

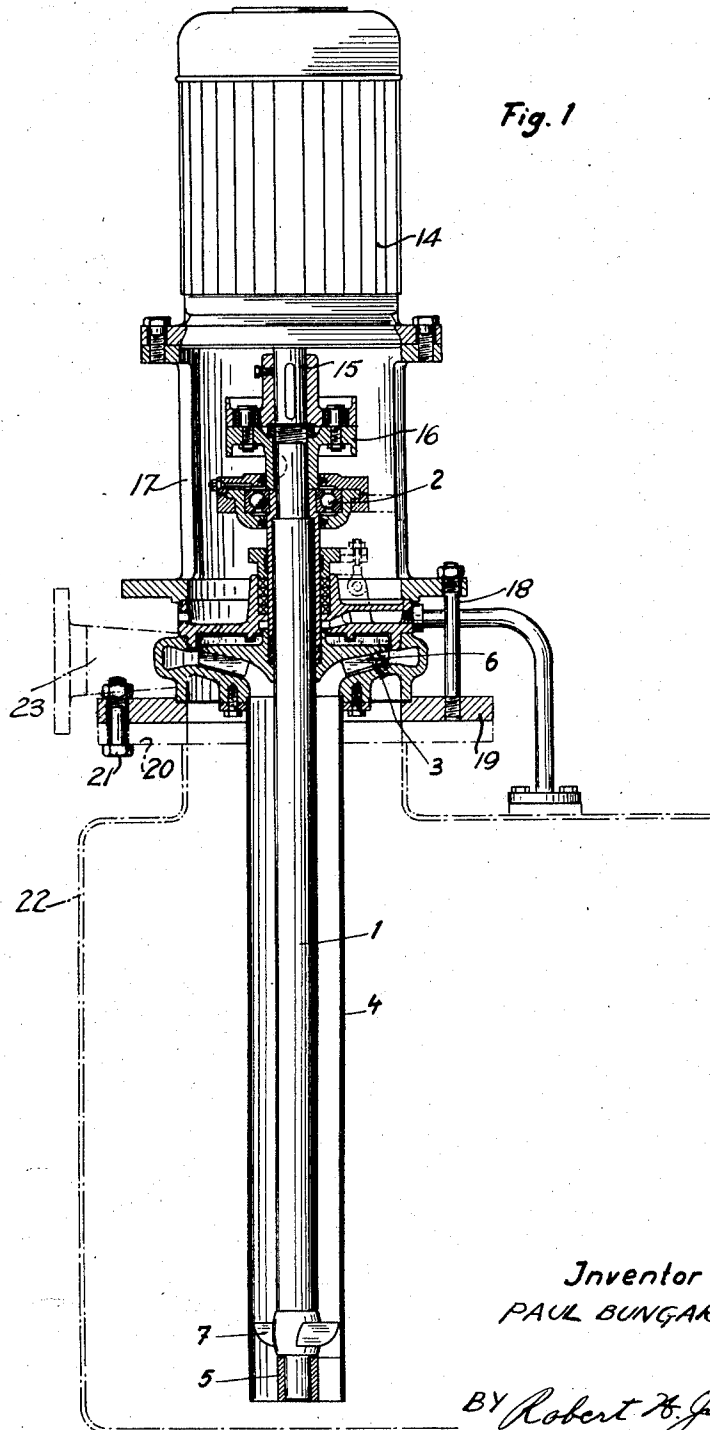
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ROTARY PUMPS

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2 Sheets-Sheet 1



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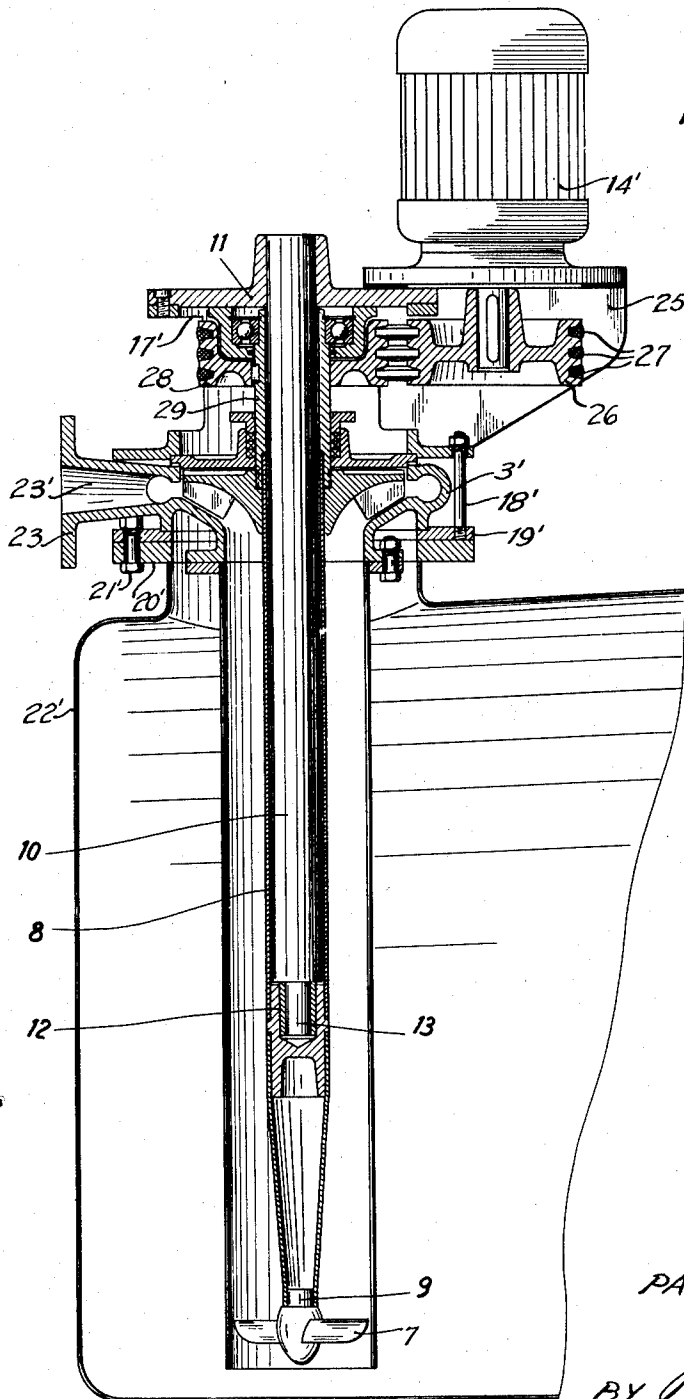


Fig. 2

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ROTARY PUMPS

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3 Claims. (Cl. 103—88)

This invention relates to a rotary pump of the kind having a vertical spindle which is immersed in the liquid to be pumped and is surrounded by a pipe through which the liquid is delivered, which is supported by bearings disposed near the upper end above the liquid and near the lower end which is immersed in the liquid and provided with an impeller and wherein a drive means for the pump is disposed above the level of the liquid.

For obtaining greater lengths of spindle and, therefore, as great as immersion depth as possible, an upper bearing for the shaft is provided above the level of the liquid in the form of a ball-bearing and a lower bearing in the form of a footstep bearing is provided on the end which is to be immersed in liquid. The impeller of the pump is disposed on the end of the spindle which is to be immersed in the liquid and which is surrounded at this place by the pump casing. These pumps have the disadvantage that, owing to the arrangement of the impeller at the end of the shaft to be immersed in the liquid and owing to the weight of the impeller, great stress is imposed on the foot-step bearing. Also, the pump casing which has to be lowered into the liquid occupies a relatively large space in the liquid to be pumped. If the liquid to be pumped is corrosive, the impeller and the casing surrounding it must be made of expensive material which is resistant to attack by the liquid.

If the impeller and the bearings of the spindle are arranged above the level of the liquid and an auxiliary impeller is provided at the free end of the spindle which extends beyond the bearings into the liquid, the above disadvantages can be overcome. In this case, however, the immersion depth is necessarily small and the structural height above the level of the liquid becomes somewhat great.

Since the invention permits also the actual pump parts consisting of the impeller and the pump casing, even with great immersion depth, to be arranged above the level of the liquid, these parts, even when a corrosive liquid, such as hydrochloric acid, is to be pumped, need only be provided on the inside with acid resistant coverings which reduces the cost of manufacture of pumps for pumping such liquids.

Pumps according to the invention are illustrated diagrammatically and by way of example in the accompanying drawings, in which:

Fig. 1 is a longitudinal section through one structural embodiment of the invention; and

Fig. 2 is a similar section through a second embodiment of the invention.

According to the invention, in a pump of the kind set forth the impeller wheel is attached to the spindle at or near the upper end above the level of the liquid and at the lower end of the spindle and within the pipe which serves to convey the liquid there is provided an auxiliary impeller for raising the liquid in the pipe. By this means it becomes possible, while avoiding the above-

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mentioned disadvantages, to obtain great immersion depths, the bearing at the end of the spindle to be lowered into the liquid to be pumped is at the same time relieved from load even when the shaft is long and need resist no considerable stresses. Since the additional impeller needs to raise the liquid contained in the surrounding tube only to the main impeller, it may be of small dimensions and small weight and since it conveys the liquid in the axial direction of the shaft it leads to no radial stress on the bearing. The loads due to the impeller are taken by the spindle bearing arranged above the level of the liquid. Since the bearing which is immersed in the liquid is relieved from stress, the pump operates with greater certainty and its life is increased, especially because this bearing need not be lubricated by a special lubricant but can be lubricated by the liquid to be pumped. The construction also has a favourable influence on the total dimensions and material requirements.

Referring to Fig. 1 of the drawing, the spindle 1 is carried in a ball bearing 2 above the level of the liquid and in a footstep bearing 5 in an immersion pipe 4 which surrounds the spindle 1 and extends from the pump casing 3. The bearing 5 is disposed at the end of the pipe to be lowered into the liquid. A main impeller 6 is arranged in the pump casing which is also disposed above the level of the liquid. Above the bearing 5 there is provided an auxiliary impeller 7 which is mounted on the spindle and which, when the pump is set in operation, raises the liquid in the pipe 4 until it reaches the impeller.

The spindle or shaft 1 is driven by the motor 14 having a shaft 15 which is connected to the shaft 1 by means of a coupling 16. Motor 14 is mounted upon a cylindrical casing 17 which is seated upon the pump housing 3 and secured by means of bolts 18 (only one is shown) to a flange 19 which supports the housing 3 of the pump. The flange 19 is fastened by means of bolts such as 21 to flange 20 on the tank or container 22. Housing 3 is provided with a pump discharge member 23.

It is particularly advantageous if, in the pump in accordance with the invention, the spindle is hollow and its end which is lowered into the liquid is closed and a fixed rod extends from the opposite end into the hollow spindle and engages a bearing in the spindle. This affords the advantage that no bearing which is subject to attack or corrosion is present in the liquid to be pumped and even when corrosive and dirty liquids have to be pumped, large immersion depths can be obtained by using a long spindle which was not hitherto possible owing to the lack of suitable materials for the bearing.

In Fig. 2 the vertical pump spindle is designated by the numeral 8. The spindle is hollow and is closed at the end 9 which is to be lowered into the liquid. A fixed supporting rod 10 extends into the hollow spindle and is carried by a flanged disc 11 above the level of the liquid. The hollow spindle 8 is provided with an inner bearing member 12 which is engaged by the end 13 of the stationary rod 10 thus forming a support bearing for spindle 8.

The flange disk 11 is mounted upon housing 17', which in turn is seated on housing 3' of the pump and secured by means of screws 18' to the flange 19' which supports the housing. This flange 19' again is secured to flange 20' on the liquid container 22' by means of bolts 21'. The pump housing 3' is also provided with a discharge member 23'.

Hollow shaft 8 is driven by motor 14' which is mounted on an arm 25 of the supporting housing 17'. A V-belt pulley 26 on motor 14' is connected by means of V belts 27 to the pulley 28, which is secured to a

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rotatable extension 29 of hollow shaft 8 which is thus rotated around the stationary rod 10.

I claim:

1. A rotary pump of the type comprising a vertically disposed hollow and elongated impeller spindle closed at its lower immersible end and having an internal bearing proximate said lower end, a main impeller carried by said spindle and disposed above the level of the liquid to be pumped, an upper bearing disposed above said main impeller and rotatably supporting said spindle and said impeller, drive means for said spindle disposed proximate the upper end of said spindle above said main impeller, a suction pipe disposed around and extending longitudinally of said spindle below said main impeller, an auxiliary impeller supported on said spindle within the lower end of said pipe, a stationary shaft supporting member disposed above said upper spindle bearing and a stationary shaft extending upwardly into said supporting member and downwardly into said spindle, the lower end of said shaft having bearing engagement with said internal bearing and providing stationary support for said spindle proximate the lower end thereof.

2. A rotary pump of the type comprising a vertically disposed hollow and elongated impeller spindle closed at its lower immersible end and having an internal bearing proximate said lower end, a main impeller carried by said spindle and disposed above the level of the liquid to be pumped, an upper bearing disposed above said main impeller and rotatably supporting said spindle and said impeller, drive means for said spindle disposed proximate the upper end of said spindle above said main impeller, a suction pipe disposed around and extending longitudinally of said spindle below said main impeller, an auxiliary impeller supported on said spindle within the lower end of said pipe, a stationary shaft supporting member disposed above said upper spindle bearing and a stationary shaft extending upwardly into said supporting member and downwardly into said spindle, the lower end of said shaft having bearing engagement with said internal bearing and providing stationary support for said spindle proximate the lower end

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thereof, said suction pipe being continuous and of cylindrical conformation in a manner permitting unobstructed removal of said spindle and said auxiliary impeller from said pipe.

3. A rotary pump of the type comprising a vertically disposed hollow and elongated impeller spindle closed at its lower immersible end and having an internal bearing proximate said lower end, a main impeller carried by said spindle and disposed above the level of the liquid to be pumped, an upper bearing disposed above said main impeller and rotatably supporting said spindle and said impeller, drive means for said spindle disposed proximate the upper end of said spindle above said main impeller, a suction pipe disposed around and extending longitudinally of said spindle below said main impeller, an auxiliary impeller supported on said spindle within the lower end of said pipe, a stationary shaft supporting member disposed above said upper spindle bearing and a stationary shaft extending upwardly into said supporting member and downwardly into said spindle, the lower end of said shaft having bearing engagement with said internal bearing and providing stationary support for said spindle proximate the lower end thereof, said drive means including a drive member disposed around said spindle above said upper bearing and below said stationary shaft supporting member.

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