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ROTARY PUMP

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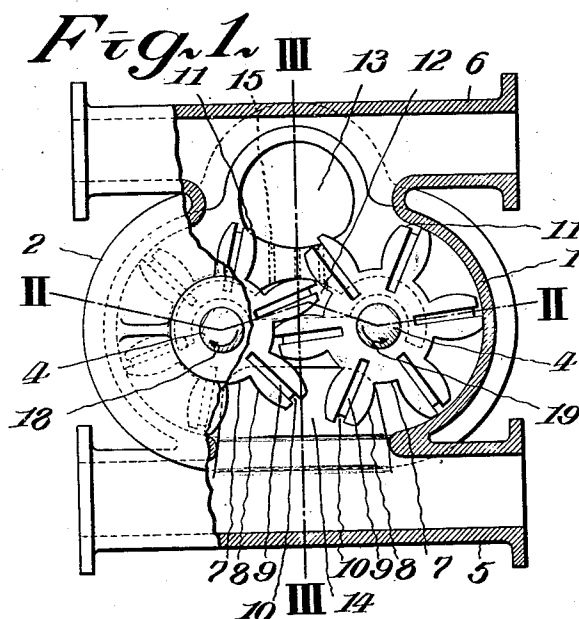


Fig. 2

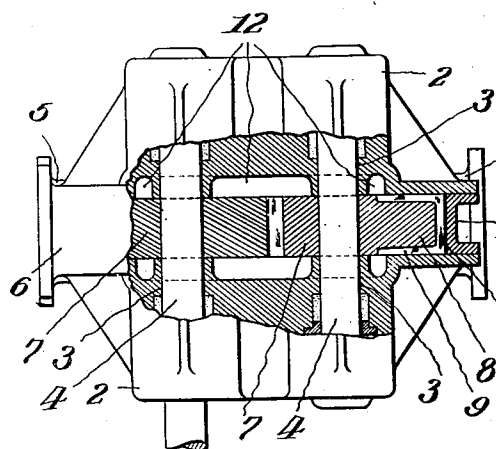
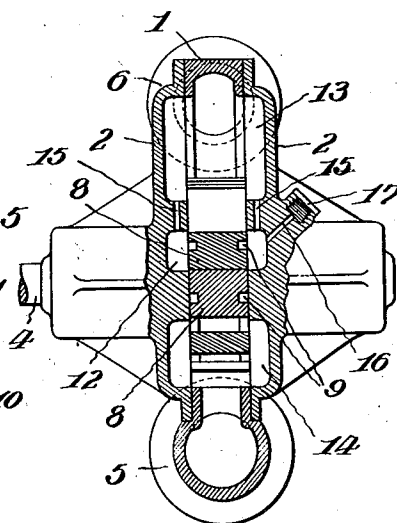


Fig. 3



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ROTARY PUMP

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This invention relates to certain new and useful improvements in rotary pumps and especially to that class of pumps in which a pair of similar parallel rotors having intermeshing tooth blades are mounted in a casing having covers in opposite ends thereof, the walls of which cooperate to confine the pumping fluid to the spaces between the tooth blades of the rotors, and has for its object to provide a rotary pump of the class described of improved efficiency wherein any shock due to change of the direction and pressure of the fluid forced out alternately and intermittently from the spaces between the tooth blades of either rotors to cause unbalanced effect, when the tooth blades of the rotors intermesh, shall be substantially avoided and the water seal shall be ensured between the apex of the tooth blades positioned in the delivery side of the pump and circumferential wall of the casing and between end faces of the tooth blades and the inner faces of the covers engaging therewith.

In the hitherto known ordinary rotary pumps, when the tooth blades of the rotors intermesh the fluid contained in the spaces between tooth blades of one rotor will be forced out or subjected to a compression by the tooth blades of another rotor coming in the space between the said tooth blades, so that the fluid will be forced out in cross directions alternately from the space between the blades of either rotors, and at the same time the compression of the fluid will be increased or changed as the intermeshing degree of the tooth blades increases, thereby a shock and unbalanced effect in the pump being caused.

My invention is designed to obviate this disadvantage and I achieve this result by permitting the fluid contained in the space between the tooth blades, when the tooth blades of the rotors intermesh, to easily deliver into cavities having ends extending around substantially a half part of circumference of the rotor shafts at the delivery side of the pump, provided at the inner faces of the casing covers engaging the end faces of the rotors, through radial grooves provided at end faces of the tooth blades and

axial grooves provided on the apex of the tooth blades so as to connect the radial grooves at their ends, the radial grooves being adapted to come to a communication at their inner end portions with the cavities as the rotor rotates, and thence by permitting the fluid to easily and continually deliver in several directions separately through the radial grooves communicating the cavities with the delivery spaces of the pump, without causing any shock.

My invention has a further advantage that the water seal between the apex of the tooth blades positioned in the delivery side of the pump and circumferential wall of the casing and between end faces of the tooth blades and the inner faces of the covers engaging therewith is ensured by moving water films or walls formed at the delivery side of the pump by the fluid passing through the axial and radial grooves on the tooth blades of the rotors.

In the accompanying drawing I have shown for purpose of illustration one form which my invention may assume in practice.

In this drawing:

Fig. 1 is a front view of a rotary pump embodying the illustrative form of my invention, partly in section to show an inner view.

Fig. 2 is a side view of Fig. 1, partly in section on the line II—II.

Fig. 3 is an end view of Fig. 1, partly in section on the line III—III.

Referring to the drawing, the pump comprises a casing 1 and covers 2 in opposite ends thereof. The covers are provided with bearings 3 in opposite sides thereof adapted to receive the opposite ends of the rotor shafts 4. One of said bearings extends entirely through one of said covers so that one of the rotor shafts may extend therethrough and be connected with the driving means (not shown), as will be understood. At opposite sides of the casing there are also a suction branch 5 and delivery branch 6.

In the casing 1 is mounted a pair of similar parallel rotors 7 having intermeshing tooth blades 8, the rotor shafts 4 being journaled in the bearings 3. The casing 1 and the covers

2 are of such construction and shape as to snugly fit the rotors to confine the pumping fluid to the spaces between the blades of the rotors, that is, end faces of the rotors being in contact with inner walls of the covers and apex of the tooth blades being in contact with circumferential inner wall of the casing.

Each tooth blade 8 of the rotors is formed at its end faces with radial grooves 9 extending inwardly from its apex to points a little beyond its base and on the apex with axial groove 10 to establish a communication between the radial grooves. A ridge at leading side of the axial groove 10 on each tooth blade 8 is partly cut away as indicated by 11 in Fig. 1 to permit the axial groove to communicate with the space between the tooth blade and the other preceding consecutive tooth blade.

The covers 2 are formed at the opposite inner walls with cavities 12, in Fig. 1 being partly shown in dotted line, each of which is arranged between the delivery space 13 and the plane including the axes of the rotors and near the said plane, with ends extending around substantially a half part of the circumference of the rotor shafts at the delivery space side up to points a little beyond the said plane towards the side of the suction space 14, so as to communicate with the inner end portion of the radial grooves of the tooth blades opposite the cavity.

In case the number of the tooth blades is small, additional small holes 15 may be provided in the cover for a communication between the cavities 12 and the delivery space 13, if desired, for the purpose as described hereinafter.

16 is an inlet leading into the cavity in the cover and with a connection having a screwed cover 17 for an access of fluid from a suitable source into the pump upon starting the same, in case the pump contains no fluid, so that the atmosphere in the pump will be expelled and the pump will be suitably lubricated by the fluid to render the pump to efficiently operate.

In operation, the rotors 7 will be driven in the opposite directions indicated by arrows 18 and 19 respectively. The fluid is sucked in through the suction branch 5 and delivered out through the delivery branch 6.

In the meantime, it will be noted that the fluid in the spaces between the intermeshed tooth blades will be easily delivered into the cavities 12 through the axial grooves 10 and the radial grooves 9 and thence delivered into the delivery space 13, so that the moving water films or walls will be formed in the spaces in the radial and axial grooves of the tooth blades on the delivery side of the pump, while the fluid in those on the suction side will not be moved, so that the fluid will not return from the delivery space to the suction

space. In case the spaces between the tooth blades are not fully filled up with the fluid sucked in from the suction space, these spaces may be supplemented with the fluid from the cavities through the radial and axial grooves and the partly cut away ridge of the axial grooves.

In case the number of the tooth blades of the rotor is small, the delivery of the fluid from the cavities 12 into the delivery space 13 may be facilitated by providing the additional small holes 15 as hereinbefore described for directly delivering fluid from the cavities into the delivery spaces in addition to the delivery of the fluid through the radial and axial grooves of the tooth blades.

From the foregoing it will be observed with my said pump that the fluid expelled from the spaces between the intermeshed tooth blades will be easily delivered into the delivery space without any considerable pressure, so that the pump is not subjected to any shock or stress and the moving water films or walls in the spaces in the radial and axial grooves of the tooth blades of the rotor are formed, so that the efficient water seal between the tooth blades of the rotor and the casing and covers and on the delivery side of the pump may be ensured to diminish the possibilities of leakage of the fluid, thus the effect of avoiding shocks and promoting the smooth and steady working being obtained, which increases the efficiency of the pump.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I claim:

1. A rotary pump of a kind in which a pair of similar parallel rotors having intermeshing tooth blades are mounted in a casing having covers in its opposite ends, the walls of which cooperate to confine the pumping fluid to the spaces between the tooth blades of the rotors, in which each tooth blade of the rotors is formed at its end faces with radial grooves extending inwardly from its apex to points a little beyond its base and on the apex with an axial groove extending through its length to establish a communication between the radial grooves, and each cover is formed at its inner wall with a cavity which is arranged independently between delivery space of the pump and the plane including axes of the rotors and near the said plane, with its wings extending around substantially a half part of the circumference of shafts of the rotors at the delivery space side up to points a little beyond the said plane towards suction space side of the pump, so as to communicate with the inner end portion of the radial grooves of tooth blades opposite the cavity.

2. A rotary pump according to claim 1, in which the leading ridge of the axial groove on the apex of the tooth blades of the rotors is partly cut away so as to communicate the

groove with space between the tooth blade and the other preceding consecutive tooth blade.

3. A rotary pump according to claim 1, in
5 which additional several small holes are provided to communicate the cavities provided in the covers with the delivery space of the pump.

10 In testimony whereof I affix my signature.
NOBUYA MIKI.

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