May 6, 1941. O. JACOBSEN 2,240,782

HYDRAULIC PUMP WITH LEAK-PREVENTING CONSTRUCTION

Filed April 17, 1939 2 Sheets-Sheet 1

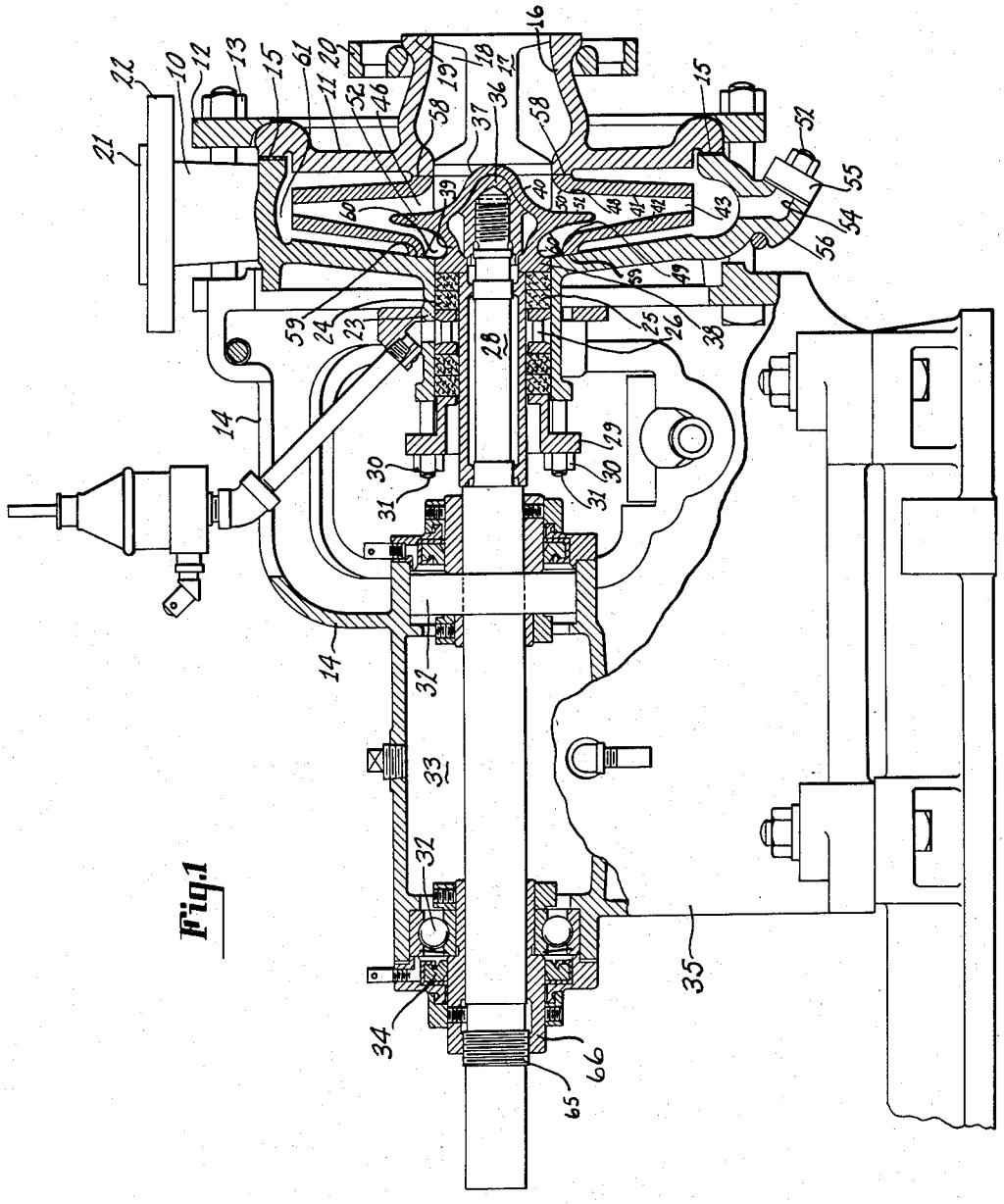


Fig.1

INVENTOR
By OYSTEIN JACOBSEN
Faulmin & Faulmin
ATTORNEYS

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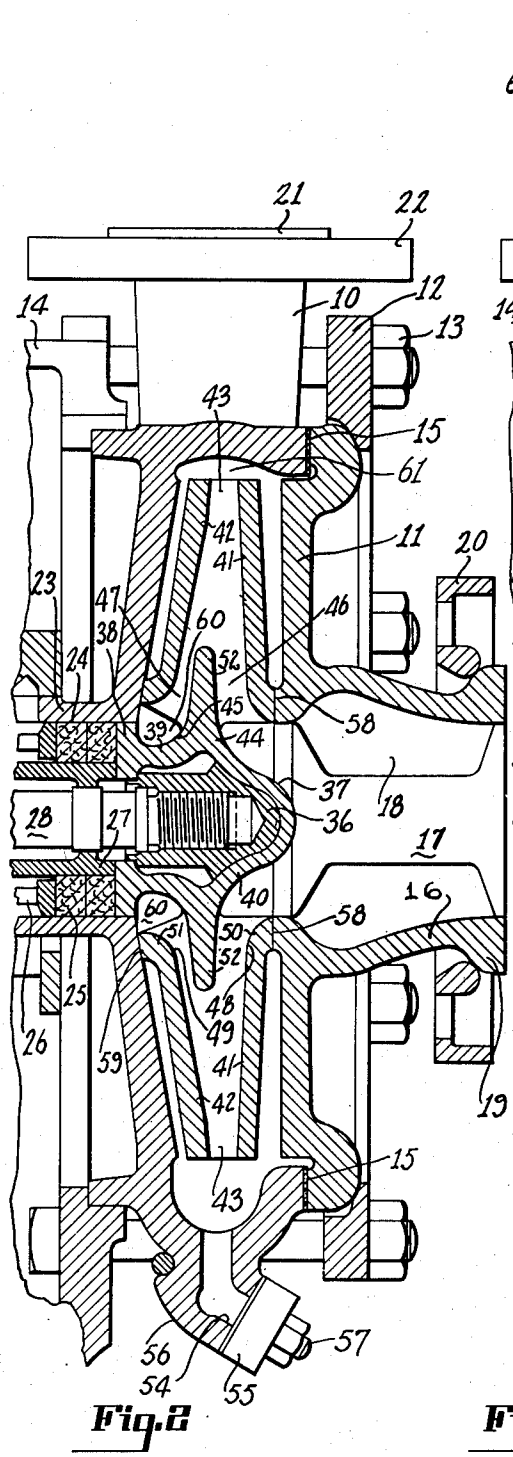


Fig. 2

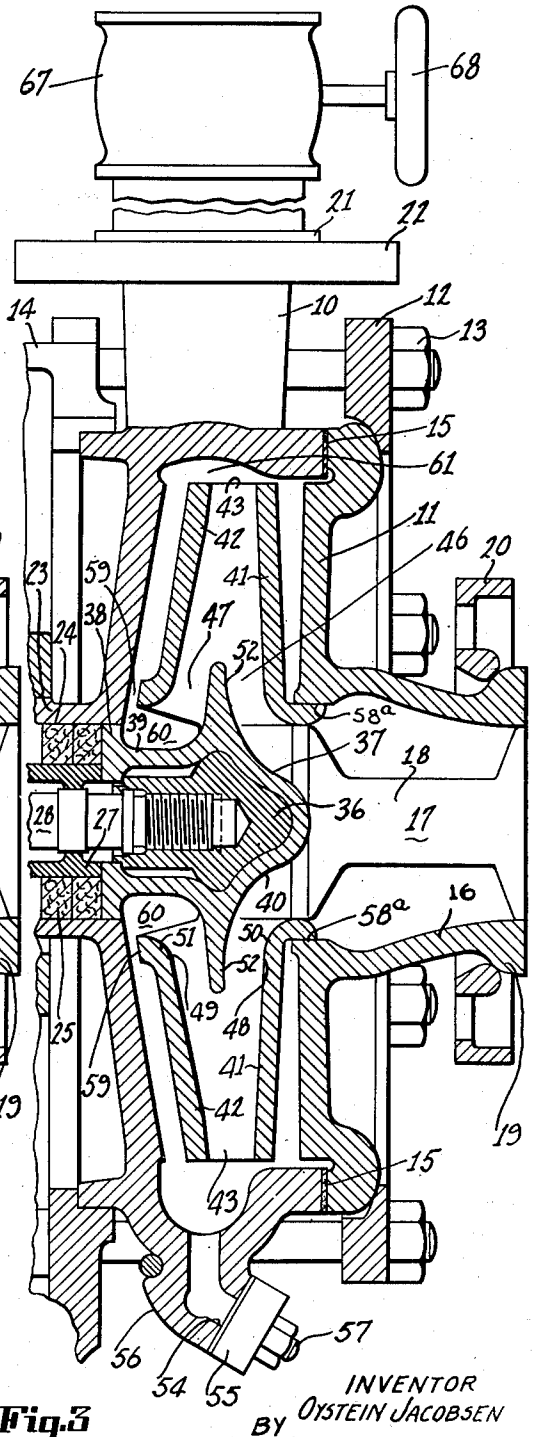


Fig. 3

INVENTOR
OYSTEIN JACOBSEN
BY Faulmin & Faulmin
ATTORNEYS

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HYDRAULIC PUMP WITH LEAK-PREVENTING CONSTRUCTION

Oystein Jacobsen, Montgomery County, Ohio, assignor to The Duriron Company, Inc., Dayton, Ohio, a corporation of New York

Application April 17, 1939, Serial No. 268,157

2 Claims. (Cl. 103—103)

This invention relates to hydraulic pumps, and in particular, to such pumps as are employed for pumping corrosive fluids.

One object of this invention is to provide a centrifugal pump having means for preventing the flow of corrosive fluids along the drive shaft and through the packing thereof.

Another object is to provide a centrifugal pump having an impeller mounted on a shaft supported within a casing, this impeller having a dual pumping function whereby it pumps fluid, not only from the main body of fluid in the pump intake chamber, but also from a chamber opposite the pump intake chamber on the other side of the impeller and adjacent the packing, which is designed to prevent leakage along the drive shaft.

Another object is to provide a centrifugal pump, as described in the preceding object, wherein the impeller is provided with means directly engaging the packing and serving to further assist in the prevention of leakage along the shaft and through the packing.

Another object is to provide a centrifugal pump having an impeller with double chambers equipped with vanes and separated by a partition.

Another object is to provide a centrifugal pump having an impeller with vanes enclosing separate chambers within the impeller, one set of vane chambers opening into the pump intake chamber, the other set of vane chambers opening into a leakage chamber adjacent the shaft packing, but separated therefrom by an annular impeller portion which directly engages the packing and furnishes additional means for the prevention of leakage from the leakage chamber into the packing.

Another object is to provide a centrifugal pump having a hollow impeller and vanes therein enclosing separate chambers within the impeller, one set of vane chambers opening into the pump intake chamber, the other set of vane chambers opening into a leakage chamber on the opposite side of the impeller, the impeller having an integral annular portion directly engaging the packing around the drive shaft and impeding the leakage of fluid by necessitating this following a labyrinthine path around the annular portion.

Another object is to provide a centrifugal pump as set forth in the preceding object wherein the packing surrounds a sleeve, which, in turn, surrounds the drive shaft and thus protects the drive shaft from injury by a corrosive fluid.

Another object is to provide a centrifugal pump having an impeller with a hub formed of corrosion-resisting material, the impeller hub being mounted upon a core, which, in turn, is mounted upon the end of the impeller drive shaft, the impeller carrying annular portion engaging a packing surrounding a sleeve, which, in turn, surrounds the drive shaft.

Another object is to provide a centrifugal pump having a double impeller, together with means for moving the impeller axially to vary the width of the leakage channel between the impeller and the casing in order to vary the amount of fluid conveyed by the auxiliary portion of the impeller.

Another object is to provide a centrifugal pump as set forth in the preceding object wherein a valve is provided in the outlet circuit of the pump for throttling or wholly cutting off the discharge of the pump thereby causing the pump to become a recirculator and to recirculate any desired portion of the liquid within the pump before discharging it through the throttled outlet circuit.

In the drawings:

Figure 1 is a central longitudinal section through a preferred embodiment of the pump of this invention.

Figure 2 is an enlarged, detailed view of the impeller and adjacent structure shown in Figure 1.

Figure 3 is a view similar to Figure 2 but shows the pump of this invention arranged as a recirculator and recirculating the fluid within the interior of the pump before completely discharging it from the pump.

General arrangement

In general, the centrifugal pump of this invention is intended for the pumping of corrosive fluids, and particularly to prevent the flow of such corrosive fluids along the drive shaft.

Hitherto the leakage of corrosive fluids along the drive shaft of centrifugal pumps has caused great damage to the shaft and its associated structure and this action is particularly serious when acids are being pumped and has often resulted in a complete break down of the pumping apparatus.

The present invention effectively prevents such leakage by providing a hollov impeller with the vanes thereof dividing the interior of the impeller into two sets of vane chambers, these vane chambers being separated f m each other by a partition formed with the hub of the impeller. The main set of vane chambers communicates

directly with the intake passageway of the pump, whereas the auxiliary set of vane chambers communicates with the leakage chamber adjacent the pump shaft packing. The leakage chamber is separated from this packing, however, by an annular member preferably formed integral with the impeller and directly engaging the packing. In this manner, any leakage of fluid cannot take place along the drive shaft and through the packing, because of the presence of the annular portion of the impeller. At the same time, the auxiliary vanes of the impeller pump the leakage fluid out of the leakage chamber and prevent its reaching the packing by any tendency to flow around the annular obstacle.

Construction

Referring to the drawings in detail, Figure 1 shows a preferred embodiment of the pump of this invention as consisting of a pump casing, or volute 10, having an end plate 11 engaged by a clamping ring 12 and secured by the bolts 13 to the frame 14. A gasket 15 prevents leakage of fluids between the casing 10 and the end plate 11. The latter is provided with an axially extended portion 16 having an inlet chamber 17, having axially directed guide vanes 18 for preventing swirling of the fluid as it enters the impeller. The enlarged outer end 19 of the end plate 11 is engaged by a clamping ring 20, forming part of a union with a suitable intake, or suction conduit, forming no part of the present invention. The outlet end 21 of the casing or volute 10 is similarly enlarged and engaged by a similar clamping ring 22 for a similar purpose.

The casing, or volute 10, is likewise provided with an axially extending portion 23, containing a bore 24 with packings 25, arranged in pairs and separated by annular spacing members 26.

The packings 25 surround a sleeve 27, which, in turn, is mounted upon the drive shaft 28 of the pump and rotatable with it. The packings 25 are compressed by a gland 29 by means of the nuts 30 mounted upon the studs 31.

Beyond the gland 29 the drive shaft 28 is rotatably mounted in anti-friction bearings 32 within the frame 14, the latter being provided with a lubricant chamber 33. Escape of lubricant is prevented by the oil seal rings 34. The frame 14 is extended downwardly to provide a base 35.

Threaded upon one end of the drive shaft 28 is a core 36 upon which is mounted the pump impeller generally designated 37. The impeller 37 is provided with an annular enlargement 38 connected by the tubular wall 39 to the hub 40 of the impeller. The impeller 37 is provided with side walls 41 and 42, between which are arranged impeller vanes 43. The hub 40 is also provided with curved surfaces 44 and 45, respectively forming main and auxiliary passages 46 and 47 with the curved inner surfaces 48 and 49 of the impeller walls 41 and 42. The curved surfaces 48 and 49 are additionally rounded at 50 and 51 respectively, so as to increase the efficiency of the inward flow. The hub 40 is provided with a projecting portion 52 forming a partition separating the main vane chamber 46 from the auxiliary vane chamber 47. The vanes 43 are secured to this partition 52. The volute 10 is provided at its bottom portion with a drainage port 54 closed by a cover plate 55 secured to the volute extension 56 by means of the U-bolt 57.

In order to permit free rotation of the impeller 37, the latter is separated a slight distance from the volute 10 by the spaces 58 and 59 respectively. The space 59 leads into the leakage chamber 60 partially enclosed by the annular portion 38 of the impeller 37 and also by the tubular portion 39 thereof.

Operation

In the operation of the centrifugal pump of this invention the fluid enters the inlet chamber 17 of the end plate extension 16, and is drawn by suction into the passageway 46 of the impeller, this suction being created by the rotation of the vanes 43. The main flow of fluid through the inlet passageway 46 passes outwardly through the spaces between the vanes 43, into the marginal chamber 61 of the volute 10, and thence into the discharge passageway of the volute 10.

During this operation, however, a certain portion of the corrosive fluid being pumped leaks through the space 59 into the leakage chamber 60. Meanwhile, however, the rotation of the impeller 37 and its blades 43 causes a suction to be set up in the auxiliary vane chamber 47, thereby pumping the leakage fluid out of the chamber 60 and likewise into the marginal chamber 61 of the volute 10. The annular portion 38 of the impeller hub 40 likewise rotates with the impeller 37 and prevents the escape of the corrosive fluid since it directly engages the packings 25. It will also be observed that while the impeller 37 is stationary, during periods in which the pump is not in operation, the annular enlargement 38 of the impeller 37 likewise prevents seepage of the corrosive fluid into engagement with the pump drive shaft 28 or its sleeve 27.

Pump employed as recirculator

The arrangement shown in Figure 3 is generally similar in construction to the form of the invention shown in Figures 1 and 2 and similar parts bear the same reference numerals. It should be further pointed out, however, that the drive shaft 28 is adjustable longitudinally by means of its threaded portion 65 and the threaded member 66 engaging it. By this means the impeller 37 may be moved inward or outward relatively to the packings 25 so as to increase or decrease the width of the space 59. A valve 67 is provided at some convenient point beyond the outlet of the volute 10 so that the latter may be partially or wholly throttled. When this is done and a sufficient space 59 is provided by adjustment upon the drive shaft 28, the fluid entering by way of the intake conduit 17 will be recirculated through the passageway 46, the chamber 61, the space 59, the leakage chamber 60, the passageway 47 and the chamber 61, etc., repeating this recirculation one or more times depending on the amount of throttling due to adjustment of valve 67 by its adjusting member 68.

The telescoping connection 58*a* permits this longitudinal adjustment to be made in order to vary the recirculation effect yet prevents the formation of a gap between the forward end of the impeller and the end plate 11.

In certain installations of this device, for example, it has been found desirable to mix certain liquids with other substances. For this purpose the present modification has been found very valuable by the provision of this recirculation feature. If the space 59 between the impeller 37 and the casing wall is made very narrow, a comparatively small amount of fluid will flow through it. The wider this space 59 becomes the greater will be the amount of fluid carried by it. Thus, by adjusting the amount of throttling due to the

valve 67 and also by adjusting the width of the space 59 by adjustments upon the drive shaft 28 the amount of recirculation can be effectively regulated.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a centrifugal pump, a casing having an intake chamber at one end and a cylindrical extension at the other end, an impeller adapted to rotate within the casing, said impeller having a hub from which the impeller blades radiate, a shaft contained within the casing extension and secured to said hub, and packing material between the shaft and said extension, said hub terminating in a portion of limited width and greater diameter than the main portion of the hub, said main hub portion of smaller diameter extending from said enlarged portion toward said blades, whereby a sump is provided, the blades of said impeller having two sets of pumping surfaces at their inner ends, one set being positioned adjacent the intake chamber to pump fluid from said chamber toward the periphery of the impeller and the other set being positioned adjacent said sump in order to pump fluid which collects in the sump toward the periphery of the impeller, whereby leakage of fluid toward the packing material is prevented.

2. In a centrifugal pump, a casing having an intake chamber at one end and a cylindrical extension at the other end, an impeller adapted to rotate within the casing, said impeller having a hollow hub with an enlarged exterior portion from which the impeller blades radiate, a shaft contained within the extension and secured to the interior of said hub, packing material between the shaft and said extension, said hub terminating in a portion of limited width and of greater diameter than the main portion of the hub, the main hub portion of smaller diameter extending from said portion of greater diameter toward said enlarged exterior portion of the hub from which the impeller blades radiate, whereby a sump is provided, the blades of said impeller having two sets of pumping surfaces at their inner ends, one set being positioned adjacent the intake chamber to pump fluid from said chamber toward the periphery of the impeller and the other set being positioned adjacent said sump and extending toward the periphery of the impeller, whereby leakage of fluid toward the packing material is prevented.

OYSTEIN JACOBSEN.