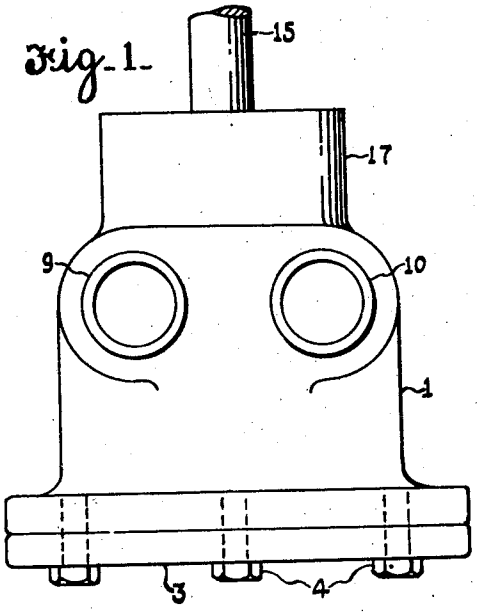
Sept. 30 1947. E. SIBLEY 2,428,181

ROTARY GEAR PUMP

Filed Oct. 27, 1944

Fig. 1.



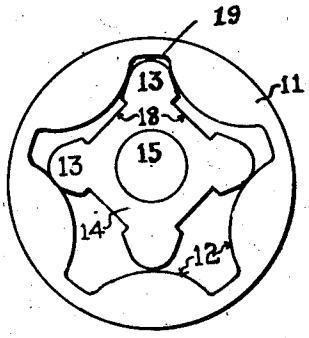


Fig. 4.

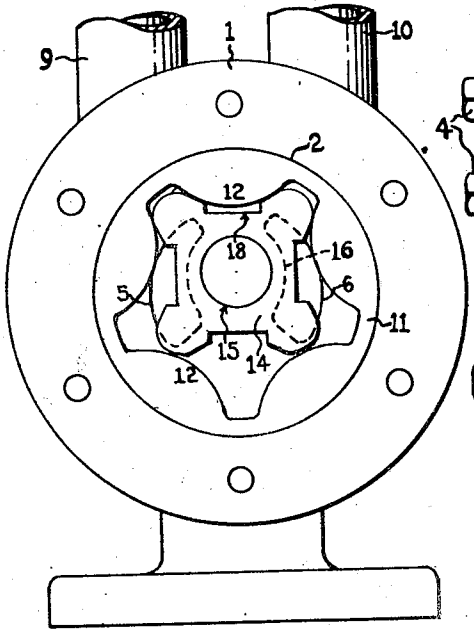


Fig. 2.

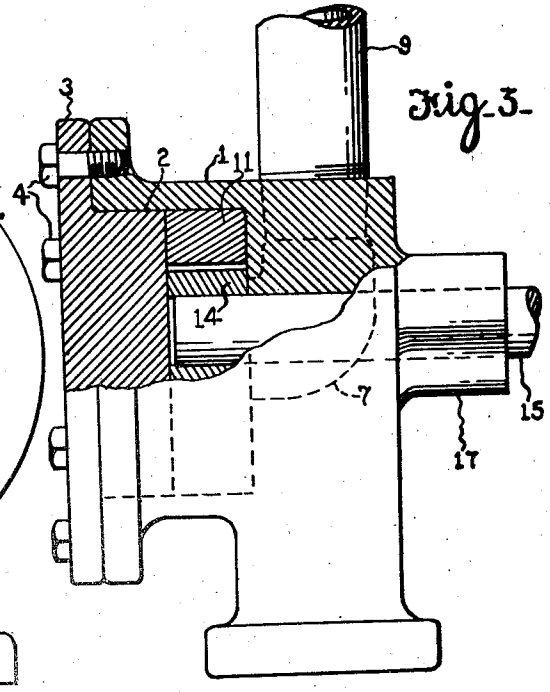


Fig. 3.

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ROTARY GEAR PUMP

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Application October 27, 1944, Serial No. 560,548

1 Claim. (Cl. 103—126)

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This invention relates to rotary pumps and particularly pumps which trap a liquid between the teeth of an internally toothed outer rotor and a smaller externally toothed inner rotor.

In such pumps very accurate machining is required to assure a good running seal between the rotors, and in many cases complicated and expensive mechanisms are required to accomplish this purpose. Because of their high accuracy, it has been necessary to avoid use of such pumps for moving liquids contaminated with sand or other suspended abrasives, and rapid deterioration has resulted when such abrasives have been encountered.

It is an object of the present invention to provide a toothed rotor pump in which one of the rotors is so formed as to permit abrasives and other foreign matter to be carried through the pump to its discharge port without damage to the rotors or wear of their intermeshing teeth.

Another object is to so construct the inner rotor of such a pump as to afford a considerable clearance between the teeth of the outer rotor and the intertooth areas of the inner rotor during a cycle interval entailing intimate engagement in present practice, such clearance affording a harmless passage through the pump of abrasive particles contained in the pumped liquid.

Another object is to simplify manufacture and reduce cost of a pump of the type discussed, by establishing a clearance between the rotors in their passage through a certain cycle interval, such interval entailing the intimate engagement in present practice, and further entailing a burnishing or other expensive operations to establish close tolerances. It is to be noted in this connection that prior art practice relating to this type of pump has largely been to generate the tooth form of one rotor from a form predetermined for the other, thus entailing a constant sliding contact at various angularly spaced points very difficult to achieve.

Another object is to increase the pumping capacity of the type of pump discussed without corresponding increase of their size.

These and various other objects are attained by the construction hereinafter described and illustrated in the accompanying drawing, wherein:

Fig. 1 is a top plan view of the improved pump.

Fig. 2 is a front view of the pump with its cover plate removed.

Fig. 3 is a side elevational view of the pump.

Fig. 4 is a view of the intermeshing rotors in a rotative position different from that appearing in Fig. 2.

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In these views, the reference character 1 designates a housing having a cylindrical chamber 2 opening in its front face and normally closed by a cover plate 3 held in place by bolts 4. Inlet and outlet ports 5 and 6 open into the chamber 2 through its rear wall from passages 7 and 8 (not shown) to and from which a liquid is delivered by pipes 9 and 10. Rotatively fitted in the chamber 2 is an outer rotor 11, having internal teeth 12 meshed with the external teeth 13 of an inner rotor 14 fixed on a shaft 15 journaled in the casing in a definitely eccentric relation to the gear 11, said rotors being of accurately equal thickness. The bearing for said shaft comprises a front portion 16 between the ports 5 and 6 and a rear portion 17 formed as a rearward extension of the casing. As illustrated, the outer rotor has five teeth in the nature of arcuate convexities and the inner rotor has four teeth considerably less wide than the outer rotor teeth and designed to mesh perfectly with the latter teeth, thereby rotatively driving the outer rotor. However, the invention is by no means limited to any certain number of teeth or any particular tooth forms, it being a requisite however, that the inner rotor have one tooth less than the outer rotor.

The construction so far described is well known and in common use and the present invention consists primarily in affording the inner rotor a novel relief or clearance from the outer rotor by forming grooves 18 symmetrically between the teeth 13. While preferably these grooves are rectangular as shown to facilitate their machining, the rectangular form is not vital. Said grooves extend from end to end of the inner rotor and their depth may be determined by considerations of strength. In other words, it is desirable to afford said grooves the maximum depth consistent with an adequate strength safety factor.

Provision of the grooves 18 secures a number of important advantages, of which the most vital is avoidance of material detriment to the rotors in event sand or other abrasives are present in the pumped liquid. Heretofore each tooth of the outer rotor has intimately engaged an entire intertooth surface area of the inner rotor at full mesh, and any particles of abrasive material engaging between the fully meshed teeth have been highly destructive to both rotors. The improved construction greatly reduces the surface areas engaged at full mesh and separates such areas by the grooves 18 into which the particles escape from between the teeth when the latter are in or

approximately in a fully meshed relation. It has been found by actual test that provision of the grooves 18 permits use of the pump in handling liquids highly contaminated with abrasive particles without resulting detriment, whereas in prior pumps of this general character, a small abrasive content in the liquid has proven highly detrimental.

Provision of the grooves 18 is further advantageous in simplifying the production of a pump of the described character, the clearance provided eliminating a practice heretofore common of wearing, burnishing or machining the rotors to a condition of very accurate fit at full mesh.

It is evident furthermore that the grooves 18 serve to materially increase the effective capacity of a pump of the described character with no increase in size of the pump.

A further improved feature is the provision of a material clearance 19 between the crests of the inner rotor teeth and the intertooth areas of the outer rotor as the teeth occupy their full mesh position. The spaces 19 additionally serve to receive particles of sand or the like and to avoid an abrasive action which such particles exert on the rotors of prior pumps lacking such clearance.

It is to be noted in connection with my present improvements that the destructive effect of abrasive particles has been exercised in prior constructions entirely between the intertooth areas of the inner rotor and the outer rotor teeth in passing through the position of full mesh, these large engaging areas being highly susceptible to the abrasive action. The relatively small contact areas established at points of only partial mesh have not been materially abraded as such areas do not retain and confine the particles and they are generally ejected from such small areas as the latter approach contact. The areas afforded relief by the grooves 18 are those which in prior practice have tended to trap the abrasive particles affording them no escape.

Pumps of the described character are further improved by my provision of the grooves 18 in that the liquid carried in these grooves aids materially in cooling and lubricating the faces of the two rotors contacted by such liquid.

The problem presented by abrasives in the pumped liquid has long been recognized in connection with the type of pump to which my improvements relate, since existence of such problem has greatly restricted the useful field of such pumps. A partial solution of the problem has been achieved by employing resilient material to form at least one of the rotors, but such material is not acceptable nor suitable in many instances since it involves a sacrifice of strength and durability as compared to all-metal rotors. It has also been found by actual experience, that all-metal rotors are more suitable for pumps required to operate at high altitudes when the temperatures are considerably below zero, and also under high temperature conditions, such as are encountered in tropical climates.

While the construction illustrated employs the inner rotor as a driving element for the outer one, it is to be understood that a reversal of such drive is readily feasible and has been occasionally employed heretofore in pumps of this general type.

The rotors as improved by my invention need

not have actual mutual contact except for the purpose of transmitting rotation from one to the other and this is accomplished by a lateral contact between the teeth of the intermeshing rotors. An adequate seal is derived if a clearance is provided approximating .001 of an inch between the seal-forming areas of the two rotors. By providing such clearance, wear at the sealing points is avoided without sacrifice of efficiency.

It may be mentioned that the cavities between the teeth of the inner rotor may vary to clear the tooth crests of the outer rotor by a thirty second of an inch or more, depending on the viscosity of the fluid being pumped.

By reference to Fig. 4, it may be noted that the driving contact between the two rotors, when in operation, is lateral only. However, the driving power may be applied to either the inner or outer rotor, whichever is desired. In this type of construction the rotors bear upon their journals instead of upon the tooth surfaces of each other, and no contact is made between the crests of the teeth of the inner rotor and the outer rotor teeth.

The pump disclosed herein is capable of many applications and it will be understood that the materials used may be determined by nature of the fluid to be pumped, the atmospheric pressure, temperature and other conditions. Gear pumps embodying certain features disclosed in the drawings have long been known to the art and their principles are well understood. My present invention relates specifically to the intermeshing relation of the teeth of the two rotors.

What I claim is:

In a pump of the character described, an outer annular internally toothed rotor, and an inner externally toothed rotor disposed within the outer rotor and having a lesser number of teeth than the outer rotor, and means journaling said rotors in a relatively eccentric relation, the eccentricity of the rotors and their tooth form being such as to fully intermesh their teeth as they rotatively encounter the plane determined by the rotor axes, at one side of such axes, and to effect a bare clearance between their teeth in encountering such plane at the other side of said axes, the teeth of the two rotors maintaining mutual contact in substantially all other rotative positions, whereby a plurality of sealed fluid chambers are jointly formed by the teeth of the two rotors, the tooth roots of each rotor having clearance from the tooth crests of the other.

EUGENE SIBLEY.

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