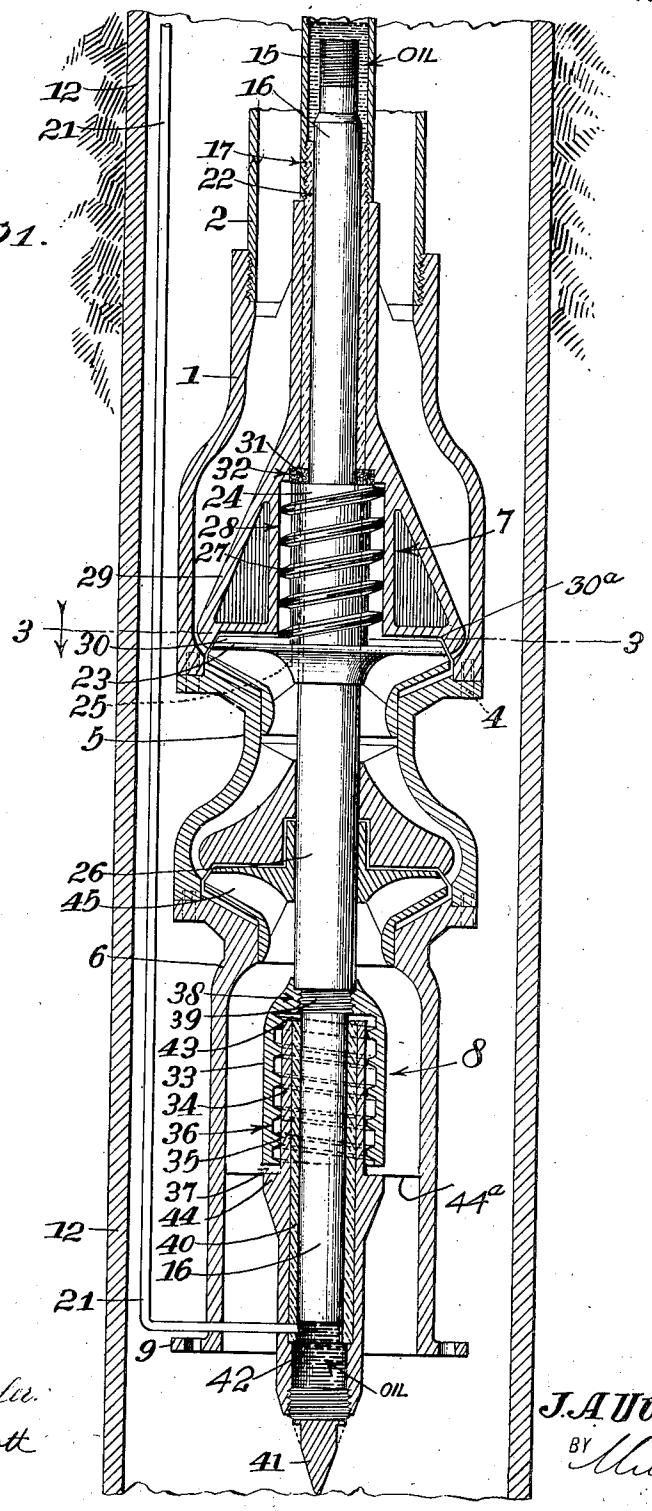
Aug. 12, 1924. 1,504,658

J. A. ULMER

TURBINE PUMP

Filed Dec. 29, 1922 2 Sheets-Sheet 1

Fig 1.



WITNESSES

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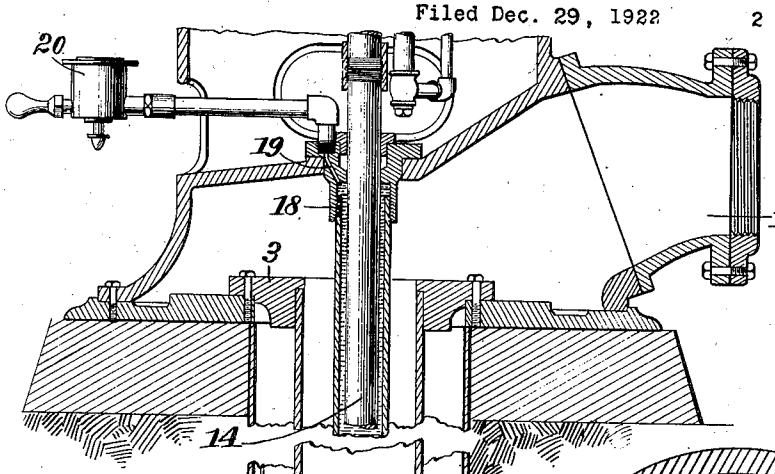


Fig. 2.

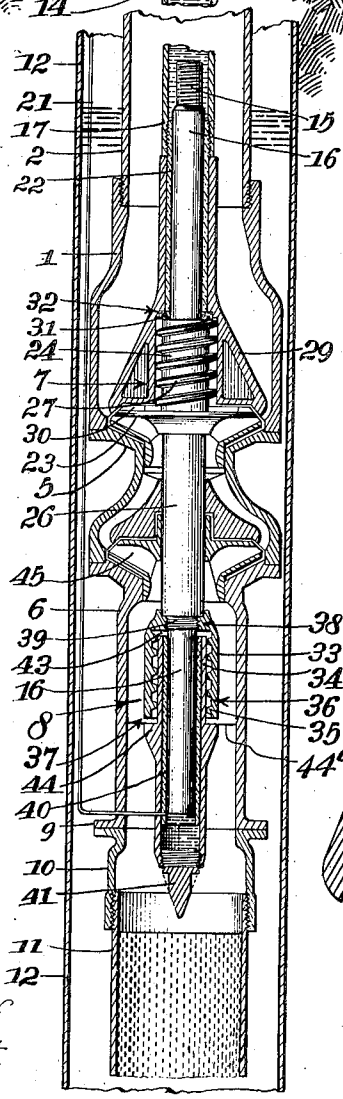


Fig. 3.

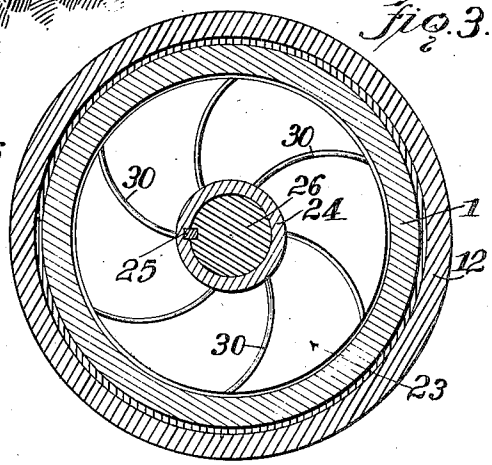
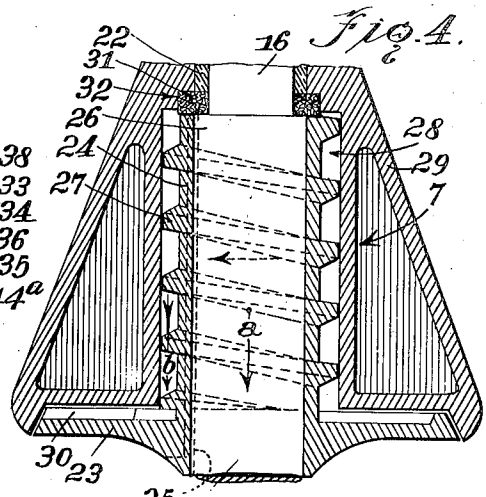


Fig. 4.



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UNITED STATES PATENT OFFICE.

JOSEPH AMES ULMER, OF PORTERVILLE, CALIFORNIA.

TURBINE PUMP.

Application filed December 29, 1922. Serial No. 609,687.

To all whom it may concern:

Be it known that I, JOSEPH AMES ULMER, a citizen of the United States, and a resident of Porterville, in the county of Tulare and State of California, have invented certain new and useful Improvements in Turbine Pumps, of which the following is a specification.

My invention relates to improvements in turbine pumps and it consists of the constructions, combinations and mode of operation herein described and claimed.

An object of the invention is to provide means to exclude water and sand from the bearings of a turbine pump, such means, however, being adaptable to other and similar places in water columns where water and sand are likely to penetrate.

A further object of the invention is to provide an improved bearing for the impeller or runner of a turbine pump, which includes means for causing a vacuum to draw the oil out and cause an outward pressure to keep the water and sand from entering.

A further object of the invention is to provide a turbine pump in which the runner bearings may be oiled either by a pipe extending down on the outside of the bowls as in the case of a solid runner shaft, or from the inside, as in the case of a hollow runner shaft.

Other objects and advantages will appear in the following specification, reference being had to the accompanying drawings, in which:

Fig. 1 is a longitudinal section of a turbine pump showing the improved bearings embodied therein,

Fig. 2 is a longitudinal section showing the familiar arrangement of a deep well pump and illustrating the improved bearings associated with the runners at the bottom,

Fig. 3 is a cross section on the line 3—3 of Figure 1, and

Fig. 4 is a detail section of the upper bearing, diagrammatically illustrating the action of the helix or spiral vanes.

The invention herein disclosed is an improvement on the patent tc Isaac N. Johnston, for pump, granted Feb. 2, 1921, No. 1,369,527. By way of a general introduction, it may be stated that turbine pumps, or the so-called deep well pumps, have been developed for the purpose of raising water from far greater depths than the ordinary suction pump is capable of raising water. A turbine pump, broadly described, consists of a revolving shaft carrying a runner which causes a whirling action and moves the water up through a pump or water column.

Such a pump will operate efficiently at very great depths. The foregoing revolving shaft naturally requires bearings, the important ones of these being located at the bottom adjacent to the runner or runners. Being submerged by the water and in the midst of particles of sand which are bound to be present, these bearings must be made subject to unusual precautions to keep the water and sand out. So far as known, the means commonly employed are not entirely satisfactory, and as briefly stated in the objects of the invention, the purpose in mind is to provide a bearing which operates against the tendency of the water and sand to enter and thereby keep the latter from reaching the moving parts. Consider first the general construction of the turbine pump. The pump bearing bowl 1 is affixed to the lower end of the pump column 2 which is suspended by a collar 3 at the top of the well. Secured at 4 to the lower rim of the bowl 1, is the main bowl 5, and to the lower rim of the latter is secured the lower bearing bowl 6. The upper and lower bowls are distinguished from the main bowl 5 by having the upper and lower runner bearings 7 and 8 incorporated therein. It is with these bearings that the invention is concerned.

The lower bearing bowl 6 has the customary flange 9 to which the bottom flange 10 and screen 11 are secured. The foregoing structure, which is merely an outline of the turbine pump, hangs within the well casing 12. Water standing at the approximate level indicated in Fig. 2, is drawn through the screen 11 and is forced up in the pump column 2, finally leaving at the discharge 13 at the top.

A shaft 14 extends from a driving pulley (not shown) to a place near the bottom where it has connection by means of a shaft coupling 15 with the top stub shaft 16, these elements constituting the drive shaft of the pump. The drive shaft is encased by a tubing 17 which is suspended from the tubing head 18 at the top. This tubing head has a duct 19 through which oil is injected into the tubing by means of a gun

20. The shaft tubing 17 therefore may be made to contain oil up to any desired level above the top bearing and the top bearing 7 receives its supply of oil from this source. The lower bearing 8 receives its oil from a pipe 21 which runs to a suitable supply at the surface. A bronze bushing 22 receives the stub shaft 16, and extends down to the top bearing 7 which is one of the two bearings illustrating the principles of the invention. The impeller or runner 23 has a hub 24 which is keyed at 25 to a substantially medial enlargement 26 of the stub shaft 16. This hub has a helix or spiral thread 27 formed on the outside in the direction of the axis.

The helix 27 occupies a chamber 28 in the cone 29 of the top bearing bowl 1, the right-hand pitch of the helix 27 (upon a counter clockwise rotation of the drive shaft) serving to express water and sand tending to enter the chamber 28 from the bottom, and incidentally, creating a vacuum in the chamber. Naturally, the partial or total absence of pressure in the chamber 28 will facilitate the gravitation of oil from the shaft tubing 17, through the space between the bushing 22 and stub shaft 16 to the lowermost extremity of this portion of the drive shaft. In other words, the vacuum draws the oil out.

Arranged on top of the runner 23 is a plurality of ribs or vanes 30. These assume a generally radial position (Fig. 3) but are curved slightly backward in reference to the aforesaid counter clock-wise direction of rotation. The vanes occupy a depression 30ª with which the chamber 28 communicates at the bottom. The purpose of these vanes is to throw outwardly any water or sand which might reach the top of the runner, and in this respect, the vanes function similarly to the runner 23 itself. The result of this outward throwing of the sand and water is to augment the function of the helix 27 in forming a vacuum in the chamber 28 and keeping foreign matter out.

A washer of felt or other absorbent material 31 is located in the place where the bushing 22 ends and the medial enlargement 26 begins. The washer rests upon the shoulder formed by this enlargement and occupies an annular recess 32 at the upper end of the chamber 28. The washer prevents an undesirably free flow and consequent loss of oil.

The lower bearing 8 comprises a hood 33 which is superposed upon the sleeve 34 which is the central part or core of the lower bearing bowl 6. The hood 33 has a helix or spiral vane 35 on the inside, facing the sleeve 34, and the hood forms a chamber 36 which the helix occupies. In this respect the lower bearing is arranged on an order reverse of that of the upper bearing. Instead of the helix pointing outwardly, as in the case of the upper bearing 7, the helix of the lower bearing points inwardly. However, the operation is the same. The pitch of the helix 35 is arranged for a right hand thread and a counter clockwise rotation of the driving shaft will serve to express the water from the chamber 36 toward the bottom where a space 37 is conveniently left for its escape.

The hood 33 is affixed at 38 to the stub shaft 16 which has a threaded portion 39 for the purpose. The hood which is tightly screwed upon the threads of the shaft in the inverted position shown makes a dead-end which therefore stops any current tending to flow into the sleeve. The sleeve 34 contains a bronze bushing 40 in which the lower extremity of the stub shaft has bearing. The lower end of the stub shaft falls short of the bottom of the bushing as does also the bushing in respect to the plug 41. This arrangement leaves a chamber 42 in which oil from the pipe 21 collects, and from which it works upwardly around the stub shaft by virtue of the vacuum created in the space 43 due to the action of the helix 35.

An annular shoulder 44 opposes the lower end of the hood 33, and it is between this shoulder and the end of the hood that the space 37 occurs. The sleeve 34 and shoulder 44 are integral parts of the lower bearing bowl 6, being connected therewith by a well-known arrangement of webs 44ª shown in Figs. 1 and 2. The purpose of the shoulder or enlargement 44 is to deflect the upwardly moving column of water from the end of the hood 33 thereby creating a vacuum at that point and aiding the action of the thread 35 in excluding water and sand. The stub shaft carries a second and lower runner or impeller 45 which, in construction and function, is practically identical with the runner 23, the exceptions being that it carries no radial ribs 30 nor does it have a hub with a spiral vane, as in the first instance.

The operation may be reviewed in connection with Figs. 1 and 4. The runner shaft 14, stub shaft 16, impellers 23 and 45 and the hood 33 are the only rotating parts. The hub 24 and helix 27 rotate too, but as these are integral with the runner 23, it is obvious that they must. In the case of the upper runner 23, oil standing in the shaft tubing 17 gravitates around the upper part of the stub shaft 16 until it reaches the felt washer 31, thus providing lubrication for the upper bearing.

In the case of the lower part of the stub shaft 16, oil stands in the chamber 42, (being supplied by the pipe 21 from the surface) whence it works upward around the lower part of the stub shaft until it reaches

the space 43. In the latter case, the oil moves over the bearing surface in the direction contrary to gravity but this is due to the fact that the rotating helix 35 constantly exerts a downward pressure upon the water which has a tendency to enter the chamber 36, and in working the water outward, a vacuum is formed in the region of the space 43, naturally attracting the oil which seeks to occupy the evacuated space and thus draw it upwardly in the bottom bearing.

A similar action occurs in the case of the upper bearing. The drive shaft moves in a counter clockwise direction, as indicated by the arrow in Fig. 4. The vanes or ribs 30 thereby throw outwardly, by centrifugal force, any water or sand that might work upwardly beyond the periphery of the runner 23. This of itself tends to evacuate the chamber 28, but the helix 27, working in this chamber, contributes directly to this result.

The reader can readily imagine the helix 27 moving in the counter clockwise direction in Fig. 4. The edge of the helix has a working fit inside of the chamber 28. The direction of any point on the periphery of the helix is downward as indicated by the arrow *a*. Naturally, any water or sand which might have gotten as far as the entrance to the chamber 28, will be moved in the direction of the arrow *b*, and as soon as such water reaches the vanes 30, it is thrown outwardly in accordance with the action described.

The expressing or expelling action of the helix 27 forms a vacuum in the upper part of the chamber 28 adjacent to the felt washer 31. The passage of oil from the shaft tubing 17 is thereby facilitated, so that not only is an adequate supply of lubricant insured, but the possibility of water and sand reaching the bearing surface of the upper stub shaft, is made very remote.

There is another action in the operation of the pump, besides that of the two spirals 27 and 35, which tends to produce a vacuum in the bearings. The water in passing the point marked 37 in the lower bearing and the place at the periphery of the runner 23 in the upper bearing has an effect upon the adjacent internal chambers like that of an injector because there is a tendency to draw out any water that may get on the inside. This action, together with that of the bearing itself, effectively excludes the water and sand.

Mention is made in the beginning of a tubing head from which the shaft tubing 17 is suspended. This tubing head includes the packing shown, and the packing seals the oil line at the surface so that any pressure from the bottom of the oil line is equalized by the oil pressure in the shaft tubing. The function of the helices 27 and 35 suggests the application thereto of the term "pumps" inasmuch as they exert pressure on the water in such a way as to rarefy the space which such water would occupy in the chambers 28 and 36. The vacuum created by the action of the helices or pumps serves to urge the oil over the entire bearing surfaces concerned, but is not intended to establish a circulatory oiling system, as in the foregoing Johnston patent.

While the construction and arrangement of the improved turbine pump as herein described and claimed is that of a generally preferred form, obviously modifications and changes may be made without departing from the spirit of the invention or the scope of the claims.

I claim:—

1. In mechanism of the character disclosed, a pump bowl including an axial sleeve, a bushing fitted in the sleeve, a revoluble shaft having bearing in the bushing but falling short of the lower end of the sleeve to define an oil chamber which has communication with the bearing surfaces, a hood carried by the shaft extending over the sleeve in spaced relationship thereto to define an annular chamber, and a spiral vane carried by said hood operating in said chamber to expel water tending to enter from said bowl and thereby creating a vacuum at the other end of the hood to draw oil from said oil chamber over said bearing surfaces contrary to the action of gravity.

2. In mechanism of the character disclosed, a pump bowl including an axial sleeve having a shoulder, a plug closing the end of the sleeve, a bushing fitted in the sleeve, a revoluble shaft of two diameters, the portion of smaller diameter having bearing in the bushing but falling short of the lower end of the sleeve to define an oil chamber above said plug; a thread cut on the smaller shaft portion where it joins the larger portion, a hood attached to the shaft by means of said thread extending down over the sleeve almost to the shoulder to leave a space, and a spiral vane formed inside of the hood throughout its length, said vane contacting with the sleeve to expel water at said space.

3. In mechanism of the character disclosed, a pump bowl through which a water column passes, a drive shaft, an axial bearing sleeve in said pump bowl receiving the end of the shaft, means on and turning with the shaft fitting down over a part of the sleeve to provide a shield and having means to contact therewith to tend to expel water, and a shoulder formed on the sleeve below said means protruding into the water column to deflect the water from the bottom of the hood and creating a vacuum at said point.

4. In mechanism of the character disclosed, a pump bowl through which a water column passes, a drive shaft, an axial bearing receiving the end of the shaft, a hood over the shaft inverted over the upper end of the sleeve and providing a shield over the outside of the joint, a thread in the hood contacting with the sleeve to tend to expel water, and an enlargement on the sleeve adjacent to said hood deflecting water from the end of the hood to create a vacuum at said point.

5. In mechanism of the character disclosed, a pump bowl through which a water column passes, a drive shaft, an axial bearing receiving the end of the shaft, a hood on the shaft inverted over the upper end of the sleeve and providing a shield over the outside of the joint, a thread in the hood contacting with the sleeve to tend to expel water, and an annular shoulder on the sleeve adjacent to the hood said sleeve becoming larger in the direction of the hood.

6. In mechanism of the character disclosed, a pump bowl, an axial bearing sleeve having an external shoulder, a shaft extending into the sleeve and having a threaded portion thereabove, a hood screwed on the threaded portion in inverted position to fit over the end of the sleeve into proximity with but not contacting said shoulder to provide a shield thereby dead-ending the sleeve and means including a thread inside of the hood contacting the outside of the sleeve.

7. In mechanism of the character disclosed, a pump bowl, an axial bearing sleeve, a shaft extending into the sleeve and having a threaded portion thereabove, and a hood screwed on the threaded portion in inverted position to fit over the end of the sleeve and provide a shield thereby dead-ending the sleeve, and means inside of the hood contacting the outside of the sleeve.

8. In mechanism of the character disclosed, a pump runner, a shaft carrying the runner, bearing means for the shaft, a pump bowl carrying the bearing means and having an annular recess at the end of the bearing means, means supplying the bearing means with oil, means defining a chamber around the shaft communicating at one end with the bearing surfaces, means for maintaining a vacuum in said chamber to draw the oil through said bearing means toward said communicating end, and means situated in said annular recess checking the free flow of oil into said chamber.

9. In mechanism of the character disclosed, a pump bowl having a chamber, a runner in the pump bowl having a portion extending into the chamber, a shaft carrying the runner, a bearing bushing carried by the bowl for the shaft, and means including an absorbent washer situated at the head of said extending portion and below said bearing bushing checking the unduly free flow of oil through the bushing.

10. In mechanism of the character disclosed, a pump bowl, a runner therein, a shaft carrying and driving the runner to impel the water upwardly, bearing means for the shaft, an oil supply above the bearing means, means carrying the bearing means defining a chamber around the shaft and having an annular recess, both being in communication with the bearing surfaces, means operating against the chamber wall revolving with the shaft arranged in such a way as to reverse the natural course of the water tending to enter the chamber thereby keeping it away from the bearing surfaces and creating a suction in said chamber, and an absorbent washer fitted in the annular recess to contact the shaft and keep the oil from flowing too freely.

11. In mechanism of the character disclosed, a revoluble shaft, a pump bowl having a cone into which the shaft extends provided with a chamber and an annular recess, a bearing bushing for the shaft extending up from said recess, a shaft tubing encasing the shaft and having attachment to the bushing at one end to form an oil reservoir around the shaft above the bearing bushing, a hub carried by the shaft in said chamber having a spiral thread contacting with the wall of the chamber to force water away from the bushing, and a felt washer in the annular recess absorbing the oil as it passes through the bushing to prevent an excessively free flow due to the suction in the chamber.

12. In mechanism of the character disclosed, a pump bowl including a cone having a chamber and a communicating depression therebeneath, a bushing fitted in the cone, a revoluble shaft extending through the bushing carrying a runner, a plurality of vanes formed on top of the runner occupying and operating in said depression to expel water by centrifugal force, means to supply oil to the bearing surfaces which have communication with the end of the chamber opposite to that which communicates with the pump bowl, a hub on the runner extending beyond said vanes into the chamber and having connection with the shaft, a spiral outstanding thread of low pitch reverse to the prescribed direction of rotation of the shaft, said thread contacting with the wall of the chamber to perform an expelling action on water tending to enter the chamber and thereby create a vacuum at the other end of the chamber to draw the oil over said bearing surfaces toward said end, and a felt or like washer situated at the end of the bearing surfaces to prevent an unduly free flow of oil.

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