

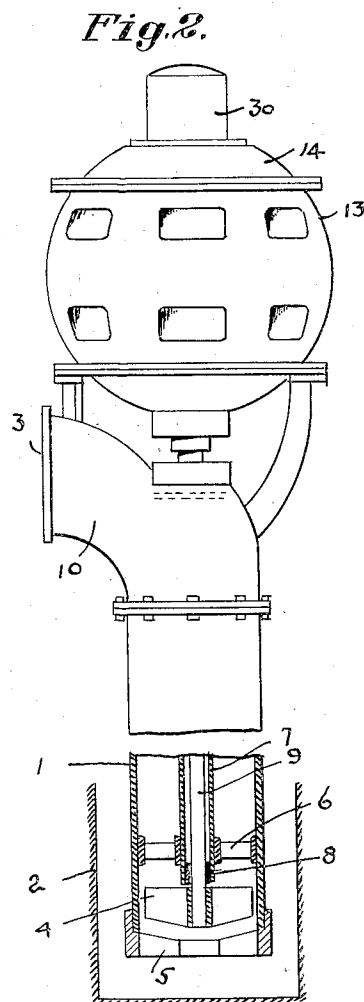
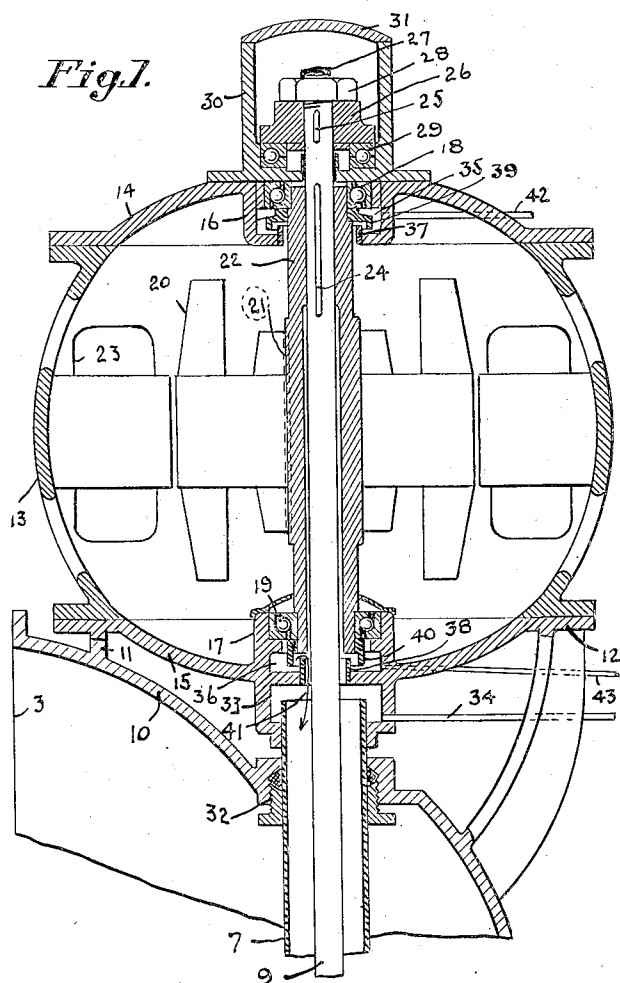
June 1, 1926.

1,586,900

A. HOLLANDER

CENTRIFUGAL PUMP HEAD

Filed Jan. 25, 1926



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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL-PUMP HEAD.

Application filed January 25, 1926. Serial No. 83,433.

My invention has for its object a centrifugal pump head particularly adapted to the suspension and driving of the rotating element and is more particularly applicable to what is known as deep well vertical shaft centrifugal pumps.

An object of my invention is the simplification of the driving and operating mechanism of a pump of the character described and one wherein the motor elements may be standardized for various sizes of pumps and whereby several sizes of motors may be readily interchanged with pumps of varying construction so that the motor may be adapted to the particular service for which any particular pump may be chosen. In this way, a manufacturer is enabled to fill a wide range of pump conditions from a stock consisting of relatively fewer units of motor sizes and pump sizes.

A further object of my invention is the simplification of the driving means and connections for a pump of the character described.

A further object is a pump and motor of the character described with provision of adjustments, whereby the pump shaft may be readily adjusted without disturbing the adjustment of the rotating parts of the motor.

A further object is a pump of the character described wherein the motor which is provided with a hollow shaft rotor may be operated entirely independent of the pump shaft, as for purposes of testing or adjusting of the motor or the motor parts and rotor shaft and the bearings, or any of them may be removed without removing the pump shaft and its assembled parts from the well.

Another object is a head for vertical shaft pumps and the like constructed and adapted to receive a standard electric motor having a hollow rotor shaft, through which hollow shaft the main driving shaft of the pump passes with a freedom of longitudinal movement for vertical adjustment, the rotor shaft being carried in suitable bearings adapted to support the rotor against radial and thrust stresses, in combination with a thrust bearing independent of said rotor and adapted to support the longitudinal stresses due to

the weight and operating conditions of the main operating shaft and its associated parts in the pump column.

Another object is a pump of the character described with special lubricating features for the bearing elements, whereby longer life and more efficient operation is attained.

These objects I attain by providing a standardized electric motor having a hollow rotor element, said rotor being carried in bearings above and below and permitting free rotation but resisting all normal operating stresses in the motor, in a radial and also in an axial direction, the said hollow rotor being provided with connecting means for driving, rotatively, a main pump operating shaft, the said motor being in combination with a pump head and centrifugal pump column through which is introduced a main driving shaft passing through and driven from the hollow rotor and carrying on its lower extremity centrifugal pump impeller means.

At its upper extremity the said operating shaft is provided with vertical adjustments whereby the shaft may be raised or lowered throughout a range of positions of adjustment and a thrust bearing positioned above and independent of the rotor but supported from the stationary portions of the motor and on which thrust bearing the axial or longitudinal weight and other stresses imposed by the rotating operating shaft and its impeller means while in operation, are supported.

The motor bearings I prefer to carry in special compartments adapted also to retain lubricant and I also prefer to introduce a stationary tubular member around and separated from the operating shaft and extending substantially the length of the pump column whereby the operating shaft is kept free from the pump discharge water and within which are other bearings at spaced intervals.

These bearings around the main operating shaft are lubricated from above the pump head as more specifically set forth below.

I do not claim any novelty generally in the protecting tubular shell, as this is well known in the art; but in combination with such a shell I provide a special drainage

compartment and means of feeding lubricant to said sleeve which is novel.

Reference is herein made to my co-pending application Serial No. 81,655, filed January 16, 1926, wherein are separately claimed certain combinations set forth in this disclosure.

By referring to the accompanying drawing my invention will be made clear.

Referring to the drawing, Figure 1 is a vertical cross section through a portion of a pump head employing my invention, with the electric motor shown mounted thereon and with fragmentary portions of the tubular protecting sleeve and the main operating shaft.

Fig. 2 is a reduced drawing of a portion of a pump column showing the impeller and guide vanes in section and showing in side view the upper portion of the pump column, with the discharge head and the motor mounted thereon.

Throughout the figures similar numerals refer to identical parts.

A vertical discharge casing is shown by the numeral 1, positioned vertically in a well 2, and having a discharge outlet at 3 on the pump head 10.

At 4 is a centrifugal impeller and therebelow a spider or foot piece having guide vanes 5.

Above the impeller is shown a stationary spider 6, supporting the tubular shell member 7 and at 8 a conventional bearing supporting the main operating shaft 9 and whereby leakage is prevented from the discharge column 1, flowing into the space between the shaft 9 and shell 7 when the pump is operating.

At 11 and 12 are supporting members from the head 10 for the standard electric motor whose outer casing is shown at 13 and which is provided with a cover 14 and a bottom 15.

Supported from 14 and 15 respectively are the bearing compartments 16, 17 within which are positioned conventional bearings 18, 19 above and below the rotating element 20 which is keyed at 21 to the sleeve or hollow shaft 22.

The members 20, 21 and 22 form the rotor of the electric motor, the stator of which is shown diagrammatically at 23. The entire rotor is thus mounted free to rotate within the bearings 18, 19 which are also preferably designed to prevent axial displacement of the said rotor which is thus rotatively mounted for free operation without axial displacement within the stationary motor parts 13, 14, 15.

The main pump shaft 9 passing through the protecting tubular member 7 extends up and through the hollow shaft 22 being splined thereto at 24 and having a second spline at 25 engaging the thrust collar 26

which is freely and axially movable on the shaft 9 but constrained to rotate therewith because of the spline 25.

The shaft 9 is threaded at its upper end at 27 and provided with an adjusting nut 28 which bears upon the block 26 and below the block 26 is provided the conventional axial or longitudinal thrust bearing 29.

The thrust bearing 29 and its associated parts are assembled within the cap 30 having a cover 31.

The tubular shell 7 passes through conventional packing means at 32 and extends into the compartment 33 from which compartment drainage is effected through the duct 34.

I prefer to provide below the bearings 18, 19 respectively, lubricant chambers 35, 36 and rising in each of these chambers surrounding the shaft 9 and spaced therefrom and also spaced from the hollow shaft 22 are the stationary collars 37, 38.

Outside of these collars and projecting downward are the centrifugal rings 39, 40 constrained to rotate with the rotor and which, through centrifugal action retain a normal quantity of lubricant in the compartments 35, 36. This lubricant is preferably a heavy grease and only in cases where it becomes hot or its quantity excessive does this grease overflow as from the compartment 36, between the centrifugal collar 40 and sleeve 38 and thence downward as shown by the arrow 41 into the sleeve 7.

Lubricant may be fed, as required, to the compartments 35, 36 through the tubes 42, 43 respectively.

Any water leakage from the discharge column 1, into the tubular shell 7 is collected in the compartment 33 and finds egress through the duct 34.

During normal operation of the properly adjusted pump, the shaft 9 operates free from any contact with water and is adequately lubricated as by lubricant entering in the direction of the arrow 41.

The operation is as follows:

Assuming the parts to be assembled as described, the nut 28 is adjusted until the impeller 4 is freely rotatable without contact on the foot spider 5 and the entire rotating element including the rotor of the electric motor with its hollow shaft 22 and the main operating shaft 9 are freely rotatable. The current is now turned on and the pump operates.

The main shaft may be adjusted as required from time to time by the adjusting nut 28.

The bearings may be lubricated through tubes 42, 43, there being provided through tube 43 sufficient lubricant when required to feed any bearings as 8 in the pump column and within the shell 7.

If it is desired to gain access to the bear-

ings it is not necessary to disturb the main shaft 9 for by removing the nut 28, block 26, the thrust bearing 29 is made accessible or the entire cap 30 may be lifted from the top 14 and the bearing 18 is available or the entire top 14 may be removed and the rotor 20, 21, 22 may be slipped up and free from the shaft 9 and the bearing 19 made accessible and the parts may be reassembled in the reverse order and the nut 28 readjusted to raise the shaft 9 free from the foot piece 5.

Particular attention is directed to the rotor of the electric motor being free from the heavy thrust stresses of the shaft 9 and its associated parts and the water column which they are pumping and which stresses are carried upon the thrust bearing 29 entirely free from the rotor.

Moreover the longitudinal adjustment of the shaft 9 is accomplished without disturbing the independently adjusted position of the rotor and its bearings 18, 19.

The entire motor and with its rotor may be employed on pumps of different dimensions but requiring only the same driving power or motors of different capacities may be mounted on the same pumphead employed under different conditions of operation and hence requiring different speeds or capacities. Such interchangeability is effected without machine work and merely by assembly operations in the field.

I claim:

1. In combination with a vertical shaft centrifugal pump having a pump column and a pump head, a motor having a hollow rotor said motor mounted on said head, a plurality of rotor bearings in which said rotor is mounted to freely rotate, said bearings adapted to resist radial stresses and retaining said rotor against axial displacement, a thrust bearing supported on said motor in axial alignment but spaced from said rotor, a main pump operating shaft having an impeller on its lower end and carried rotatively on said thrust bearing at its other end, said shaft passing slidably through said rotor and splined thereto and means interposed between said thrust bearing and said shaft upper end for longitudinally adjusting said shaft with respect to said thrust bearing.

2. In combination with a vertical shaft centrifugal pump having a pump column and a pump head, a motor having a hollow rotor said motor mounted on said head, a plurality of rotor bearings in which said rotor is mounted to freely rotate, said bearings adapted to resist radial stresses and retaining said rotor against axial displacement, a thrust bearing supported on said motor in axial alignment but spaced from said rotor, a main pump operating shaft having an impeller on its lower end and carried rotatively on said thrust bearing

at its other end, said shaft passing slidably through said rotor and splined thereto and means interposed between said thrust bearing and said shaft upper end for longitudinally adjusting said shaft with respect to said thrust bearing, said radial bearings mounted in grease compartments, and grease retaining means comprising a stationary upstanding collar spaced from and about said shaft and a centrifugal ring carried by the rotor and extending over and outside of said collar.

3. In combination with a vertical shaft centrifugal pump having a pump column and a pump head, a motor having a hollow rotor said motor mounted on said head, a plurality of rotor bearings in which said rotor is mounted to freely rotate, said bearings adapted to resist radial stresses and retaining said rotor against axial displacement, a thrust bearing supported on said motor in axial alignment but spaced from said rotor, a main pump operating shaft having an impeller on its lower end and carried rotatively on said thrust bearing at its other end, said shaft passing slidably through said rotor and splined thereto and means interposed between said thrust bearing and said shaft upper end for longitudinally adjusting said shaft with respect to said thrust bearing, a protecting tube around said shaft in said column and extending through said head, a drainage compartment into which said tube extends and a drainage duct from said compartment a drip space from one of said grease compartments around said shaft whereby lubricant is fed into the upper end of said tube.

4. In a centrifugal pump having a vertical cylindrical pump column, a discharge member from said column and a motor casing spaced above said discharge member, a hollow rotor in said casing, a plurality of rotor bearings for said hollow rotor holding the said rotor rotatively positioned within said casing and axially aligned with said column, a thrust bearing spaced from said rotor and a housing therefor mounted on said casing and above said rotor, a main driving shaft passing through said column said rotor and said thrust bearing, adjusting means suspending said driving shaft on said thrust bearing and adapted to vertically adjust said driving shaft with respect to said rotor, and means engaging the said rotor and the said driving shaft in rotative engagement.

5. In a centrifugal pump having a vertical cylindrical pump column, a discharge member from said column and a motor casing spaced above said discharge member, a hollow rotor in said casing, a plurality of rotor bearings for said hollow rotor holding the said rotor rotatively positioned within said casing and axially aligned with

said column, a thrust bearing spaced from said rotor and a housing therefor mounted on said casing and above said rotor, a main driving shaft passing through said column said rotor and said thrust bearing, adjusting means suspending said driving shaft on said thrust bearing and adapted to vertically adjust said driving shaft with respect to said rotor, and means engaging the said rotor and the said driving shaft in rotative engagement, a protecting tube surrounding said shaft and fixed in said column and said head and extending through said head, and a socket above said head embracing said extended portion and having a drainage compartment about the upper end of said tube.

6. Apparatus as set forth in claim 5 and a lubricant passage around said driving shaft from one of said rotor bearings adapted to discharge lubricant into the upper end of said tube.

7. In a vertical shaft centrifugal pump, a pump column and a pump head, a motor for driving said shaft positioned at the upper end of said shaft, bearing means for said motor and a grease compartment for said bearing means, a protecting tube around said shaft in said column and extending through said head, a drainage compartment into which said tube extends and a drainage duct from said compartment, a drip space from one of said grease compartments around said shaft whereby lubricant is fed into the upper end of said tube.

8. In a vertical shaft centrifugal pump, a pump column and a pump head, a motor for driving said shaft positioned at the upper end of said shaft, bearing means for said motor and a grease compartment for said bearing means, a stationary upstanding collar around said shaft in said compartment and a ring extending over and outside of said collar and fixed to rotate with said shaft whereby grease is retained in said compartment available to said bearing means.

9. In a vertical shaft centrifugal pump, a pump column and a pump head a motor for driving said shaft positioned at the upper end of said shaft and having a hollow rotor, rotor bearings on each side of said rotor in which said rotor is adapted to rotate and is held against axial displacement, lubricant compartments for said bearings, a thrust bearing adapted to support axial stresses of the driving shaft and supported above the motor and independent of said radial bearings and of said rotor, and adjusting means interposed between the driving shaft and the thrust bearing.

10. In a vertical shaft centrifugal pump, a pump column and a pump head, a motor for driving said shaft positioned at the upper end of said shaft and having a hollow

rotor, rotor bearings on each side of said rotor in which said rotor is adapted to rotate and is held against axial displacement, lubricant compartments for said bearings, a thrust bearing adapted to support axial stresses of the driving shaft and supported above the motor and independent of said radial bearings and of said rotor, and adjusting means interposed between the driving shaft and the thrust bearing, a stationary upstanding collar around the shaft rising from the bottom of said lubricating compartment, and a ring adapted to rotate over and outside of said collar whereby lubricant is retained available in the compartment for the corresponding bearing.

11. In a vertical shaft centrifugal pump, a pump column and a pump head, a motor for driving said shaft positioned at the upper end of said shaft and having a hollow rotor, rotor bearings on each side of said rotor in which said rotor is adapted to rotate and is held against axial displacement, lubricant compartments for said bearings, a thrust bearing adapted to support axial stresses of the driving shaft and supported above the motor and independent of said radial bearings and of said rotor, and adjusting means interposed between the driving shaft and the thrust bearing, a fixed protecting tube around said shaft having an inlet end adjacent and under one of said compartments and a lubricant passage from the last mentioned compartment adapted to feed lubricant by gravity into the said tube inlet end.

12. In a vertical shaft centrifugal pump, a pump column and a pump head, a motor for driving said shaft positioned at the upper end of said shaft and having a hollow rotor, rotor bearings on each side of said rotor in which said rotor is adapted to rotate and is held against axial displacement, lubricant compartments for said bearings, a thrust bearing adapted to support axial stresses of the driving shaft and supported above the motor and independent of said radial bearings and of said rotor, and adjusting means interposed between the driving shaft and the thrust bearing, a stationary upstanding collar around the shaft rising from the bottom of said lubricating compartment, and a ring adapted to rotate over and outside of said collar whereby lubricant is retained available in the compartment for the corresponding bearing, a fixed protecting tube around said shaft having an inlet end adjacent and under one of said compartments and a lubricant passage from the last mentioned compartment adapted to feed lubricant by gravity into the said tube inlet end.