

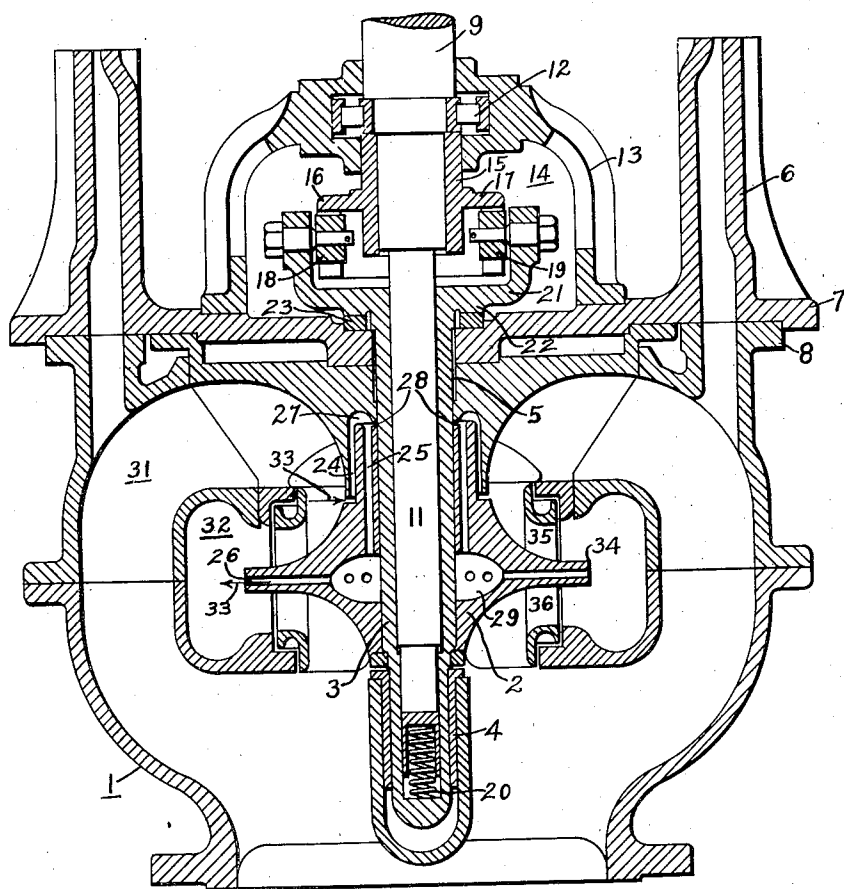
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PUMP

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PUMP

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The invention relates generally to pumps and more particularly to rotary type pumps which may be utilized in connection with submersion-type pumping equipment.

5 In operating submersion-type pumping equipment such, for example, as a centrifugal pump driven by a direct-connected submersion-type motor, in pumping fluid from wells, considerable difficulty is experienced
10 in preventing leakage fluid from entering the motor casing through the seam or joint formed at the drive shaft connecting the motor armature and the pump impeller. Since it is practically impossible to construct
15 a perfect fluid-tight packing for the drive shaft to prevent the entrance or leakage of fluid into the motor casing, under all operating conditions, it has been found desirable to provide separate fluid seals for running
20 and idle conditions of the pump.

It is, therefore, an object of this invention to provide for preventing fluid from entering the motor casing through the drive-shaft joint when the pump is in operation.

25 A more specific object of the invention is to provide for creating a partial vacuum in the drive-shaft joint so that any leakage fluid which may accumulate in the motor casing may be expelled readily.

30 Another object of the invention is to provide for removing leakage fluid from the motor casing through the drive-shaft joint, discharging it by centrifugal force as the impeller rotates.

35 For a more comprehensive understanding of the invention, reference may be had to the accompanying drawing, in which the single figure is a cross-sectional view of a centrifugal pump embodying my invention.

40 Referring to the drawing, the structure shown comprises a centrifugal pump having a casing 1 with an impeller 2 rotatably mounted therein. As shown, the impeller 2 is supported by a sleeve shaft 3 journaled in a suitable sleeve bearing 4 in the casing 1 and extending through the top portion of the casing 1, forming a loosely-fitting joint or seam 5.

50 The pump may be driven in any suitable manner and, in this particular embodiment

of the invention, the pump casing 1 is adapted to support the motor casing 6, the two casings being connected, as shown, by the flanges 7 and 8 in a manner to form a fluid-tight joint. The motor is provided with a shaft 9 having
55 a portion 11 extending into the sleeve shaft 3 and is rotatably supported by the thrust bearing 12 carried in the spider member 13 in the usual manner.

In order to rotate the pump impeller 2, the
60 motor shaft 9 and impeller shaft 3 are connected by means of a clutch 14 comprising a sleeve member 15 secured to the shaft 9 and provided with arms 16 and 17 which are adapted to engage the rollers 18 and 19 carried by the yoke portion 21 of the sleeve
65 shaft 3 in such a way as to cause a slight upward axial movement of the impeller shaft 3 when rotated by the motor.

In this particular embodiment of my invention, fluid is prevented from entering the
70 motor casing, when the pump is inoperative, by means of a valve plate 22 provided on the yoke portion 21 of the impeller shaft 3, which is disposed to engage with the valve seat 23
75 provided in the lower portion of the motor casing 6.

It will be observed that the impeller shaft 3 is closed at its lower end and encloses a compression spring 20 which bears upwardly
80 against the lower end of the motor shaft extension 11, thereby biasing the valve plate 22 against the valve seat 23 when the pump is at rest.

As described hereinbefore, the rotation of
85 the motor shaft 9 causes a slight axial movement of the impeller shaft 3 with relation to the motor shaft and, therefore, it will be readily understood that this action automatically raises the valve plate 22 off the seat 23, to
90 prevent the friction and wear of these members when the pump is in operation.

In order to prevent the penetration of fluid into the motor casing 6 through the
95 seam 5, when the pump is in operation, and to remove any leakage fluid which may have collected in the motor casing, provision is made for lowering the pressure in the seam 5 to create a suction effect therein, tending
100 to draw the fluid out of the motor casing. It

will be readily understood that various methods may be employed to perform this function; however, in this particular embodiment of the invention, the seam 5 is connected with
 5 a channel which extends through the impeller 2 in such a manner as to cause the circulation of fluid therethrough as the impeller 2 is rotated.

The impeller channel, which may be considered the equivalent of a conduit, is divided into three main sections, which are designated as 24, 25 and 26, the first section 24 being formed by spaced portions of the pump casing 1 and impeller 2 disposed concentric
 10 with the pump shaft 9 and communicating with the second section 25 through an enlarged portion 27. The middle section of the channel 25 is concentric with the shaft 11 and terminates in a chamber in the impeller 2.
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The third section 26 of the impeller channel extends radially through the impeller blade, and comprises a plurality of passages drilled in the impeller blade as shown. Communication is established between the seam
 20 5 and the enlarged portion 27 of the channel by means of a second channel 28 of relatively small cross-section which permits fluid to drain downwardly from the motor casing
 25 6 into the impeller channel.

It will be readily understood that during rotation of the impeller 2, a centrifugal force is exerted upon the fluid which is contained
 30 in the chamber 29 causing the fluid to circulate through the channel from the low pressure compartment 31 of the pump into the high pressure or discharge compartment 32, in such a direction as indicated by the
 35 arrows 33.

By providing a discharge opening of larger cross-section than the intake opening of the channel, the pressure may be reduced within the impeller channel to such an extent as to cause a suction effect at the enlarged
 40 portion 27, which communicates with the seam 5, thereby relieving the seam 5 of hydrostatic pressure from inside the pump casing which permits any leakage fluid, which may have accumulated in the motor
 45 casing, to readily drain into the channel section 25.

It will be observed that the impeller 2 is so constructed that the disc portion 34
 50 which separates the two rows of blades 35 and 36 is extended beyond the discharge edges of the blades so that the outlet opening of the radial section of the channel 26 extends further from the axis of the pump
 55 than the discharge edges of the blades. By resorting to such a construction, the pressure increase in the whole channel is greater than the pressure increase through the rows of blades with a result that any stoppage or flow reversal in the channel is
 60 avoided. The pressure increase in the chan-

nel may also be changed to suit the operating requirements by varying the cross-sectional area in such manner as to either increase or decrease the rate of discharge in relation to the possible rate of fluid entrance.
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It may be stated, in conclusion, that while the illustrated example constitutes a practical embodiment of my invention, I do not wish to limit myself strictly to the exact details herein illustrated, since modifications of the same may be made without departing from the spirit of the invention as defined in the appended claims.
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I claim as my invention:

1. In a rotary pump for pumping fluids, in combination, a pump casing having intake and discharge chambers, an impeller rotatably mounted in the casing, a channel leading from the intake chamber and extending through the impeller for the circulation of a fluid, said channel being adapted to permit a more rapid discharge than intake of the fluid under the action of the impeller as it rotates thereby to give a low fluid pressure in the impeller channel, an auxiliary casing associated with the pump casing, and a second fluid channel extending from the auxiliary casing and communicating with the impeller channel to provide a drain for the auxiliary casing whereby the fluid is caused to flow from the auxiliary casing into the impeller channel.
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2. In a rotary pump for pumping fluids, in combination, a pump casing, an impeller rotatably mounted in the casing, a channel extending through the impeller for carrying fluid, said channel having inlet openings in the intake section of the casing and discharge openings in the impeller blades, and adapted to permit a more rapid discharge than intake of the fluid to provide forced circulation, an auxiliary casing associated with the pump casing, and a channel of relatively small cross-section establishing communication between the auxiliary casing and the impeller channel and disposed in such relation to the impeller inlet openings as to utilize the suction effect produced by the circulation of fluid in the impeller channel to draw leakage fluid from the auxiliary casing.
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3. In a rotary pump for pumping fluids, in combination, a pump casing, an impeller rotatably mounted in said casing, a motor for driving the pump having a casing associated with the pump casing, a channel having inlet openings in the intake chamber of the pump casing and discharge openings in the impeller blades for bleeding fluid from the pump casing, said channel extending through the impeller to effect a circulation of the fluid therethrough, a second channel of substantially smaller cross-section connecting the motor casing with the bleeder channel in such relation to the impeller as to subject the motor casing to a vacuum action to prevent fluid
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in the pump casing from entering the motor casing.

4. In a rotary pump for pumping fluid, in combination, a pump casing, an impeller rotatably mounted in the casing and having a channel for circulating fluid, said pump casing being provided with a channel having an enlarged portion communicating with the impeller channel, an auxiliary casing associated with the pump casing, and a second fluid channel connecting the auxiliary casing and the enlarged portion of the channel in the pump casing to permit leakage fluid to be drawn from the auxiliary casing into the impeller channel by the rotating action of the impeller.

5. In a rotary pump for pumping fluids, in combination, a pump casing having intake and discharge chambers, an impeller rotatably mounted in the casing, said impeller having a disc portion separating two rows of blades which extends beyond the blade edges, a channel for circulating fluid extending from the intake chamber of the casing through the impeller having discharge openings in the extended disc portion of the impeller, said channel being adapted to permit a more rapid discharge than intake of fluid to provide a suction effect in the impeller channel, an auxiliary casing associated with the pump casing, and a channel connecting the auxiliary casing and impeller channel to conduct leakage fluid from the auxiliary casing.

6. In a rotary pump for pumping fluids, in combination, a pump casing, an impeller rotatably mounted in the pump casing, said impeller having an internal chamber and flow ducts extending radially therefrom through the impeller blades, a channel for conveying fluid from the intake chamber of the pump casing to the internal chamber of the impeller, said channel being disposed so that the rotation of the impeller effects a circulation of the fluid therethrough, an auxiliary casing associated with the pump casing, a channel connecting the auxiliary casing to the first mentioned channel and disposed in a predetermined position relative to the impeller to cause a pumping action to effect the drawing of leakage fluid from the auxiliary casing.

7. In a rotary pump for pumping fluids, in combination, a pump casing having intake and discharge compartments, an impeller rotatably mounted in the casing discharge compartment, said impeller having an internal chamber and flow ducts extending therefrom through the blades, means for establishing communication between said compartments for carrying fluid, said means extending from the intake compartment through the pump impeller to the internal chamber, an auxiliary casing associated with the pump casing, and means for establishing commu-

nication between said auxiliary casing and the means for establishing communication between the pump compartments to provide for removing leakage fluid from the auxiliary casing by the suction effect produced by the rotating action of the impeller.

8. In a rotary pump for pumping fluids, in combination, a pump casing, an impeller rotatably mounted in the casing, said impeller and casing having portions which form a bleeder channel having an enlarged section, a channel extending through the impeller and communicating with the enlarged section of the bleeder channel for the circulation of fluid, said impeller channel having a discharge opening greater in cross section than the intake opening of the bleeder channel, an auxiliary casing associated with the pump casing, a third channel connecting said auxiliary casing with the enlarged section of the bleeder channel to provide for draining leakage fluid from the auxiliary casing under the influence of the suction effect produced in the enlarged portion of the impeller channel by the action of the impeller.

9. In a rotary pump for pumping fluids, in combination, a pump casing having communicating intake and discharge compartments, an impeller rotatably mounted in one of said compartments, said impeller having a chamber near its center with a plurality of discharge ducts extending therefrom through the impeller blades and an intake channel extending from said chamber through the impeller and casing to the intake compartment to provide a bleeder channel between the compartments, said bleeder channel having a larger discharge opening than an intake opening to create a suction effect in the channel as the impeller rotates, an auxiliary casing associated with the pump casing, and means communicating between the auxiliary casing and the bleeder channel for conducting leakage fluid from the auxiliary casing into the impeller chamber under the influence of the suction created in the impeller channel by the operation of the impeller.

10. In a rotary pump for pumping fluids, in combination, a pump casing, an impeller rotatably mounted in the casing, said impeller being provided with an annular chamber, an auxiliary casing associated with the pump casing, a shaft extending from the auxiliary casing into the pump casing for rotating the impeller, said shaft forming a seam with the pump casing and auxiliary casing, a channel extending partially through the impeller concentrically with the pump shaft and terminating in the annular chamber, a second channel having an enlarged section near the seam for connecting the impeller channel with the pump casing to permit fluid to enter the impeller channel, a plurality of discharge ducts extending through the impeller blades communicating with the axial

channel through the annular chamber for discharging fluid therefrom, and means establishing communication between the seam and the enlarged section of the impeller channel.

5 In testimony whereof, I have hereunto subscribed my name this 1st day of June 1928, at Nuremberg, Germany.

HANS RICHTER.

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