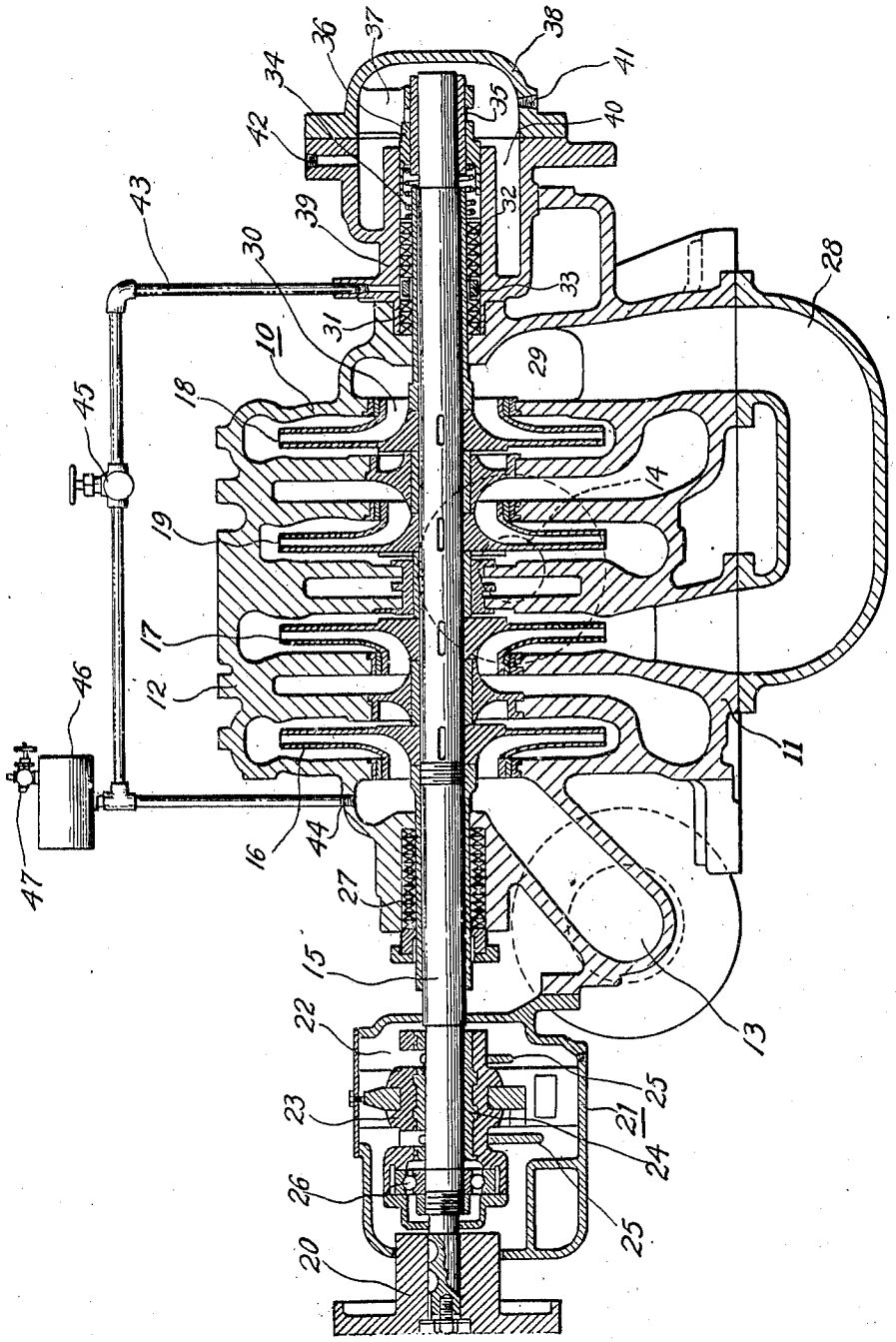
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CENTRIFUGAL PUMP

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CENTRIFUGAL PUMP

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My invention relates to centrifugal pumps, and has for its object an improvement in the form of packing used for preventing leakage along the shaft of the liquid being pumped.

In the operation of most centrifugal pumps employed for the purpose of pumping water, a slight leakage of water through the packing and along the shaft is not objectionable. In fact, the packing is usually operated in a somewhat loose condition in order that there may be some leakage which acts as a lubricant for the packing. In other cases, however, where the liquid being pumped is of such a nature that its leakage is objectionable, it is desirable that all leakage be eliminated.

Where the pressure is low, as is usually the case at the suction end of the pump, it is not difficult to provide a suitable and tight packing about the shaft, but in the case of multi-stage pumps, where the packing at one end of the pump is exposed to a much higher intermediate pressure or to the final discharge pressure, a more difficult problem is presented.

It is therefore a primary object of the present invention to provide a shaft bearing and packing for such a condition and adapted to prevent leakage of any of the fluid being pumped.

With the above and other objects in view the invention may include the features of construction and operation set forth in the following specification and illustrated in the accompanying drawing.

In the accompanying drawing annexed hereto and forming a part of this specification, I have shown the invention embodied in a four-stage pump of the closed impeller type but it will be understood that the invention can be otherwise embodied and that the drawing is not to be construed as defining or limiting the scope of the invention, the claims appended to this specification being relied upon for that purpose.

In the drawing the figure shows a central vertical sectional view of a complete pump incorporating the present invention.

In the above-mentioned drawing there has been shown but one embodiment of the invention which is now deemed preferable, but it is to be understood that changes and modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

Briefly, and in its preferred aspect, the invention may include the following principal parts: First, a casing; second, a shaft rotatable therein on which are mounted one or more impellers; third, bearings at opposite ends of said shaft having suitable packings therein; fourth, a spacer dividing one of said packings at an intermediate point; fifth, a conduit from the bearing adjacent the spacer to the suction of the pump; sixth, a reservoir and flow restricting means in said conduit; and seventh, means to release gasses accumulating within said tank.

Referring to the figure of the drawing, this shows in longitudinal section a typical multi-stage pump of the four-stage type. The two impellers comprising the first and second stages are opposed to and are disposed back to back relative to the two impellers comprising the third and fourth stages. The casing 10 is composed of the lower half 11 and upper half 12 joined centrally in the usual manner through the axis of the impeller shaft 15. The inlet or suction of the pump is at 13 and the outlet or discharge opening at 14. The shaft 15 carries the four impellers 16, 17, 18 and 19, comprising the first, second, third and fourth stages respectively. This rotating element, comprising the shaft 15 and impellers 16, 17, 18 and 19, is driven through the flange coupling 20 by any suitable means such as an electric motor or steam turbine.

The driven end of the shaft 15, which is adjacent the suction end of the casing 10, is mounted in a suitable bearing 21 of any usual design. This bearing is shown as a bearing enclosure 22 in which is mounted the spherical seated bearing bushing 23 suitably lined with anti-friction metal 24 and oiled by the oil rings 25.

If desired, a thrust bearing such as the anti-friction bearing 26 may be provided to take care of any end thrust that may occur. The above bearings are of standard or usual type, and form no part of the present invention.

The packing 27 at this end of the shaft 15 is exposed only to the low pressure under which the liquid being pumped enters the pump and may be of any suitable type adapted for the particular liquid being pumped.

As the liquid flows through the pump, its pressure is built up by the action of each successive impeller, and as it passes from the second stage impeller 17, its pressure has been increased substantially half way from the suction to the final discharge pressure. The liquid passing from the second stage impeller 17 flows through passage 28 to the chamber 29, from which it flows into the suction opening 30 of third stage impeller 18.

The packing 31 is therefore exposed to a pressure of liquid substantially half of the difference between suction and discharge pressures, and it

is the primary object of my invention to provide means for packing this shaft 15 against leakage under the increased pressure.

In the housing 39, which may be a separate member bolted directly to the casing halves immediately next to the chamber 29, is the packing 31 and the packing 32. These packings are separated by the lantern type spacer 33. Inasmuch as this packing is not readily accessible, by reason of the preferred design calling for a closed end, the packing is preferably followed up with the pressure of coiled spring 34. The desired pressure is put upon this spring by the sleeve 36 against which it bears so that the packings 31 and 32 are always forced axially toward the left.

This end of the shaft 15 is supported in the bearing bushing 35 mounted in the sleeve 36 supported through a plurality of ribs 37 by the housing 38.

In use, the lubrication of the shaft 15 in bearing 35 and packings 31 and 32 is effected by keeping the cavity 40 filled with lubricating oil. This oil may be drained away through drain 41 and refilled through opening 42 as may be desired.

Leading from the cavity formed by spacer 33 is a suitable pipe 43 leading back to the suction passage of the pump as at 44. This pipe 43 may be of suitable size to impose a desired drop in pressure between the spacer 33 and suction at 44. If desired, however, a suitable controlling valve 45 may be installed somewhere along its length. Connected to this pipe 43 and in open communication with it is the tank 46.

This tank 46 may be of open or closed type. If open, it should be placed at sufficient height above the suction at 44 to overcome any head or pressure that may be upon the liquid being pumped at this point. If of closed type, provision must be made to remove any air, gases or vapors which may develop in the passage of liquid through pipe 43.

By this construction I am able to provide a pump in which the difficulties incident to a leaky packing, particularly when the liquid is subject to vaporization or otherwise objectionable, are eliminated.

In operation there will be a slight amount of leakage through the packing 31, creating a pressure in the lantern spacer 33, which pressure will be much lower than that in the chamber 29, but, of course, will necessarily be higher than that in the suction chamber 44. Owing to this pressure difference there will be a flow of liquid through pipe 43, this flow being regulated as by the valve 45 to cause the desired pressure in lantern spacer 33.

Owing to this drop in pressure while passing through pipe 43, the liquid is apt to effect a partial vaporization or give up certain free gases, and it is the function of the tank 46 to gather these and prevent their passing down into the suction chamber 44. If the tank is open, these gases will pass off freely, but if it is operated on a closed system the gases may be removed in any suitable manner as by occasionally opening a small relief valve 47.

I claim:

1. A centrifugal pump comprising in combination, a casing, an impeller and shaft rotatable therein, a suction connection for said casing, a packing at the opposite end of said casing surrounding said shaft and exposed to a pressure higher than that existing at the suction connection, packing within said bearing, a spacer dividing said packing into two sections, a conduit leading from the bearing adjacent said spacer to the suction connection, and a tank in said conduit adapted to receive any gases passing through said conduit.

2. A centrifugal pump comprising in combination, a casing, an impeller and shaft rotatable therein, a bearing for said impeller having a packing therein, a spring exerting a constant axial pressure upon said packing to compress the packing about said shaft, a cover enclosing said shaft, and a chamber enclosing said shaft end and bearing therefor, said chamber adapted to contain lubricating oil for said bearing and packing.

3. A centrifugal pump comprising in combination, a casing, an impeller and shaft rotatable therein, a suction connection for said impeller, a bearing at one end of said casing having a packing surrounding the shaft, said packing being exposed to a pressure higher than that existing at the suction connection, a spacer within said bearing dividing said packing into two sections, a conduit leading from the bearing adjacent said spacer to the suction connection, a tank within said conduit adapted to receive any gases passing through said pipe, and pressure releasing means in said conduit.

4. A centrifugal pump comprising in combination, a casing, an impeller and shaft rotatable therein, a suction connection within said casing, a bearing within said casing exposed to a pressure higher than the suction pressure, a flexible packing within said bearing, a spring exerting a constant pressure upon said packing to compress the packing about the shaft, a cover extending over the end of said shaft, a chamber enclosing said shaft end and bearing therefor, said chamber adapted to contain lubricating oil for said bearing and packing, and a conduit extending from an intermediate point in said packing to the suction connection.

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