May 21, 1929. C. E. JOHNSON 1,714,484

TURBINE PUMP

Filed Nov. 27, 1922

Fig. 2.

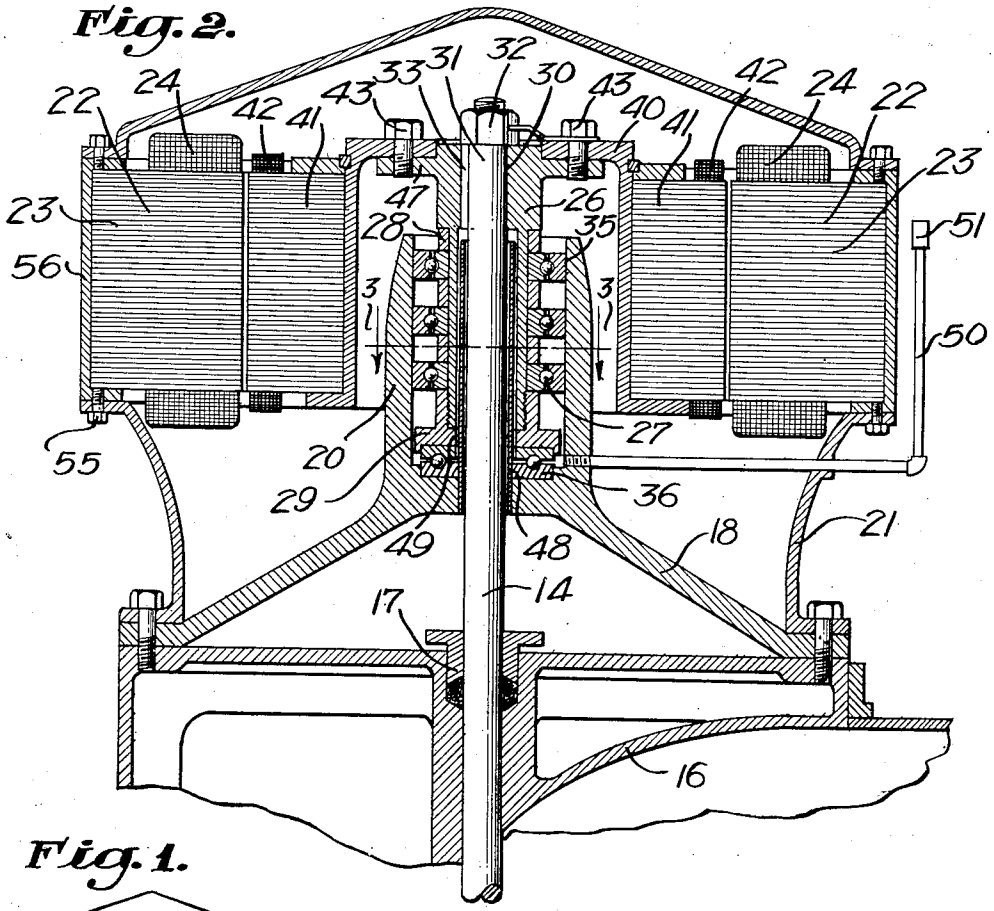


Fig. 1.

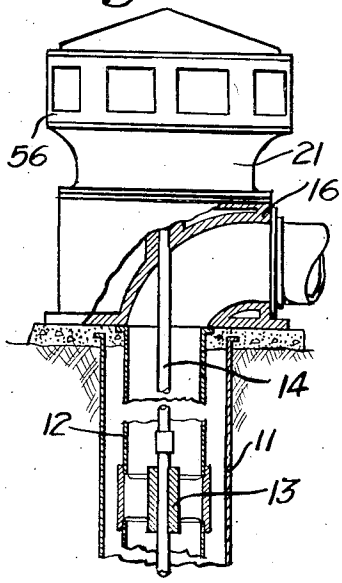
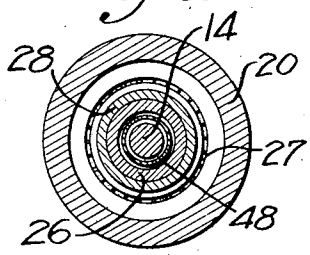


Fig. 3.



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Patented May 21, 1929. 1,714,484

UNITED STATES PATENT OFFICE.

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TURBINE PUMP.

Application filed November 27, 1922. Serial No. 603,487.

This invention relates to electrically driven deep well turbine pumping equipment. Deep well turbine pumps are comprised of an impeller system which is placed within the well casing, a drive shaft extending vertically through the well casing by which the impeller system may be driven from the surface of the ground. The drive shaft is rotated in some cases by a belt which drives a pulley mounted upon the upper end of the drive shaft from a pulley of an adjacently placed motor while other turbine pumps are driven by a direct connected motor which is mounted upon the discharge head of the pump and coupled to the drive shaft, thus eliminating the pulleys and belting.

The installation of direct connected motor drive requires considerable skill owing to the number of bearings employed which must be mounted in workable alignment and require constant attention thereafter.

It is an object of the invention to provide an improved form of electrically driven turbine for deep well pumping, which is adapted to the same utility as those pumps now employed equipped with direct connected motor drives, which is much more simple and economical in construction, and which is self-aligning owing to the utilization of a single bearing member in the drive head.

This improved electric drive employs a rotor and a stator magnetically linked to accomplish the rotation of the rotor. The rotor is mounted directly upon the pump drive shaft and is maintained centrally and in alignment by an especially constructed bearing unit which is provided with a number of ball bearing members which operate in a bath of oil.

The especial advantages and further objects of my invention will be made evident hereinafter.

Referring to the drawing which is for illustrative purposes only,

Fig. 1 is an elevational view showing a pump head equipped with an electric drive embodying the features of my invention.

Fig. 2 is an enlarged section illustrating the improved electric drive mounted upon the pump head as shown in Fig. 1.

Fig. 3 is a horizontal section taken upon a plane represented by the line 3—3 of Fig. 2.

In Fig. 1 of the drawing, a well casing 11 is shown in which a pump casing 12, having bearing members 13, is placed. The bearing members 13 of the casing 12 support a centrally disposed drive shaft 14 by which the turbine impellers, not shown, are rotated. In my invention the shaft 14 is extended up through the top of the discharge head 16, a packing member 17 being employed as operating conditions may require. Upon the head 16 a bearing casting 18 is mounted providing an upwardly pointed cup 20, disposed concentrically with regard to the upwardly extending shaft 14.

By means of a ring 21 a stator 22 comprised of punchings 23 and windings 24 is mounted concentrically with the shaft 14. A bearing hub 26 is provided having a number of radial ball bearing units 27 which are spaced upon the hub 26 by accurately ground sleeves 28 and clamped thereupon by a ring nut 29. The member 26 is bored at 30 to receive the upper end 31 of the shaft 14, and is secured upon the shaft by a nut 32 and maintained in rotating relationship therewith by a key 33. After the casting 18 is placed over the shaft, the hub 26 is installed upon the shaft 14 and when so installed the ball bearing members 27 rest within the cup 20 which is bored to fit the cylindrical faces of the outer ball bearing rings 35. A thrust bearing 36 is employed between the bottom of the cup and the ring nut 29 secured to the member 26, this thrust bearing 36 being employed for the purpose of supporting the weight of the shaft 14.

A cylindrical member 40 which is of inverted cup form is provided with rotor punchings 41 having compensating coils 42 and may be secured upon the member 26 by screws 43 which thread into the flange 47 of the member 26. A tube 48 extends upwardly from the bottom of the cup 20 within a counterbore 49 formed in the lower end of

the member 26 and prevents the leakage and wastage of oil in which the bearings 27 are maintained, this oil being supplied through a stand pipe 50 which has the filling end 51 thereof positioned slightly above the level at which it is desired to maintain the oil in the cup 20. The bearing members 27, being spaced along the member 26 and being closely mounted within the cup serve to centralize the member 26 and the rotor member 40 secured thereto as well as centralizing the upper end of the shaft 14.

It will readily be perceived that such a bearing as I employ will hold the rotor in rigid alignment with the stator, and that the weight of the shaft will serve to hold the member 26 securely down against the thrust bearing 36, therefore, eliminating requirement for other thrust bearings, to control the axial movement of the rotor.

The device herein described and shown in the drawing constitutes a marked improvement over the standard form of direct connected motor drive, as the alignment of parts is controlled entirely by the placing of bolt holes in the head 16 to receive the castings 18 and 21 and the locating of holes through which cap screws 55 are passed in securing the ring 56 which sustains the stator punchings 23. These holes are customarily all drilled and threaded in the factory and the installation of the drive consists essentially of placing the parts together in the manner shown. By such construction the multiplicity of bearings now found in the discharge head and the direct connected motor employed therewith is cut down to a single bearing member, thus eliminating the necessity for flexible couplings, and reducing the number of bearings which must be periodically oiled.

I claim as my invention:

1. In a centrifugal pump, the combination of: a discharge head; a shaft extending upwardly through said discharge head, said shaft supporting the impellers of the pump; a bearing member rigidly secured to said discharge head; bearings between said shaft and said bearing member whereby said shaft is rotatably supported in said bearing member; a stator rigidly secured to said bearing member; and a rotor turning freely inside said stator and supported wholly upon a free end of said shaft which projects above said bearing.

2. In a centrifugal pump, the combination of: a discharge head; a shaft extending upwardly through said discharge head, said shaft supporting the impellers of the pump; a bearing member rigidly secured to said discharge head; bearings between said shaft and said bearing member whereby said shaft is rotatably supported in said bearing member; a stator rigidly secured to said bearing member; and a rotor turning freely inside said stator and supported wholly upon a free end of said shaft which projects above said bearing, said bearings extending up inside said rotor.

3. In a centrifugal pump, the combination of: a discharge head; a bearing member rigidly secured to said discharge head; a stator secured relatively to said bearing member; a shaft having a bearing hub secured thereto, said shaft supporting the impellers of the pump; a bearing placed on said bearing member and arranged to rotatably support said bearing hub and said shaft; and a rotor having a central opening, said rotor being wholly supported by the upper end of said shaft in such a manner that said bearing hub rests within said central opening.

4. A pump as described in claim 1 in which said bearing member comprises a cup in which said bearings are located.

5. In a rotary pump mechanism, the combination of a vertical discharge casing, a casing forming the upper end of the discharge casing, a stand supported on the casing head, and an electric motor mounted on the stand, said motor having a hollow operating shaft, and an actuating shaft for the pump extending through and engaging the hollow operating shaft of the motor.

6. In a rotary pump mechanism, the combination of a vertical discharge casing, a motor stand mounted on the upper end of the discharge casing, a motor support on the stand, said motor having a hollow driving shaft, an actuating shaft for the pump extending vertically through the discharge casing and through and connected to said hollow shaft, and means supported by the hollow shaft for longitudinally adjusting the actuating shaft.

7. A rotary pump mechanism comprising an electric motor having a hollow rotor, a pump shaft extending through the hollow rotor, means supporting said pump shaft on said rotor, and a thrust bearing receiving the combined longitudinal thrust of the pump shaft and rotor, said bearing being connected to the rotor.

8. In a rotary pump mechanism, the combination of an electric motor having a hollow rotor, a vertical pump shaft extending through the rotor, means disposed above the motor for vertically adjusting the pump shaft while maintaining the rotor in set vertical adjustment, means for connecting the pump shaft to the rotor, and bearings connected to the rotor.

9. In a rotary pump mechanism, an electric motor having a hollow power member and a rotor mounted thereon, a vertical pump shaft extending through the power member, means connecting the pump shaft to the motor, and a bearing contacting with

the power member, said bearing being disposed intermediate the top and bottom of the rotor.

10. In a rotary pump mechanism, an electric motor having a rotor including a hollow power member, said power member extending below the rotor, a vertical pump shaft extending through the power member, means connecting the pump shaft to the motor, a sleeve radial bearing extending up into the rotor so as to provide a bearing for the same, an oil reservoir below the rotor and around the pump shaft and an oil retaining sleeve extending up between the power member and pump shaft.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 22nd day of November, 1922.

CARL E. JOHNSON.