Sept. 20, 1927. 1,642,914

J. P. WHANN

SANDPROOF BEARING

Filed July 3, 1926

Fig. 1.

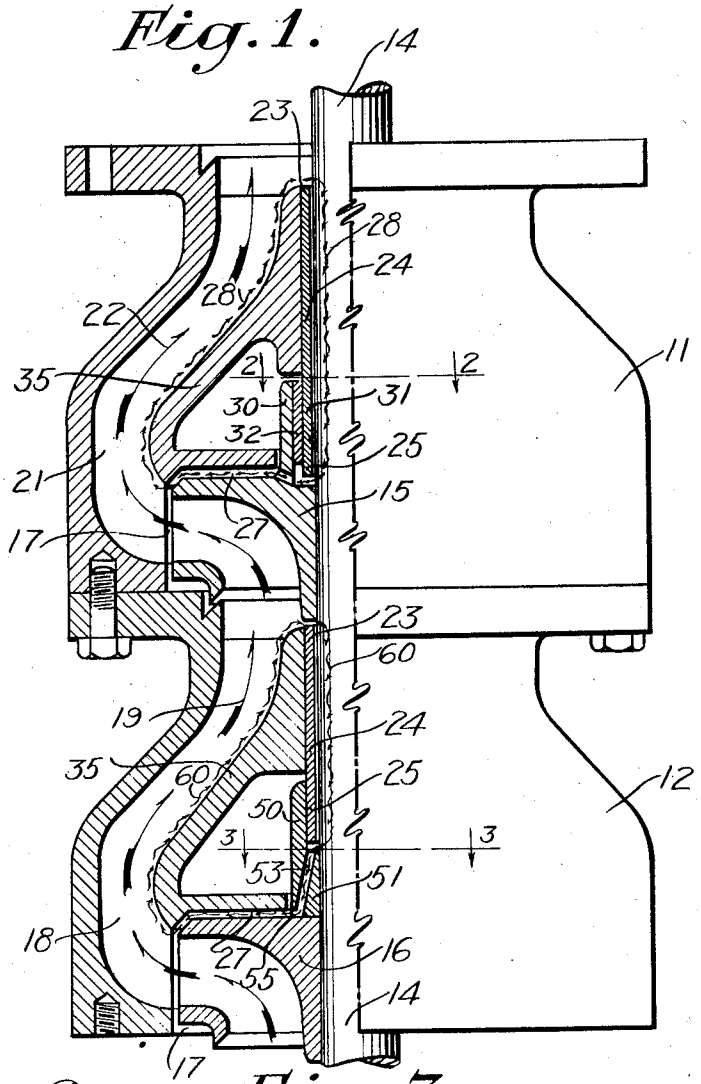


Fig. 2.

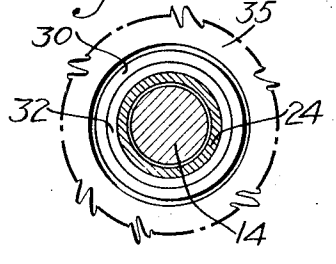
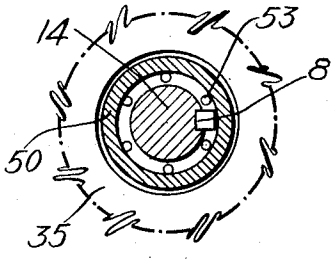


Fig. 3.



INVENTOR:
Jesse P. Whann

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JESSE P. WHANN, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO LAYNE & BOWLER CORPORATION, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA.

SANDPROOF BEARING.

Application filed July 3, 1926. Serial No. 120,429.

This invention relates to bearings of a character suitable for use in pumping equipment employed for the transfer of liquids in which injurious substances are carried. Rotary pumps of the impeller type, in their present stage of development, afford a highly efficient means for transferring liquids in which abrasive materials are carried. Although in this type of pump the wearing parts are of a very simple form and the difficulties encountered due to the abrasive action of materials in the pumped liquid are not so pronounced as found in other types of pumps, the bearings of these rotary or centrifugal pumps are, in their present form, still subject to the detrimental influences of substances carried into the space between the bearing surfaces by localized circuits due to conditions within the pump, which circuits result from the differences in pressures existing at the opposite ends of the pump bearing members.

Each impeller section or stage of a rotary pump receives the transferred liquid at one pressure and delivers this liquid at a higher pressure to the next impeller section or to the discharge outlet of the pump; therefore, the action of the pump is not in the form of a gradual increase in the pressure applied to drive the liquid, but is rather in the form of a series of consecutive steps through which the water pressure is raised by the successive impeller sections. Owing to the fact that the bearings which support the impeller shaft are situated between the consecutive impellers, it follows, when the pump is in operation, that the liquid pressure existant at the two ends of each bearing varies in accordance with the inlet and discharge pressures of the impeller sections. The marked difference in pressure at the two ends of each bearing results in a return flow or circulation of liquid through the bearing and the consequent conducting into the bearing of whatever substances may be carried in suspension or solution in the liquid being pumped.

An extensive use to which pumps of this type are applied is the lifting of water from wells. Sand carried in the well water is conducted in to the bearings in the manner hereinabove stated, and passing through the bearings this sand produces a grinding or cutting action on the bearing surfaces, which soon cuts away the bearing to such an extent that it ceases to perform the function of a bearing and the efficiency of the pump is impaired to such an extent that it must be dismantled and the bearings replaced. In rotary pumps of the impeller type the principal wear is at the bearings. By reducing this wear to a minimum, the effective life of such pumps may be extended to an almost indefinite period.

It is an object of the invention to provide a rotary pump bearing of a form adapted to exclude from its wearing surfaces, those localized circuits or currents of the liquid being pumped which are characteristic of the type of rotary pumps herein mentioned, thus eliminating the rapid wearing away of the bearing structure due to the abrasive action of the sand or other destructive substances which may be carried in the transferred liquid.

Further objects and advantages will be made evident hereinafter.

Referring to the drawing which is for illustrative purposes only,

Fig. 1 is an elevational sectional view of a portion of a rotary pump, showing therein two forms in which the invention may be practised.

Fig. 2 is a fragmentary section on a plane represented by the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary section on a plane represented by the line 3—3 of Fig. 1.

In Fig. 1 of the drawing are shown an upper pump bowl 11 and a lower pump bowl 12, forming part of a vertical centrifugal pump having a central impeller shaft 14 arranged to drive an upper impeller 15 and a lower impeller 16. Each of the impellers 15 and 16 is received in a recess 17 in the bottom of the respective pump bowl 11 or 12. The impeller 16 may receive liquid from an adjacent pump bowl or suction structure as desired, and deliver this liquid through the pump passages indicated at 18, as shown by the arrows 19, to the upper impeller 15,

which in turn forces the liquid at a higher pressure upwardly through the passages 21 of the pump bowl 11 as indicated by the arrows 22. The pressure of the liquid at the upper end 23 of the sleeve member 24 is greater than the pressure of liquid at the lower end 25 of this sleeve, this difference in pressure causing liquid to flow downwardly from the upper end 23 between the sleeve 24 and the shaft 14 which extends through it, and outwardly through the space 27 and through the pump passages 21 as an internal circuit or localized circulation within the pump indicated by the arrows 28 which are of small size so as to be readily distinguished from the larger arrows indicating the production flow of the pump. The impeller 15 has a tubular bearing structure 30 extending upwardly around the lower portion 31 of the sleeve 24. In the illustration, the bearing structure 30 is shown as including a bearing bushing or journal sleeve 32 which provides an interior bearing face engaging the exterior bearing face of the lower portion 31 of the sleeve 24. Although the sleeve 24 is shown as a separate member inserted in the inner wall structure 35 of the bowl 11, this sleeve, when in place forms a co-operating part of the pump bowl and could be formed as an integral part thereof, if desired. It will be understood that the interior bearing surface of the tubular structure 30 could be provided without the use of an inserted bushing such as shown at 32.

In the present form of pump construction, the sleeve 24 is used as a bearing for the shaft 14. The localized circuit indicated by the arrows 28, carries sand and other detrimental substances through the bearing thus formed with the result that the bearing surfaces are soon cut away, permitting the shaft to wobble and vibrate so as to break down the bearing structure. In the invention, this sleeve 24 is not used in bearing engagement with the shaft, but is given a small clearance just sufficient to allow sand to roll through the space thus formed between the shaft and the sleeve without retarding materially the rotation of the shaft. The sleeve 24 when in use provides a stationary tubular structure through which the shaft extends, the outer face of a portion of this tubular structure being arranged to receive an enclosing or surrounding rotating bearing member having an interior bearing face which frictionally engages the exterior of the tubular structure at a position which is outside of the path of the flow of localized circulation, and is therefore not subject to a constant intervening flow of liquid in which detrimental substances are carried. It is thought that there will be practically no tendency toward circulation through the contacting bearing faces owing to the fact that the flow which has been throttled in passing through the sleeve 24 may pass freely outward through the space 27, passing the lower end of the bearing in so doing.

In the lower half of Fig. 1 and in Fig. 2, the enclosing bearing member 50 is shown separate from the impeller 16, instead of projecting from the upper face of the impeller as does bearing structure 30 illustrated in the upper half of Fig. 1. The lower portion 51 of the bearing member 50 is bored to fit snugly on the shaft 14 and is keyed thereto as indicated in Fig. 3 at 8. The upper portion of the member 50 is counterbored to fit over the lower end 25 of the sleeve 24 in bearing engagement therewith. Holes 53 are drilled between the shoulder 54 and the lower outer corner 55 of the member 50, so as to provide communication between the lower end 25 of the sleeve 24 and the space 27 which exists above the impeller 16. In this construction also we have a bearing member for supporting the impeller shaft, which bearing member is outside the path of the flow of liquid in localized circulation, this circulation being indicated by the arrows 60.

I claim as my invention:

1. In a pump, the combination with a tubular structure having its ends exposed to the interior of the pump and through which localized circulation tends to occur, of a shaft extending through said tubular structure, and bearing means engaging the exterior of said tubular structure for supporting said shaft in running position.

2. In combination with a rotary pump having impellers which tend to create localized circuits: tubular structure through which the impeller shaft extends, and through which localized circulation occurs; and bearing means having association with said shaft and having bearing engagement with the exterior of said tubular structure.

3. In combination with a rotary pump having impellers which tend to create localized circuits; tubular structure through which the shaft extends; and bearing means having association with said shaft and having bearing engagement with the exterior of said tubular structure, said bearing means having passages for diverting from the bearing faces the flow of liquid which has passed through the tubular structure.

4. In combination with a rotary pump having impellers which tend to create localized circuits; tubular structure through which the impeller shaft extends; and bearing means having association with said shaft and having bearing engagement with the exterior of said tubular structure, said bearing means having passages for diverting from the bearing faces thereof the liquid flow of a localized circuit.

5. In combination with a rotary pump having impellers which tend to create local-

ized circuits; tubular structure through which the impeller shaft of the pump extends; and means arranged for mounting on said impeller shaft; said means having an annular portion providing an interior bearing surface arranged to engage the exterior of said tubular structure and having passages therein for diverting from the bearing face thereof the liquid flow of a localized circuit.

Signed at Los Angeles, California, this 28 day of June, 1926.

JESSE P. WHANN.