

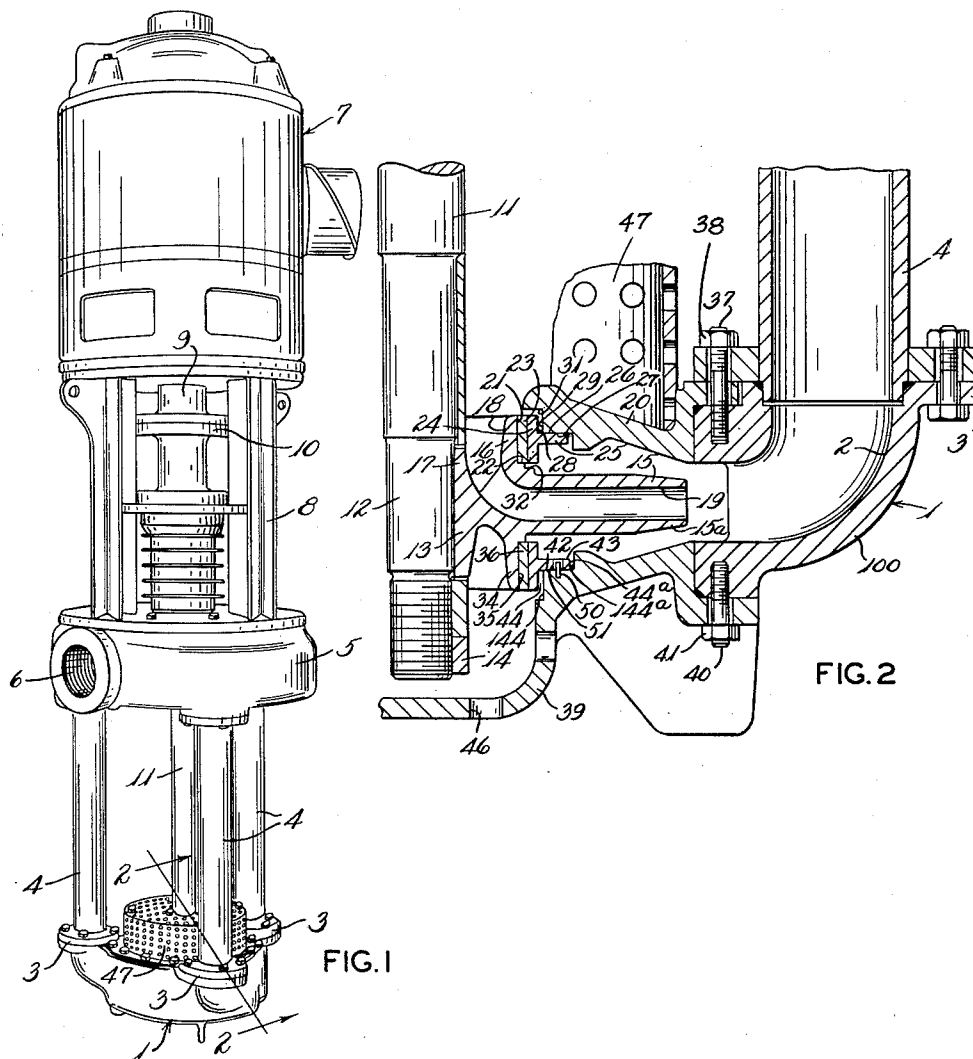
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W. D. HAENTJENS

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SINKING PUMP

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INVENTOR.
WALTER D. HAENTJENS
BY *Adham & Adham*
ATTYS.

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SINKING PUMP

Walter D. Haentjens, R.D. 1, Sugarloaf, Pa.

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This invention relates to pumps for use in mine sinking and other situations where water or other liquid must be moved from a sump or other space. The pump is designed to produce a high pressure, at good efficiency; be compact, readily installed and operate in a confined area without special supports.

Pumps for this type of use have been proposed in which a pump shaft rotatable about a vertical axis has been employed to rotate the impeller of a rotary pump submerged in a liquid. Where such pumps have been provided with a lower bearing at the rotary impeller it has been found difficult or impossible to properly lubricate such a bearing to prevent wear thereof, particularly if the liquid should contain some abrasive materials.

It has also been proposed to mount the impeller on the end of a cantilever shaft and to eliminate submerged bearings. Such devices of this type as have been proposed have required sealing of the space between the rotating impeller and the stationary pump housing and such sealing has been difficult to maintain due to the fact that such cantilever shafts are frequently operated above critical speed so that the shaft rotates about its center of mass rather than about its geometrical center. Also in previously proposed pumps, the construction of the pump housing has been such as to make it impossible to replace any sealing means without dismantling the entire pump.

The present invention has for an object to overcome the foregoing and other difficulties and to provide good sealing between the impeller and the pump housing while at the same time providing for access to the seal for replacement purposes without complete disassembly of the pump.

Another object is to provide a novel sealing ring for sealing a cantilever-supported rotating impeller to its surrounding housing.

A still further object is to provide a pump housing having a removable lower plate permitting removal of the impeller from its shaft and replacement of the sealing rings.

These and other objects will appear from the following description and the accompanying drawings.

Of the drawings:

FIG. 1 is an elevation of a sinking pump.

FIG. 2 is a sectional view thereof, taken on line 2—2 of FIG. 1.

Referring to the drawings, the numeral 1 generally designates a pump housing having three discharge openings 2 surrounded by flanges 3 to which are secured in sealed relation three vertical discharge pipes 4. The discharge pipes 4 have flanges at their upper ends whereby they are secured to an annular discharge head 5 having a discharge outlet 6. Above the discharge head is a vertical electric motor 7 secured to the discharge head and spaced therefrom by a frame 8. The motor shaft 9 is rotatable about a vertical axis and terminates in a coupling 10 whereby through a suitable coupling it is secured to a cantilever pump shaft 11. The lower free end of the cantilever shaft 11 has an end 12 of reduced diameter about which a rotary pump impeller 13 is removably secured, as by a draw nut 14.

The impeller 13 has upper and lower disc-like shroud portions 15 and 15a, respectively, and an upwardly extending annular flange 16 concentric with the disc and spaced radially outward of the hub portion 17 of the impeller to provide an annular inlet passage 18 therebetween. The passage 18 merges into a multiplicity of outwardly

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directed passages 19 terminating at discharge openings in the periphery of the impeller.

The upper casing or wall 20 of the pump housing extends over the impeller to the vicinity of the annular flange 16 of the impeller. It is desired that the liquids being pumped flow downwardly along the shaft 11 into passage 18 and outwardly through the impeller passages to the interior of the pump housing. In order to seal the space between flange 16 and the upper wall of the housing, while at the same time allowing the shaft to rotate about its center of mass, the flange 16 is machined to provide a cylindrical seat 21 terminating in a radial shoulder 22 above the impeller shroud 15 and an impeller wearing ring 23 of rectangular cross section is mounted thereon. A sealing ring 24 T-shaped in cross section is slidably mounted over the impeller ring 23. The flange 25 providing the stem of the T cross section is horizontal and has a sealing face 26 on its upper side which seals against a radial machined seat 27 on the upper wall 20 of the housing. The cylindrical face 28 of the sealing ring 24 is opposed to a cylindrical bore 29 of the housing but is spaced therefrom to clear it during rotation of the impeller about its mass axis. Also, the T-shaped sealing ring is normally spaced during use of the pump from a radial shoulder 31 of the housing and a radial shoulder 32 of the impeller. During use of the pump the sealing ring is in sealing position, as shown in FIG. 2, due to hydraulic pressure in the discharge chamber, but with release of pressure the sealing ring drops to a position of rest on the shoulder 32.

The impeller has a cylindrical flange 34 extending downwardly and machined on its outer face to provide a cylindrical seat 35 terminating in a radial shoulder. A bearing ring 36 of rectangular cross section is mounted on the machined surfaces of the impeller.

The pump housing 1 includes, for example, a triple volute ring, or discharge manifold 100, U-shaped in cross section and open at its innermost face. This volute ring, or housing 100 connects the impeller 13 and output therefrom to the discharge pipes 4 for smooth flow of pumped liquid thereto. The end portions of the volutes in the volute ring 100 form diffusers in the pump. The upper wall 20 is formed as a slightly conical annular ring secured to the top of the volute ring, or housing by studs 37 and nuts 38. The central opening in the volute ring 100 is of greater diameter than the impeller. To close the lower face of the housing 1, a domed cover plate, or casing head 39 is provided to clear the lower end of the shaft 11 and has a flange for removably securing it to the lower face of the volute housing, studs 40 and nuts 41 being provided for holding it in place.

The cover plate 39, which is generally slightly conical, is formed with a radial machined face 42 and a sealing ring 43 T-shaped in cross section, similar to ring 24, is provided to have its radial sealing face engage over the face 42 and its cylindrical face to slidably engage over the ring 36. Clearance 44 and 44a is provided between the sealing ring 43 and the cover plate so as to permit lateral movement of both the impeller and T-ring 24, and 43, as described above. The upper sealing ring 24 will rest on the face 32 on the pump when the pump is at rest and during its starting period. After the impeller 13 has determined its center of rotation and the pump has developed sufficient pressure, then the sealing T-ring 24 literally is blown into place with the sealing face 26 engaging the seat 27. The drawing shows the T-ring 24 operatively positioned.

FIG. 2 shows that the clearance 44 and 44a is provided between the faces 144 and 144a provided on the cover plate 39 at vertically and radially spaced portions thereof. Similar clearances are provided for the upper sealing ring 24. Relatively long radially adjustable seal-

ing surfaces are formed on the stem 25 of the ring 24 and the seat 27 provided therefor on the cover plate 20 and on the stem of the sealing ring 43 to provide effective sealing action for the pump chamber formed around the impeller 13 by the volute ring 100 and the cover plates 20 and 39.

The cover plate 39 is perforated by openings 46 to permit bleed of the liquid which passes through the annular clearance between the impeller chamber and the cover plate. For removing the impeller or the sealing rings, it is only necessary to remove the cover plate 39 and release the impeller by removing the draw nuts 14. The impeller and sealing rings may then be withdrawn through the cover opening without dismantling the remaining mechanism. Thus the problem of repair is much simplified over constructions of such pumps as heretofore proposed.

The casing is preferably of the multiple volute type as this provides better balanced operation.

A perforated strainer 47 may be mounted over the upper wall 20 of the pump housing to strain the material entering the pump. It has a clearance opening in its center to clear the shaft.

If desired, the T-shaped sealing rings may be prevented from rotating by loose fitting pins 50 secured to the upper and lower cover plates and entering slots 51 through the horizontal portions of the rings.

While a certain embodiment and details have been shown and described in order to disclose the invention, it will be understood by those skilled in the art that various modifications may be made without departing from the scope of the invention as it is defined by the following claims.

What is claimed is:

1. A pump of the rotary impeller type comprising an annular pump housing positioned in a horizontal plane and having a vertical pump shaft axis and including an annular discharge manifold for the pump housing and upper and lower annular plates removably secured to said housing and forming a part thereof, an impeller in the housing, a vertical pump shaft carrying said impeller and extending into said housing as a cantilever from the upper end thereof; said upper and lower plates having horizontally positioned radial sealing faces thereon, said impeller being positioned between said annular plates adjacent said sealing faces, said upper plate having a central opening spaced from said pump shaft to permit flow of liquid to said impeller, and upper and lower sealing rings operatively engaging said impeller for free vertical movement with relation thereto and having sealing engagement with said radially extending faces formed on said plates, said sealing rings being of T-shape in cross section with the stem of the T section extending radially outwardly with a radial face thereof sealing against the sealing face of one of said plates when the pump is operating, the upper sealing ring being held against its associated radial sealing face by pressure set up in the pump when operating, the radially outer ends of said stems having radial clearance from adjacent portions of said upper and lower plates to permit free lateral movement of said sealing rings without destroying the seal between said sealing rings and said plates whereby the pump shaft may move from its geometrical center to its center of mass when rotating without breaking the sealing action of said sealing rings.

2. A pump of the rotary impeller type comprising an annular pump housing positioned in a horizontal plane and including an annular discharge manifold for the pump housing and upper and lower annular plates form-

ing a part thereof, an impeller in the housing, a vertical pump shaft carrying said impeller and extending into said housing as a cantilever from the upper end thereof; said upper and lower plates having horizontally positioned radial sealing faces thereon, said impeller being positioned between said annular plates adjacent said sealing faces, said upper plate having an opening therein to permit flow of liquid to said impeller, and upper and lower sealing rings engaging said impeller for free vertical movement with relation thereto and having sealing engagement with said radially extending faces formed on said plates, said sealing rings being of T-shape in cross section with the stem of the T section extending extending radially outwardly for sealing against the sealing face of one of said plates when the pump is operating, the upper sealing ring being held against its associated radial sealing face by pressure set up in the pump when operating, the radially outer ends of said stems having radial clearance from adjacent portions of said upper and lower plates to permit free lateral movement of said sealing rings.

3. A pump of the rotary impeller type comprising an annular pump housing including a horizontally positioned discharge manifold for the pump housing and upper and lower plates forming a part thereof, an impeller in the housing, a vertical pump shaft carrying said impeller and extending into said housing as a cantilever from the upper end thereof; said upper and lower plates having horizontally positioned opposed radial sealing faces thereon, said impeller being positioned between said annular plates adjacent said sealing faces, and upper and lower sealing rings operatively engaging said impeller for free vertical movement with relation thereto and having sealing engagement with said radially extending faces formed on said plates, said sealing rings each having a cylindrical center section and a leg extending horizontally and radially outwardly, said legs each having a radial face formed on each said sealing ring sealing against the sealing face of one of said plates when the pump is operating, the upper sealing ring being free to move downwardly in the pump when it is inoperative, the radially outer portions of said sealing rings having radial clearance in the pump to permit free movement of said sealing rings in a horizontal plane without destroying the seal between said sealing rings and said plates whereby the pump shaft may move from its geometrical center to its center of mass when rotating without breaking the sealing action of said sealing rings.

4. A pump of the rotary impeller type as in claim 3 and where said lower plate is removable, said impeller being removable from said shaft when said lower plate is removed to provide access to said sealing rings without further disassembly of the pump.

5. A pump of the rotary impeller type as in claim 3 where said legs each have a clearance opening formed therein, and pin means on each of said plates engaging said clearance openings in said sealing rings to permit lateral movement of the rings while preventing rotation of the rings.

References Cited in the file of this patent

UNITED STATES PATENTS

834,848	Price	Oct. 30, 1906
1,369,379	Bogdanoff	Feb. 22, 1921
2,262,191	Moody	Nov. 11, 1941
2,741,991	Disbrow	April 17, 1956
2,890,659	Haentjens et al.	June 16, 1959