SUBMERSIBLE ELECTRICALLY DRIVEN PUMP

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This invention relates to a submersible electrically driven pump of the centrifugal, relatively low pressure type such as are used in the pumping out of holds in ships and various relatively shallow compartment spaces. For this purpose it is desirable to provide less costly pumps than those used for deep submerison.

One of the objects of the present invention is to provide a pump of the class described with a more efficient seal for preventing fluid being pumped from seeping into the motor chamber and into the bearings for the motor shaft.

Another object is to provide a simple construction for such a pump to facilitate assembly and disassembly for inspection.

A further object of the invention is to provide a cylindrically shaped pump of relatively small diameter and which is capable of being suspended through small openings by means of a discharge hose connected to one end of the pump.

Other objects will appear in connection with the following description of an embodiment of the invention illustrated in the accompanying drawing.

In the drawing:

Figure 1 is a longitudinal central section through a pump; and

Fig. 2 is a side elevation of the pump.

The outer casing for the motor comprises a double-wall cylindrical shell 1 having a relatively large annular chamber 2 and passages 3 for the flow of pumped fluid upwardly therethrough as a cooling medium around the motor.

The shell 1 has an inner web 4 dividing the inside into two chambers, the upper chamber being for the electric motor 5 and the lower chamber being for the pump and seal.

The motor 5 drops into the shell 1 from the top and the motor shaft 6 extends through a ball bearing 7 in web 4 into the lower pump chamber.

The upper end of the shell is closed by the upper head 8 which provides a central ball bearing 9 for the upper end of the shaft 6, and also the outlet 10 connected by passages to chamber 2 for transmitting the pumped fluid.

The upper head 8 is provided with a connection for the electrical cable 11 with suitable rubber or "neoprene" seals 12 and electric terminals 13. The upper head 8 is secured to shell 1 by a plurality of bolts 14 and gasket 15 seals the joint.

The pump and seal compartments are separated by a plate 16 threaded into the shell 1 and through which the shaft 6 extends.

A lower head 17 is bolted onto the lower end of shell 1 and provides a central inlet opening 18 for fluid being pumped. The inlet 18 is defined by a cylindrical flange 19 on the lower end of which is threaded a screen 20 or suitable valve casing.

The upper end of flange 19 defines a space for receiving the lower head of the runner 21 of the centrifugal impeller. The hub 22 of the runner is keyed onto the motor shaft 6 and held in place by a nut 23 with suitable lock washer and cap screw on the lower end of the shaft.

The runner 21 has blades 24 for impelling the fluid outwardly by centrifugal action when the runner is rotated and which discharge into the passages 3 in shell 1.

The hub 22 of the runner fits reasonably close to a flange 25 on the plate 16, and the outer edges of the runner 21 fit close to the shell 1 so as to substantially prevent leakage of fluid from the high pressure side back toward the motor shaft 6.

The hub 22 has large passages 26 therethrough for connecting the space immediately surrounding the shaft 6 between the pump and seal chambers with the low pressure or intake side of the pump, thereby continuously tending to withdraw fluid from this space.

The sealing device comprises an accurately machined collar 27 mounted on a tapered section of shaft 6 and held in place by a sleeve 28 pressed against it by hub 22 of the pump. The collar 27 is made of non-corrosive hard bearing metal or coated with the same.

An externally threaded nut 29 secures a washer 30 to plate 16, the washer 30 having a cylindrical bellows expansion member 31 extending upwardly therefrom around sleeve 28.

A sealing ring 32 is mounted on the upper end of member 31 and has an accurately machined face bearing against the lower side of collar 27. An outer flange 33 on ring 32 receives a coil spring 34 which also bears against washer 30 and holds the sealing surfaces of ring 32 and collar 27 in engagement under substantially constant pressure.

A similar sealing construction is provided above collar 27 by the sealing ring 35, bellows 36, washer 37, and nut 38 threaded into the web 4 adjacent ball bearing 7. A coil spring 39 holds the ring 35 against collar 27.

The sealing device described closes the sealing
chamber 40 against fluid entering from the pump chamber and also against fluid passing in either direction along the shaft to or from the motor chamber. The motor normally runs in air and the bearings 7 and 9 are packed with lubricant prior to assembly or provided with automatic lubricant feeding means.

The chamber 40 is preferably about three quarters filled with oil and in case water or salt water is being pumped any leakage of the latter by the sealing ring 35 into the chamber will result in a mixing of it with the oil. The resultant emulsion will have a high viscosity and will not be likely to leak by the sealing ring 35 and into the motor chamber.

A plurality of threaded plugs 41 through the wall of shell 1 provide access to the chamber 48 for cleaning and refilling as well as inspection purposes.

The motor is effectively cooled by the pumped fluid passing upwardly through chamber 2, the inner wall of which is in direct contact with the motor stator. The motor may be of any suitable construction, that shown being a two pole type induction motor.

Various embodiments of the invention may be employed within the scope of the claims.

The invention is claimed as follows:

1. In a device of the class described, a housing providing a motor chamber and a pump chamber separated by a sealing chamber sealed against communication with said first two chambers, a motor in said motor chamber and having its shaft extending through said sealing chamber into said pump chamber, said motor shaft having a section in said sealing chamber tapered to a smaller diameter toward the pump chamber, a collar having a tapered bore complemental to the taper on said shaft and mounted thereon in said sealing chamber, means biasing said collar on said shaft to make tight contact therewith and prevent leakage of fluid therebetween, and a sealing ring pressed against the side of said collar facing the pump chamber and secured by a sealed expansion member to the wall of the housing between the sealing chamber and pump chamber to prevent leakage of fluid from the pump chamber into said sealing chamber.

2. In a device of the class described, a housing providing a motor chamber and a pump chamber separated by a sealing chamber sealed against communication with said first two chambers, a motor in said motor chamber and having its shaft extending through said sealing chamber into said pump chamber, said motor shaft having a section in said sealing chamber tapered to a smaller diameter toward the pump chamber, a collar having a tapered bore complemental to the taper on said shaft and mounted thereon in said sealing chamber, means biasing said collar on said shaft to make tight contact therewith and prevent leakage of fluid therebetween, and a sealing ring pressed against the side of said collar facing the pump chamber and secured by a sealed expansion member to the wall of the housing between the sealing chamber and pump chamber to prevent leakage of fluid from the pump chamber into said sealing chamber.

3. In a device of the class described, a chamber in which liquid is present under pressure tending to effect leakage therefrom, a rotary shaft extending through the wall of said chamber, a tapered enlargement in diameter of said shaft outside and adjacent the wall of said chamber with the taper facing said chamber wall, a collar mounted on said shaft and having a tapered bore complemental to the enlargement on said shaft, means biasing said collar against said enlargement to provide a seal against leakage of fluid between the shaft and collar, said means including the pressure of fluid in said chamber, and a sealing ring secured by a sealed expansible member between said collar and the wall of said chamber and disposed to effect a frictional seal between the rotary collar and said chamber wall.

4. In a device of the class described, a chamber in which liquid is present under pressure tending to effect leakage therefrom, a rotary shaft extending through the wall of said chamber, a tapered enlargement in diameter of said shaft outside and adjacent the wall of said chamber with the taper facing said chamber wall, a collar mounted on said shaft and having a tapered bore complemental to the enlargement on said shaft, means biasing said collar against said enlargement to provide a seal against leakage of fluid between the shaft and collar, said means including the pressure of fluid in said chamber, and a sealing ring secured by a sealed expansible member between said collar and the wall of the chamber and disposed to effect a frictional seal between the rotary collar and said chamber wall, said sealing ring and collar operating in a liquid lubricant which tends to raise the viscosity of any liquid leaking past said sealing ring.

5. In a device of the class described, a chamber in which liquid is present under pressure tending to effect leakage therefrom, a rotary shaft extending through the wall of said chamber, a tapered enlargement in diameter of said shaft outside and adjacent the wall of said chamber with the taper facing said chamber wall, a collar mounted on said shaft and having a tapered bore complemental to the enlargement on said shaft, means biasing said collar against said enlargement to provide a seal against leakage of fluid between the shaft and collar, said means including the pressure of fluid in said chamber, and a spring pressed sealing ring secured by a sealed expansion member to the wall of the chamber surrounding the shaft and frictionally engaging the side of the collar toward the chamber tending to tighten the collar on said shaft.

6. In a device of the class described, a sealing ring assembly for a rotating shaft extending through a relatively fixed wall, comprising a sealing ring disposed to be pressed longitudinally against an enlargement on the shaft, corrugated bellows sleeve encircling the shaft and secured and sealed at one end to the sealing ring and at the other end to a washer, said wall having a recess for receiving said washer, an externally threaded hollow nut securing said washer in said recess and sealing the same to the wall, and a coil spring encircling the bellows in the bore of said nut and engaging the washer at one end and the sealing ring at the other to bias the latter against the enlargement on said shaft.

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