United States Patent

Dahlgren

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[54] SELF-COUPLING PUMP UNIT

[72] Inventor: **Jens Karl Adolf Dahlgren,** Stockholm, Sweden

[73] Assignee: **Stenberg-Flygt AB,** Solna, Sweden

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[51] **Int. Cl.**.....**F04b 17/00,** F04b 35/00, B67d 5/40

[58] **Field of Search** 222/180, 385; 417/360, 361; 415/201

[56] **References Cited**

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Primary Examiner—Robert M. Walker

Attorney—Sughrue, Rothwell, Mion, Zinn and Macpeak

[57] **ABSTRACT**

An immersible pump unit comprising a liquidtight motor and a pump with a lateral connection and guiding means which, on lowering of the pump unit, guides the pump connection to the vicinity of a coupling unit, the pump unit being suspended so that the central axis of the pump runs slightly obliquely downwards, there being close to the coupling unit a support for the pump unit in its lowered position. There is in the extension of the coupling unit beyond the support, at least one stop with an inclined plane facing the coupling unit, the point of contact between the pump unit and the inclined plane of the stop lying a distance below an imaginary line of operation for the force of reaction generated at the connection and coupling unit by the pump pressure.

7 Claims, 2 Drawing Figures

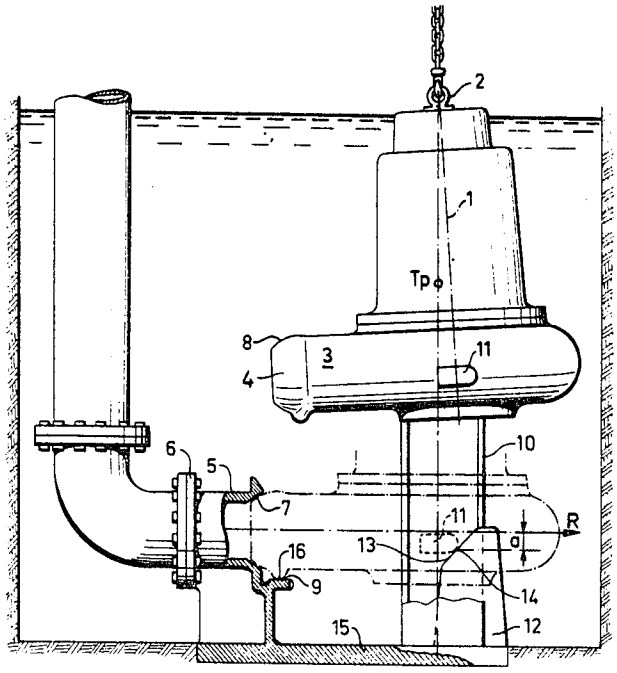


Fig. 1

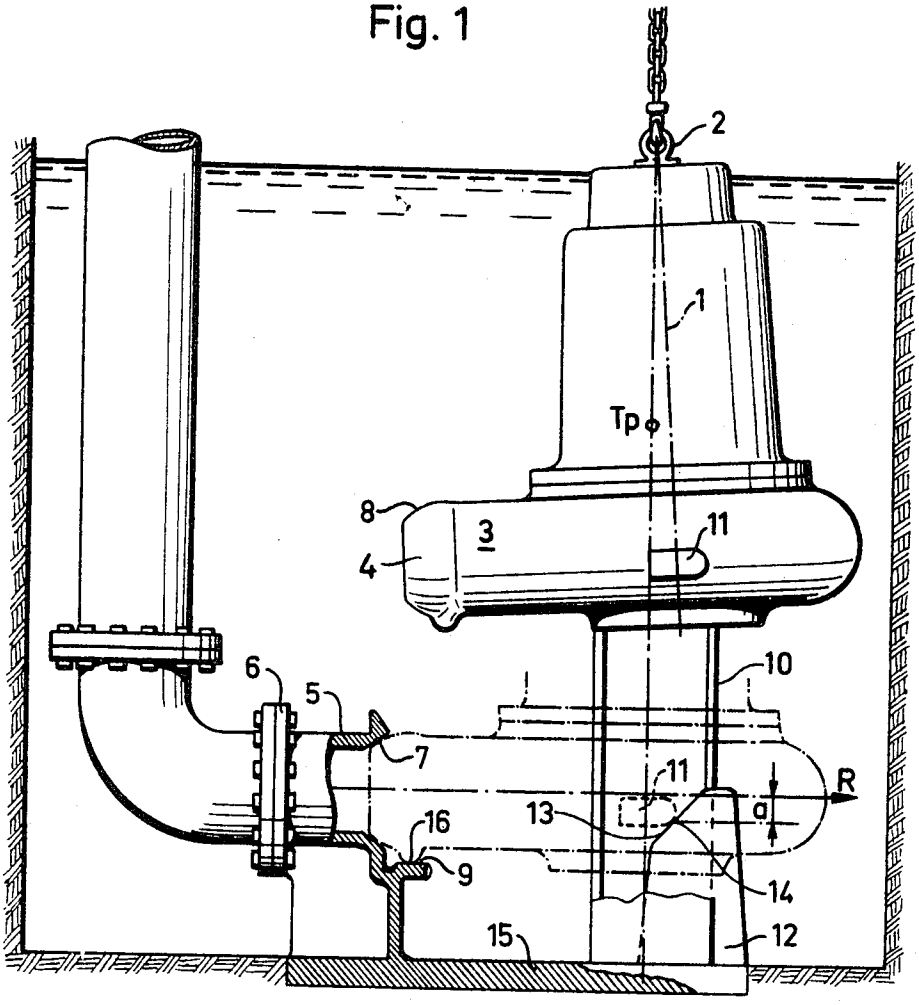
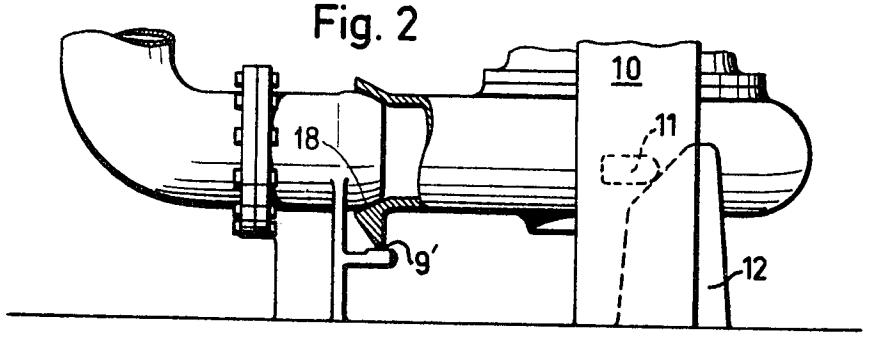


Fig. 2



SELF-COUPLING PUMP UNIT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a pump unit immersible in a liquid and consisting of a liquidtight-enclosed motor and a pump with connection leading from the pump housing, the pump unit having a guide which, on lowering and raising of the pump unit, guides the pump connection to and from the vicinity of a coupling unit, the pump unit having a suspension device preferentially so placed that the central axis of the pump unit runs slightly obliquely downwards when the pump unit is freely suspended therein.

2. Description of the Prior Art

In pump units intended for operation wholly or partially immersed in the pumped medium, there is great inconvenience in maintenance work if the pump units are permanently installed. To eliminate these inconveniences it is a known practice to arrange for the pump units to be lowered into the pumped medium, guided along guides and, in their lowered position, bearing against a coupling unit on an outlet pipe for the pumped medium. The connection of the pump unit must in this position close tightly against the outlet pipe without needing to be attached to it by means, for example, of screws.

These known devices admittedly enable the pump unit to be relatively easily raised out of the pumped medium for maintenance work or the like. But certain inconveniences remain, for example the difficulty of getting the connection of the pump unit to close tightly against the coupling unit of the outlet pipe after the pump unit has been lowered and during its operation.

The U.S. Pat. No. 3,018,925 describes a device of this kind, in which the flanges which connect a pump unit to an outlet pipe form an angle with a vertical plane. The advantage of this is that the pump unit, in its immersed position in the pumped medium, seals against the connecting pipe under the influence of the gravity of at least part of the pump unit. This provides a relatively good seal between pump and outlet pipe.

Other devices of this kind are known in which the slide-pieces which run along the guides are articulated to the pump unit, which, after immersion in the pumped medium, is turned slightly round an essentially horizontal axis, the pump unit being thereby lowered in the direction of the connecting flange of the outlet pipe. In such devices as well the weight of the pump unit is used to achieve a seal with the coupling flange, in that a certain torque arises around the axis around which the slide-shoes are rotatably arranged. In these devices as well the seal between the pump unit connection and the coupling flange is obtained only through the torque produced by the weight of the pump unit.

Another known procedure is to furnish the pump unit with gripping devices which grip across the flange of the outlet pipe. The gripping devices and/or flange of the outlet pipe are given suitably chamfered shoulder areas so that a wedge effect arises between the gripping device and the flange. In this way a fairly good seal is obtained between the pump unit and coupling unit when the area of the outlet is limited to relatively small diameters and/or the pump pressure to such low values that the torque occasioned by the outlet area, the pump pressure and the leverage does not overcome the torque determined by the weight of the pump unit and the distance to its point of gravity.

Such devices are, however, no longer of advantage for pumps with large forces of reaction since they lift the pump unit off the flange of the outlet pipe and leakage occurs.

SUMMARY OF THE INVENTION

The aim of the present invention is to overcome such disadvantages and to find a new solution which is applicable both to small and large pumps, especially the latter, and provides a sufficiently high sealing pressure between the pump unit and coupling unit, where the pressure cannot be overcome but is instead magnified by forces of reaction arising during pumping.

The invention thus relates to a pump unit immersible in a liquid and consisting of a liquidtight-enclosed motor and a pump with connection leading laterally out of the pump housing, the pump unit having a guide which, on lowering and raising of the pump unit, guides the pump connection to and from the vicinity of a coupling unit, the pump unit having a suspension device preferentially so placed that the central axis of the pump unit runs slightly obliquely downwards when the pump unit is freely suspended therein. The invention is essentially characterized in that a support for the pump unit in its lowered position is arranged at or close to the coupling unit, in addition to which, in the extension of the coupling unit beyond the support, there is arranged at least one — possibly laterally displaced — stop with an inclined plane facing the coupling unit, the point of contact between the pump unit and the inclined plane being arranged to lie below the force of reaction at the pump connection and coupling unit resulting from the pump pressure and the area.

The connection of the pump housing and/or the coupling unit may suitably have special bearing and sealing surfaces. According to a special embodiment of the invention these bearing and sealing surfaces may be of essentially spherical form, whereby they become self-centring and allow tolerances in the relations between the positions of the coupling unit and the stop.

The suspension device should preferentially be attached to the upper side of the enclosed motor on the central axis of the pump unit or on the side thereof furthest from the connection. According to a preferred embodiment of the invention the pump unit bears against the inclined plane via at least one pin, stud, roller or the like. This pin, stud, roller or the like may be arranged so as, on raising and lowering of the pump unit, to engage with the guiding device for guiding of the pump unit to and from the connection.

Further advantages are gained through a special embodiment of the invention, in which coupling unit, support, stop and inclined plane are combined in one unit which, for example, can be placed on the bottom of a basin, cesspool or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

One embodiment of the invention will now be described — without limiting the invention thereto — with reference to the attached drawings:

FIG. 1 shows the invention in schematic form, viewed from the side and partially in cross-section, the pump unit being shown with continuous lines in raised position and with broken lines in lowered position.

FIG. 2 shows a partial cross-sectional side view of a modification of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The pump unit is in the conventional manner immersibly made up of a liquidtight-enclosed electric motor and a pump, preferentially a centrifugal pump. Laterally there projects from the pump housing a stub 3 with a connection 4, the end surfaces of which run essentially vertically. Pump and motor are coaxially arranged and, on the upper side of the motor on the common central axis 1, there is a suspension device in the form of an eyelet 2. The eyelet 2 need not lie on the central axis 1 even if the subsequent description assumes this position. The point of gravity of the pump housing here lies, inter alia because of the connecting stub 3 projecting laterally from the pump housing, at the side of the central axis 1, to the left of it in the figure, so that the point of gravity Tp of the entire pump unit will lie outside the central axis 1. Consequently, during suspension of the pump unit, i.e. when its point of gravity Tp is below the suspension eyelet 2, the central axis 1 will run slightly obliquely downwards. Owing to the eccentric position of the point of gravity Tp the pump unit, and thus also the connection 4 of the pump housing, hangs slightly obliquely, as shown by continuous lines in the figure. Should the point of gravity Tp coincide with the central axis 1 of the pump unit,

the suspension device can be placed, for example, further to the right in the figure so that, when suspended, the pump unit hangs slightly obliquely, with the side facing the coupling unit 5 slightly lower.

The pump unit is intended to be coupled to the coupling unit 5, to the flange 6 of which the pumping pipe is intended to be connected. The coupling unit 5 has an essentially vertical connecting body having a bearing and sealing surface 7, which fits the corresponding bearing and sealing surface 8 of the connection 4 of the pump housing. In the embodiment under consideration these bearing and sealing surfaces 7, 8 are spherical, so that the pump housing can be rotated around the midpoint of the sphere without the seal being affected thereby, and so that the connection 4 of the pump housing becomes self-centring in the coupling unit 5.

When the pump unit, slightly obliquely suspended in the eyelet 2, is lowered, being guided in the known manner with some clearance on one or more essentially vertical U-shaped guides 10, the unit will finally assume a position with the connection 4 of the pump housing roughly opposite the coupling unit 5. A support 9 prevents the connection 4 of the pump housing from being lowered past the coupling unit 5 and furthermore, according to the invention, has the following function.

At the moment when, on lowering of the pump unit on the first occasion, the connection 4 of the pump housing comes into contact with the support 9, the pump unit still hangs obliquely. The lower part of the connection 4 of the pump housing is then at a slightly greater distance from the coupling unit 5 than its upper part. On being further lowered the pump unit, at the connection 4 of the pump housing, will be carried by the support 9, whereas it is not supported at the opposite side of the pump housing, i.e. on its right side in the drawing, as a result of which the pump unit is rotated — in the figure clockwise around a horizontal axis — and the bearing and sealing surface 8 of the pump housing thus approaches the bearing and sealing surface 7 of the coupling unit 5. At the end of the downward movement a pin, stud, roller 11 or the like comes up against a stop 12 connected to the coupling unit 5 through a base plate 15. This takes place on an inclined plane 13 of the stop 12 facing the coupling unit 5. The point of contact 14 between the stud or the like 11 and the inclined plane 13 here lies the distance *a* below the now preferentially horizontal midplane of the pump housing and connecting stud 3, and therefore below the force of reaction R resulting from the pump pressure, whereby, through the resulting wedge effect, the bearing and sealing surfaces 7 and 8 are pressed together. The placing of the point of contact 14 according to the invention, viewed in the direction of the force of reaction, below the point of engagement of the force of reaction, has the following advantageous effect.

When the pump is working — especially at a large head, i.e. pump pressure, and large area of engagement — there is generated through the forces of reaction owing to the said pump pressure and area a large resulting force R in the midplane, directed to the right in the figure. Owing to the distance *a* of this force R from the point of contact 14, a clockwise torque is obtained in the figure, which presses the stud 11 further downward towards the inclined plane 13, with consequent intensification of the force which presses together the bearing and sealing surfaces 7, 8.

The greater the force R, the greater accordingly is the intensification of the compressing force.

By making the inclination of the plane 13 steeper, a further increase of the force pressing together the bearing and sealing surfaces 7, 8 can be attained. The downward directed suction aperture also contributes to an increase of the sealing force during operation of the pump.

The stop 12 with the inclined plane 13, the support 9 and the coupling unit 5 with coupling flange 6 are, in the embodiment described, connected together by means of a base plate 15, which can suitably be placed on the bottom of a basin, cesspool or the like, and from which the guides 10 may also proceed.

By using two studs 11 or the like, a three-point mounting is obtained, as a result of which the pump unit stands very rigid and nevertheless can be easily raised without manual release of any engaging device.

In pump units of this kind the invention thus provides an arrangement which is self-centring and self-coupling, provides an increasing sealing pressure with rising pump pressure and is usable for very large and heavy pump units.

In FIG. 2 a variation of the pump mounting flange is provided. The stop 11 is still located below the central thrust R so that a clockwise torque is produced, however, the bearing and sealing surface which is pressed together, will be at a point 18 adjacent support 9'.

What I claim is:

1. A pump unit immersible in a liquid and consisting of a liquidtight-enclosed motor and pump for pumping liquid into an output conduit comprising:
   - a housing;
   - a connection member extending laterally out of the pump housing and terminating in a flange with a lower support portion;
   - a base member having a camming stop member;
   - at least one corresponding stop member positioned on the housing, and
   - a coupling member having a lower support member for supporting the flange support portion, the coupling member positioned at such a distance relative to the camming stop member that any reaction force generated during the pumping action along the axial length of the connection member will be above the contact point of the housing stop and base member stop thereby creating a torque force about the contact point that increases the sealing contact force between the connection member flange and coupling member in direct relation to the torque force.

2. A pump unit as in claim 1, where the lower support portion of the connection member flange is a protruding stud member.

3. A pump unit as in claim 1, where the coupling member is integral with the base member.

4. A pump unit as in claim 1, where the sealing surface of the connection member flange and the coupling member is spherical.

5. A pump unit as in claim 1, further including a suspension device adapted to connect the housing to a cable or the like, the suspension device positioned on the housing so that the connection member is inclined downward while suspended.

6. A pump unit as in claim 2, where the lower support member is positioned beneath and outward of the coupling member opening.

7. A pump unit as in claim 6, where the spherical connection member flange is adapted to surround the coupling member sealing surface.

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