Jan. 29, 1963 R. S. WOOD 3,075,470

ROTARY DISPLACEMENT PUMPS

Filed June 9, 1961 2 Sheets-Sheet 1

Fig. 1.

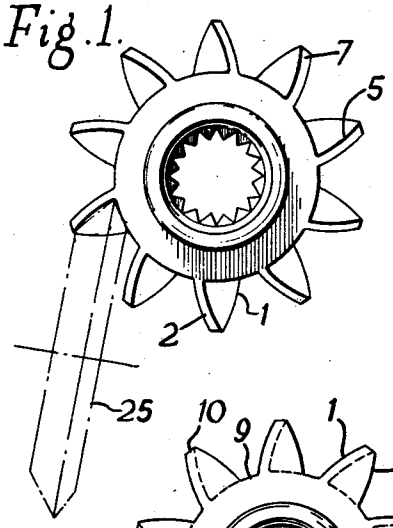


Fig. 2.

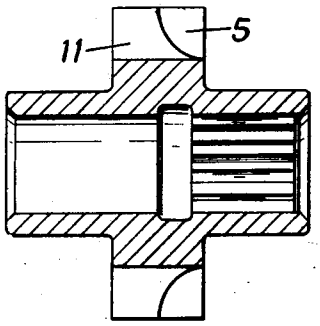


Fig. 3.

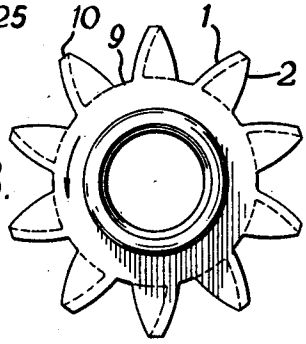


Fig. 4.

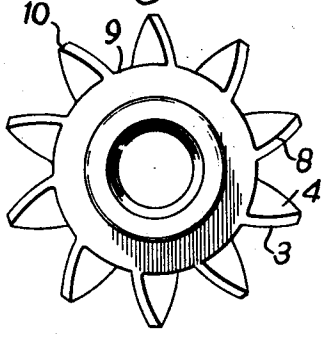


Fig. 5.

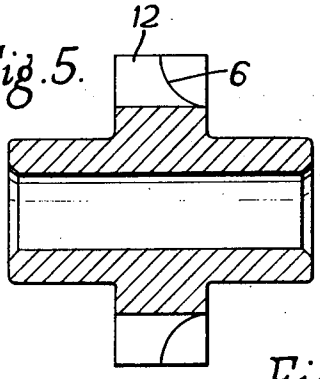
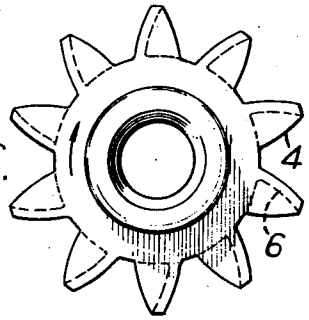


Fig. 6.

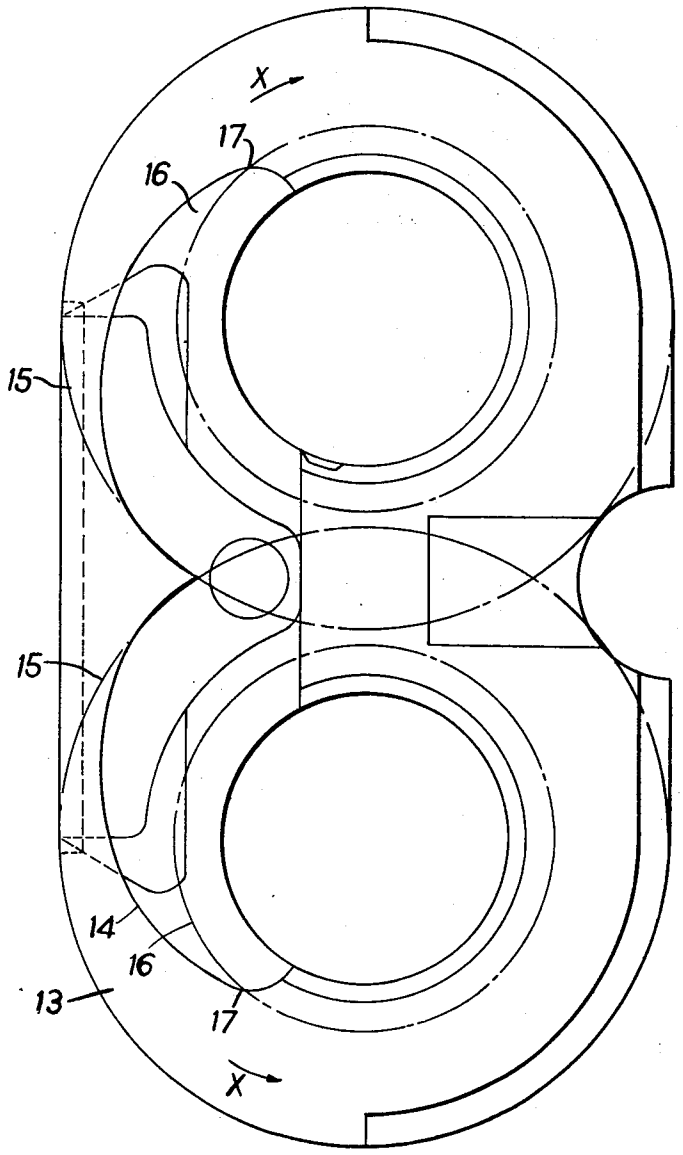


Jan. 29, 1963 R. S. WOOD 3,075,470

ROTARY DISPLACEMENT PUMPS

Filed June 9, 1961 2 Sheets-Sheet 2

Fig. 7.



United States Patent Office 3,075,470 Patented Jan. 29, 1963

3,075,470

ROTARY DISPLACEMENT PUMPS

Robert Spurgeon Wood, Romford, England, assignor to The Plessey Company Limited, London, England, a British company

Filed June 9, 1961, Ser. No. 116,208
Claims priority, application Great Britain June 15, 1960
5 Claims. (Cl. 103—126)

This invention relates to rotary-displacement pumps of the kind having intermeshing rotors and is, though not so limited, particularly applicable to gear pumps intended to work at low inlet pressures. It has for an object to provide improved rotary-displacement pumps having low resistance to the entry of fluid into the pumping chamber. According to the invention the operating liquid is arranged to enter the rotors in a substantially axial direction, and the teeth or the like of at least one of the rotors are relieved at their non-sealing flank to increase the entrance cross-section into the gaps between the teeth or the like.

According to another aspect of the invention the operating liquid is arranged to enter the gaps between the teeth or the like of the rotors in a substantially axial direction through ports in the end walls of the pumping chamber the radial distance of the radially outer edge of the ports from the axis of each rotor decreasing in the direction of rotation from a point adjacent to the area of engagement so as to separate the outer portion of each gap from the pump inlet before the root portion of the gap is separated from the pump inlet.

In a practical form of gear pump according to the invention the or each inlet port proper is cut in an end wall of the pump chamber to such a shape and size that it offers substantially no greater restriction to the flow than the passage leading to the inlet port proper, the shape of the latter being curved inwards so that the fluid in the tooth-tip portions of the tooth gaps is trapped by centrifugal action, thus counteracting a tendency of the incoming liquid to splash back from the gear teeth on striking them. In order to reduce further the restriction of flow, the gear teeth preferably are relieved at their adjacent ends by removing part of the flank portion at the back of each tooth of the driving gear and at the leading flank of each tooth of the driven gear. In order to obtain maximum flow, inlets and outlets of the kind described may be provided at both ends of the gears, relieved portions extending from each end of each gear tooth to a point near the middle of the axial length of the tooth, at least some portion of the profile being left unrelieved at the middle of the length of each tooth in order to avoid backlash of the pumping gears. Alternatively the inlet and outlet may be arranged at opposite ends of the gears.

The invention is illustrated in the drawings accompanying the specification, in which:

FIGURES 1, 2 and 3 are respectively an inlet-side end view, an axial section, and a non-inlet side end view of the driving gear of one form of pump according to the invention,

FIGURES 4, 5 and 6 similarly illustrate the driven gear, and

FIGURE 7 is a somewhat diagrammatic end view of one end wall of the pumping chamber.

Referring now to the drawings, the gears are first produced with a conventional profile as shown at **1**, **2** in FIGURES 1 to 3 and at **3**, **4** in FIGURES 4 to 6. A portion of the non-sealing flank **2** and **4** respectively adjoining the entry side of each gear is then cut away as shown at **5** and **6** respectively, leaving only a narrow spoke-like portion **7** or **8** adjacent to the respective sealing gear flank **1** and **3**, while the remainder of the annular area between the root circles **9** and tip circles **10** is available within the inlet port area for the entry of pumping liquid.

Backlash between the gears is prevented by the unrelieved portions **11** and **12** of the non-sealing gear flanks **2** and **4**.

In practice it has been found convenient to form the relief in the shape of a cylinder surface inclined to the axis of the gear, as indicated in FIGURE 1, in which a suitable milling cutter is shown in elevation (in chain-dotted lines) at **25**.

As shown in FIGURE 7 one end wall **13** of the pump-chamber has an inlet port **14**. By referring to the tip circle **15** and the root circle **16** of each gear, it will be noticed that near the zone of engagement of the gears the outer confine of the inlet port **14** extends to the tips of the teeth and that it gradually recedes inwardly in the direction of rotation of each gear, which is indicated by the arrows X, until the said outer confine finally intersects the root circle **16** at the points **17**. Due to this arrangement, the port **14** allows liquid to fill up the spaces near the roots of the teeth while the liquid which has previously entered is retained by centrifugal force in the portion of the tooth gaps adjacent the tooth tips, said portion being sealed by the end plate beyond the line **14**.

A pump according to the invention when suitably designed can be used for delivering liquid at a relatively high rate with a relatively low risk of cavitation at the inlet side.

What I claim is:

1. A rotary-displacement pump comprising a housing containing a pumping chamber having two parallel side walls spaced by a peripheral wall, a pair of intermeshing lobed rotors, mounted for rotation in said chamber in sealing contact with the walls thereof, means for applying rotational torque to one of the rotors in a predetermined direction to produce sealing contact of the leading flank of each lobe of one of the rotors with the trailing flank of a lobe of the other rotor during the passage of said flanks through the zone of intermesh, fluid-admission means causing fluid to enter the chamber axially of the rotors at one side of the plane containing the rotor axes, and fluid-outlet means communicating with the chamber at the other side of said plane, the other flank of each lobe of at least one of the two rotors being relieved for part of its axial length from the side of the rotor facing the fluid inlet to clear the adjacent lobe of the other rotor, while making contact with the profile of said lobe on another part of its axial length.

2. A gear pump comprising a housing containing a pumping chamber having two parallel side walls spaced by a peripheral wall, a pair of intermeshing pumping gears mounted for rotation in said chamber in sealing contact with the walls thereof, means for applying rotational torque to one of the gears in a predetermined direction to produce sealing contact of the leading flank of each tooth of one of the gears with the trailing flank of a tooth of the other gear during the passage of said flanks through the zone of intermesh, fluid admission means causing fluid to enter the chamber axially of the gears at one side of the plane containing the gear axes, and fluid outlet means communicating with the chamber at the other side of said plane, the other flank of each tooth of a least one of the two gears being relieved for part of its axial length from the side of the gear facing the fluid inlet to clear the adjacent tooth of the other gear, while making contact with the flank of said tooth of the other gear on another part of its axial length.

3. A rotary displacement pump as claimed in claim 1, wherein the fluid-admission means include, in at least one side wall of the pumping chamber, an inlet port having two wings respectively extending over part of the circumference of each of the rotors, the radial distance of the radially outer edge of each wing from the axis of its

associated rotor decreasing with increasing angular distance from the zone of intermesh of the rotors.

4. A gear pump as claimed in claim 2, wherein the fluid admission means include in at least one side wall of the pumping chamber, an inlet port having two wings respectively extending over part of the circumference of each gear, the radial distance of the radially outer edge of each wing from the axis of its associate gear decreasing with increasing angular distance from the zone of intermesh of the gears.

5. A gear pump as claimed in claim 4, wherein the fluid admission means include two inlet ports, one in each side wall of the pumping chamber, and each having two wings respectively extending over part of the circumference of each gear, the radial distance of the radial outer edge of each wing from the axis of its associate gear decreasing with increasing angular distance from the zone of intermesh of the gears, the other flank of each tooth of at least one of the two gears being relieved for part of its axial length from each side of the gear to clear the adjacent tooth of the other gear, while in a central portion of the length of each gear of said flank

is so profiled as to make contact with the adjacent flank of the adjacent gear of the tooth of the other gear.

References Cited in the file of this patent

UNITED STATES PATENTS

171,651	Crocker	Jan. 4, 1876
294,026	Fitts	Feb. 26, 1884
2,400,485	Cardillo	May 21, 1946
2,424,750	Heckert	July 29, 1947
2,440,986	Teeter	May 4, 1948
2,696,170	Hill	Dec. 7, 1954
2,845,031	Guibert	July 29, 1958
2,870,720	Lorenz	Jan. 27, 1959
2,986,097	Chrzanowski et al.	May 30, 1961

FOREIGN PATENTS

103,669	Great Britain	of 1917
547,463	Great Britain	Aug. 28, 1942
630,678	France	Aug. 27, 1927
865,864	Germany	Feb. 5, 1953
948,868	France	Feb. 7, 1949