or chamber part 22 and opposite end members 24 and 26 respectively. The central portion 22 has parallel opposite faces 28 and 30 against which the inner faces 29 and 31 respectively of the end members 24 and 26 abut, and the central part 22 is provided with bores 32 spaced at intervals around its suitably-bossed periphery for receiving bolts 34 passing through aligned holes 36 in the end member 24 and threaded into aligned threaded holes 38 in the opposite end member 26. The casing central part 22 is provided with oppositely-projecting port bosses 40 and 42 containing threaded inlet or suction and

outlet or discharge pipe connections 44 and 46 respectively leading by way of inlet or suction and outlet or discharge passageways 48 and 50 respectively to a cylindrical rotor chamber 52, the opposite ends of which are closed by the end members 24 and 26.

At a position located between the intake or suction port 54 at the junction of the inlet or suction passageway 48 with the rotor chamber 52 and the outlet or discharge port 56 similarly located at the junction of the outlet or discharge passageway 50 with the rotor chamber 52 (Figure 2), the central part 22 of the casing 12 is provided with a transverse cylindrical bore 58 within which the cylindrical barrier 20 is snugly but rotatably mounted. The roller thus constituting the barrier 20 may be made of any suitable material, such as steel or bronze, but a non-metallic material such as that known in industry as nylon is preferred for its noise-reducing and wear-resistant qualities. The bore 58 is so located that the cylindrical surface 59 of the roller or barrier 20 projects into the rotor chamber 52 between the inlet and outlet ports 54 and 56 (Figure 2).

The end member 24 is provided with a hollow extension 60 containing a cup-shaped bore or socket 62 within which a shaft bearing 64 is mounted. The shaft bearing 64 is provided with a bore 66 coaxial with the center of the rotor chamber 52 and rotatably receiving the inner or dead end of the shaft 14. A threaded drain port 68 closed by a threaded plug 70 is provided in the lower part of the end member 24, communicating with the lower end of the rotor chamber 52 (Figure 1). The opposite end member 26 is provided with a tubular extension 72 terminating in a mounting flange 74 containing an annular recess 76 in which the outer race of an anti-friction bearing unit 78 is mounted, the inner race of which is mounted on the opposite or outer end of the shaft 14. The outer end of the shaft 14 is bored as at 80 to receive a pin 82 by which a coupling 84 is drivingly connected to the shaft 14, for engagement with a source of power, such as, for example, a rotary part of an internal combustion engine. In place of the flange mounting 74, a base mounting may optionally be used, if preferred.

The tubular extension 72 between the flange 74 and the central casing part 22 is provided with a partition wall 86 containing a central bore 88 communicating at its outer end with an annular chamber 90 adjacent the anti-friction bearing 78 (Figure 1), access to which is gained through the ports or passageways 92, and a shaft seal chamber or ante-chamber 94 containing a conventional shaft seal, generally designated 96. Surrounding the bore 88 in the partition wall 86 is an annular boss or seat 98 engaged by an annular sealing member 100 with a wiping action, the sealing member 100 being bored as at 102 to be snugly but slidably mounted on the shaft 14 and urged against the seat 98 by a compression spring 104 engaging a flanged collar 106 surrounding and containing the sealing member 100. At its opposite end the spring 104 engages an abutment collar or disc 106a snugly and fixedly secured to the shaft 14. In this manner, even though liquid may escape from the rotor chamber 52, it is prevented from passing outward through the bore 88 by reason of the sealing engagement of the yieldingly-urged sealing member 100 with its seat 98, as the shaft 14 rotates.

The inner face 31 of the end member 26 of the casing 12 is provided with an annular recess 110 coaxial with the axis of the shaft 14 and receiving a pressure disc 112 flush with the inner face 31 and held in position by a locating pin 114 seated in the pressure disc 112 and end member 26 respectively (Figure 1). The shaft 14 passes through a central aperture 116 from the ante-chamber 94 to the rotor chamber 52.

Keyed as at **118** to the shaft **14** within the rotor chamber **52** is the hub **120** of the rotor **16**. The hub **120** is in the form of a cylindrical barrel of bronze or other suitable material having a bore **122** snugly receiving the shaft **14** and having circumferentially-spaced parallel-walled slots or grooves **124** disposed around the periphery of the hub **120** and extending from end to end thereof in directions parallel to the axis of rotation of the shaft **14**, which is of course the axis of the rotor shaft bore **122**. The slots **124** at their inner ends nearest the shaft bore **122** terminate in enlargements **126** of approximately circular cross-section extending the entire lengths of the grooves.

The grooves or slots **124** serve to snugly receive either of the correspondingly bulbous or enlarged ends **128** or **130** of the vanes **18** in such a manner as to securely but removably hold the vanes **18** therein, with the narrower neck portion **132**, preferably parallel-surfaced, of each vane **18** passing snugly through the outer portion **134** of each slot or groove **124**, which for convenience is made parallel-walled to fit the neck portion **132**. The vanes or blades **18** are made from resilient or elastic deformable material, such as natural or synthetic rubber or compounds thereof, or of resilient synthetic plastic, and have opposite end surfaces **136** of dumbbell-shaped outline engageable with the inner surfaces **28** and **31** of the casing end members **24** and **26**, or, more specifically, with the inner surface **138** of the pressure disc **112**.

In the operation of the invention, as the shaft **14** and rotor **16** are rotated clockwise in the direction of the large arrow (Figure 2), the vanes **18** are flexed successively as they arrive at the roller or barrier **59**, forcing the liquid from the chamber **52** outward through the outlet port **56** and outlet passageway **50** into the outlet or discharge pipe (not shown) connected to the outlet pipe conection **46**. The roller or barrier **20** rotates within its bore **58** as it is engaged by the ends **128** or **130** of the vanes **18**, reducing friction and consequently reducing wear and noise. As the vanes continue to move in the direction of the large arrow past the inlet or suction port **54**, they draw in liquid through the inlet port **54**, inlet passageway **48** and inlet pipe connection **44** from the inlet pipe (not shown). This liquid travels in an arcuate path around the periphery of the rotor chamber **52**, as shown by the small arrows (Figure 2). The protrusion of the roller or barrier **20** into the rotor chamber **52** and the consequent flexing of the vanes **18**, effectively prevents leakage of liquid between the inlet and pressure sides of the pump **10**, as represented by the inlet or suction and outlet or discharge passageways **48** and **50**, and the corresponding ports **54** and **56** thereof.

The pump **10** of the present invention has been found by experience to be quiet in operation, and very efficient in its action, delivering a substantially uniform flow of liquid to the point of utilization at adequate pressures, and at the same time pumping any quantities of air which may enter with the liquid, so as to prevent the pump from becoming air-locked or air-bound. The concentrically-mounted rotor **16** has also been found by experience to produce a higher efficiency than an eccentrically-mounted rotor without the barrier **20**.

If any of the rotor vanes **18** becomes cracked, broken, damaged or excessively worn, it is easily removed and replaced by unbolting the end member **24** from the central casing part **22** and pulling axially upon the vane to be removed, as with a pair of pliers or similar implement. A new vane may then be inserted in the groove or slot **124** from which the defective vane was removed, by pushing it into that groove or slot. The end member **24** is then bolted back in place, and operation of the pump resumed. If all of the vanes **18** are to be replaced, the central part **22** of the pump casing **12** may also be removed for greater accessibility of the rotor **16**. Due

to the bulbous or enlarged edges **128**, **130** of the vanes **18**, operation of the pump will not pull the vanes out of their grooves or slots **124**. At the same time, the exposed enlarged edge **128** or **130**, as the case may be, provides a wear-resisting edge which also more effectively engages the rotary barrier **59** as the pump operates. While each vane **18** may be provided with the enlargement **128** or **130** along one edge only thereof, the provision of similar enlargements **128** and **130** along both edges makes either edge of the vane insertable in the anchorage slot **124** without the necessity of previously inspecting the vanes to ascertain the proper edge to insert. Optionally, of course, the edge **130** may be made of a different size or cross-sectional shape from the edge **128**, with a corresponding loss of the advantage of interchangeability.

It will be evident that the pump **10** may be used as a rotary hydraulic motor by supplying pressure fluid to the inlet passageway **48** thereof.

What I claim is:

A rotary pump or motor comprising a pump casing containing a rotor chamber having axially-spaced opposite end walls and a peripheral wall with a generally cylindrical internal surface thereon, said casing having spaced liquid inlet and outlet ports communicating with said chamber, a shaft rotatably mounted in said casing and extending into said chamber, said peripheral wall having a vane-deflecting member thereon projecting inwardly therefrom toward said shaft, a rotor rotatably mounted on said shaft within said chamber, said rotor having flexible vanes of elastic deformable material projecting approximately radially therefrom into engagement at their side edges with said opposite end walls and at their outer ends with said peripheral wall and vane-deflecting member, said rotor having a hub with substantially radial circumferentially-spaced recesses extending inwardly from the periphery thereof and having enlargements at their inner ends, and said vanes having their inner end portions snugly and fixedly but removably seated in said recesses and having enlarged opposite outer and inner ends of similar cross-sectional dimensions interchangeably fitting said enlargements of said recesses, the inner ends thereof being secured in said hub recess enlargements.

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