

July 4, 1939.

G. T. PFLEGER

2,164,837

ADJUSTABLE ROTARY PUMP HEAD

Original Filed Feb. 19, 1934

2 Sheets-Sheet 1

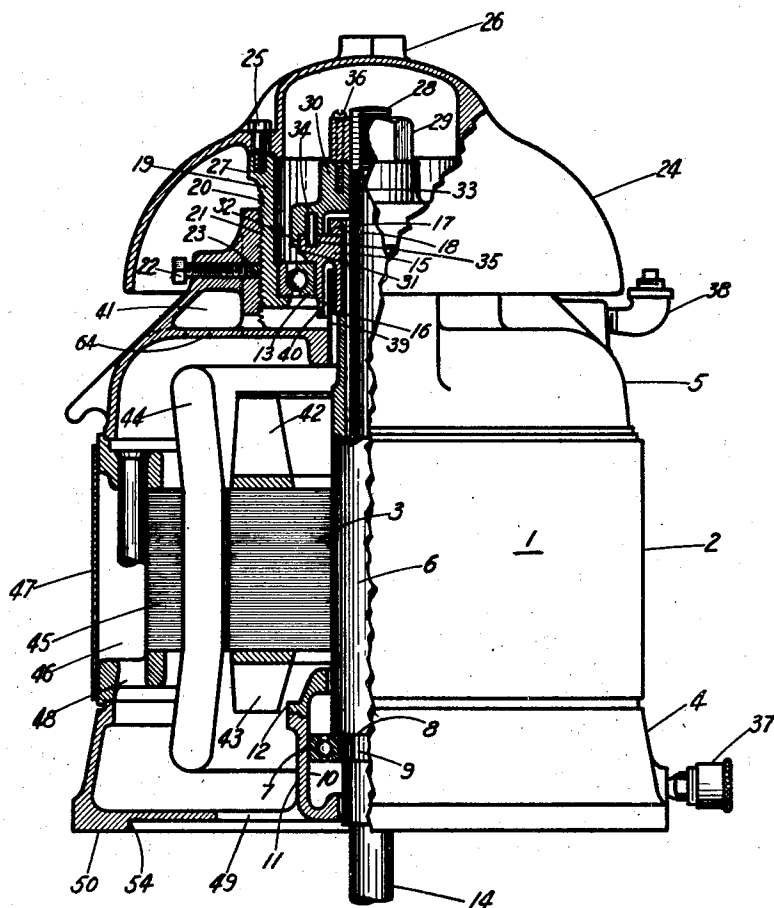


Fig. 1.

George T. Pfleger.

INVENTOR

BY

John H. Lane

ATTORNEY

July 4, 1939.

G. T. PFLEGER

2,164,837

ADJUSTABLE ROTARY PUMP HEAD

Original Filed Feb. 19, 1934

2 Sheets-Sheet 2

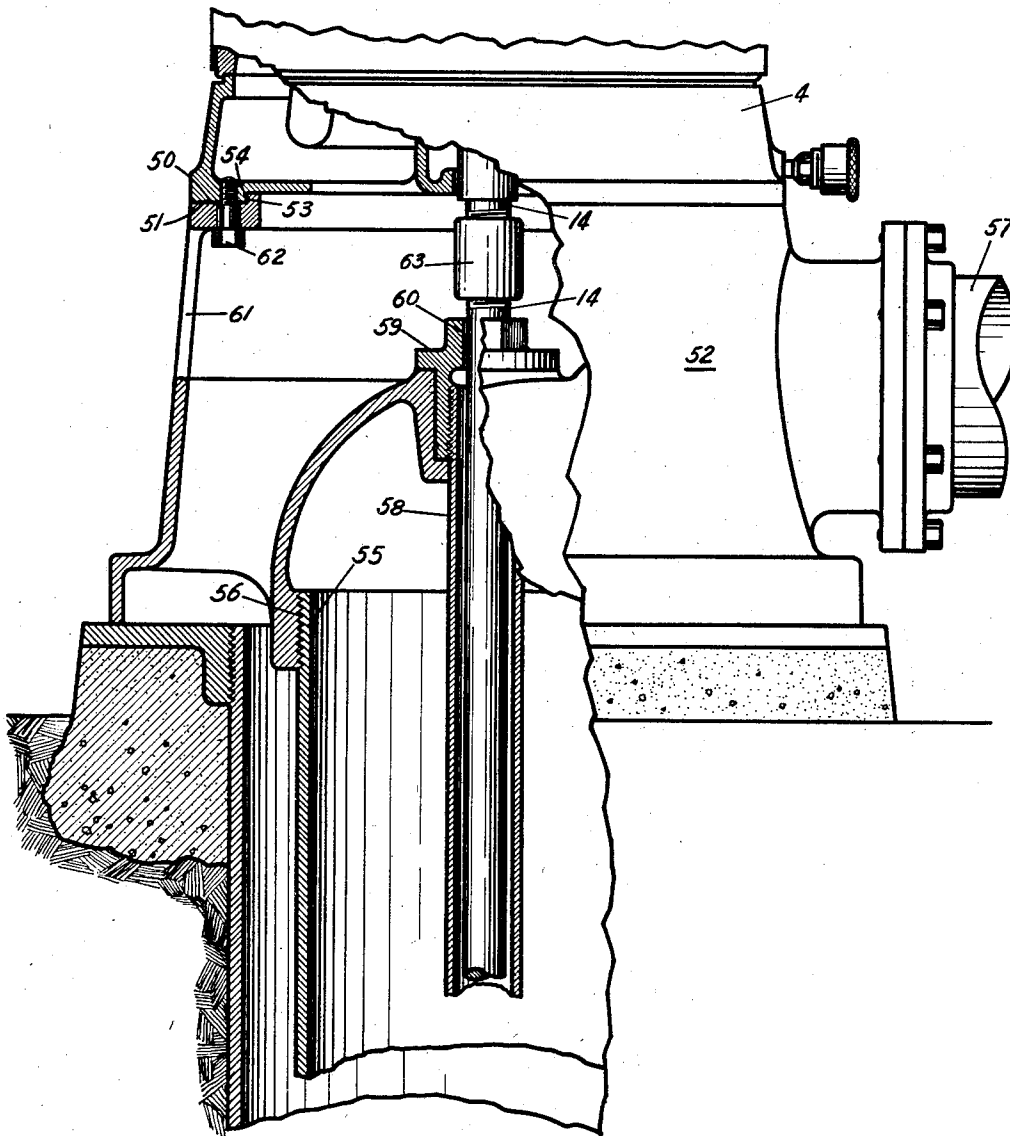


Fig. 2.

George T. Pfleger.

INVENTOR

BY

John Flann

ATTORNEY

UNITED STATES PATENT OFFICE

2,164,837

ADJUSTABLE ROTARY PUMP HEAD

George T. Pfeiffer, Los Angeles, Calif., assignor
to U. S. Electrical Motors, Inc., a corporation
of California

Application February 19, 1934, Serial No. 711,918
Renewed October 12, 1937

5 Claims. (Cl. 172—36)

This invention relates to vertical rotary pumps and particularly to an electric motor which is constructed for use with vertical rotary pumps.

A common form of a vertical rotary pump comprises a pump section which is secured to the lower end of a column pipe near the bottom of a well. The column pipe extends to the top of the well where it is secured to a discharge head. The impellers of the pump section are rotated by a pump shaft which extends from the pump section through the column pipe, to the discharge head.

In most cases the pump shaft will be of sufficient length to require the use of several members coupled together to form a continuous drive shaft.

Bearings may be provided inside of the pump section and at intervals throughout the length of the column pipe for the radial support of the pump shaft. It is not, however, convenient to axially support the pump shaft at more than one location.

The axial load on the pump shaft created by the pump and by the weight of the pump shaft is in most instances of sufficient magnitude to require the use of a bearing structure having relatively large physical dimensions. It is thus advantageous to place the bearing structure outside of the column pipe where it will not impede the discharge flow of the pump.

In order to obtain the best operating characteristics of the pump it is important that the pump impellers be maintained at the proper axial position within the pump bowls. This, of course, precludes any operating condition under which the rotating parts are axially supported by members other than the bearing structure provided for that purpose.

It is thus advantageous to provide convenient means whereby the pump shaft may be axially adjusted to accommodate the operating requirements of the pump.

In this invention the driving motor is supported in a vertical position with its shaft in driving relation and coaxial with the pump shaft.

It is one object of this invention to provide a vertical rotary pump having a driving motor which may be directly supported on the discharge head of the pump.

It is another object of this invention to axially support the pump shaft by means of an accessible located bearing structure, which may be easily replaced.

It is still another object of this invention to provide an accessible bearing structure for axially

supporting the pump shaft which imposes no unfavorable restrictions on the electrical characteristics of the motor.

It is still another object of this invention to provide a vertical rotary pump having a direct connected driving motor and an axially adjustable pump shaft, the construction of which is so coordinated that no unfavorable limitations are placed on the operation of any of the members of the mechanism.

It is still another object of this invention to provide accessible means whereby the pump shaft may be accurately located with respect to the rotating structure of the driving motor.

It is still another object of this invention to provide means whereby the pump shaft may be disconnected from the driving motor when operating conditions arise under which the pump shaft is vertically supported by means other than the bearing structure provided for that purpose.

It is still another object of this invention to provide quickly replaceable means whereby the maximum torque, transmitted by the driving motor to the pump shaft, is limited to a predetermined value.

It is still another object of this invention to provide a rotary pump structure having accessible means for axial adjustment of the pump shaft and in which the driving motor may be installed almost completely assembled.

It is still another object of this invention to provide accessible means whereby the pump shaft may be axially adjusted during the active operation of the pump and while the motor is completely assembled.

This invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of an embodiment of the invention. For this purpose there is shown a form in the drawings accompanying and forming part of the present specification. This form shall now be described in detail, which illustrates the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Fig. 1 is an elevational view of the driving motor and of the pump shaft in an embodiment of the invention; a portion of the view being shown in section.

Fig. 2 is an elevational view of the discharge

head and of the lower portion of the motor of Fig. 1.

An electric motor 1, Fig. 1, is shown mounted in a vertical position. Motor 1 has a stator 2 and a rotor 3. Stator 2 is shown supported on and centered by a bottom adapter bracket 4 which locates motor 1 in the proper relation to the stationary pump structure. A bearing supporting bracket 5 is mounted above stator 2 and is centered and supported by the stator.

Rotor 3 is mounted on a hollow rotor shaft 6 which is rotatably supported at its lower end by bearing 7. Bearing 7 has an inner race which is pressed against a shoulder 8 and centered on a cylindrical surface 9 of the rotor shaft. Bearing 7 has an outer race which is centered by an extended cylindrical surface 10 formed on the interior wall of bearing housing 11, which may be formed integral with adapter bracket 4. Cylindrical surface 10 is formed coaxial with rotor shaft 6, thus serving to maintain bearing 7 coaxial with the bearing housing irrespective of any axial movement of the rotor shaft. Bearing housing 11 may be provided with a bearing cap 12 which serves to exclude foreign matter from the bearing housing and to limit the axial movement of bearing 7.

A thrust bearing 13 is provided at the upper end of rotor shaft 6 for the axial and radial support of rotor shaft 6 and pump shaft 14.

The inner race of bearing 13 is mounted on a coupling member 15 which is in turn keyed to the rotor shaft and held between a shoulder 16, formed on the rotor shaft, and lock nut 17, which engages a threaded portion 18 of the rotor shaft. The rotor shaft is thus constrained to follow any vertical movement of the inner race of bearing 13.

It is evident from the construction that the structure supported by bearing 13 may be vertically adjusted by adjusting the vertical position of bearing 13. One construction by which this adjustment may be accomplished will now be described. In this form the outer race of bearing 13 is mounted inside of an axially movable bearing housing 19. Bearing housing 19 is provided with an external threaded portion 20. Thread 20 is formed coaxial with the rotor shaft. Threaded portion 20 engages an internal thread 21 formed on bearing supporting bracket 5.

A rotation of bearing housing 19 thus produces a corresponding axial movement of bearing housing 19, of bearing 13, and of all the structure supported by bearing 13.

Bearing housing 19 may be locked in any angular or axial position by means of locking bolt 22 which forces soft metallic plug 23 into frictional contact with thread 20.

Bearing housing 19 is provided with a canopy cap 24 which serves to exclude moisture and foreign matter from the bearing housing and also serves to prevent falling liquid from entering the ventilation openings 64 of the motor. Canopy cap 24 may be secured to bearing housing 19 by means of bolts 25. Thus a rotation of cap 24 also results in an equal rotation of bearing housing 19. Locking bolt 22 may be conveniently located near the rim of cap 24 so that bearing housing 19 and the associated structure may be axially adjusted while the motor and pump are fully assembled.

A wrench engaging head 26 may be provided for the canopy cap to aid in rotating bearing housing 19. Bearing housing 19 may be likewise directly rotated by securing a pipe wrench to

surface 27 or by means of a spanner wrench which engages the holes tapped for bolts 25.

The manner in which the rotor is rotatably supported and axially adjusted has been disclosed. Consider now the manner in which the pump shaft is driven by the motor and axially adjusted with respect to the rotor.

Pump shaft 14 is shown extending through the hollow rotor shaft to the top of the motor. The top end of the pump shaft is provided with a threaded portion 28 which is engaged by nut 29. Nut 29 bears against a coupling member 30 which is in turn vertically supported by coupling member 15 secured to the rotor shaft. By rotating nut 29 the pump shaft can be axially adjusted with respect to the rotor and to thrust bearing 13. Nut 29 may be locked in position by screw 36 tapped into coupling member 30.

Coupling member 15 is provided with an external cylindrical surface 31, formed coaxial with the rotor shaft, which engages an internal cylindrical surface 32 formed on coupling member 30. Coupling member 30 is in turn located with respect to the pump shaft by means of an internal cylindrical surface 33 which is formed coaxial with surface 32. Coupling members 15 and 30 thus serve to accurately locate the pump shaft coaxially with the rotor shaft and with the supporting bearing structure.

It is evident from the construction that coupling member 30 can be inserted in place after the pump shaft and the remaining motor structure are in position. In this way the clearance between the pump shaft and the inside of the rotor shaft can be made relatively large, thus avoiding inconvenience and the danger of bending the pump shaft while the motor is being set into position.

Coupling members 15 and 30 are provided with driving pins 34 which serve a triple purpose. Driving pins 34 may be secured to coupling 30 and may engage holes 35 formed in member 15. If the pump shaft is vertically supported by means other than the thrust bearing 13, pins 34 will be lifted out of holes 35 thereby disengaging the pump shaft from the driving motor.

Under normal operating conditions the motor torque is transmitted from member 15 to member 30 by the shearing stress set up in pins 34, coupling member 30 being in turn suitably keyed to pump shaft 14. By a suitable design this shearing stress, produced under normal operating conditions, can be made equal to the safe shearing stress of the material. Thus if a sudden overload is placed on the coupling, as by the seizure of some rotating part, the pins will be sheared off, relieving the abnormal stress from the other members of the mechanism.

In the present construction means are provided for lubricating both of the bearings supported by the motor structure. Lubricant is injected to bearing housing 11, which encloses lower bearing 7, by means of a lubricating passage from grease cup 37 which is supported by adapter bracket 4.

Thrust bearing 13 may be supplied with lubricant by means of pipe fitting 38 which is in communication with bearing housing 19. The lubricant is prevented from escaping from the bearing housing by means of a cylindrical sleeve 39, secured to bearing supporting bracket 5, which projects into annular groove 40 formed in coupling member 15.

The load carried by bearing 13 is in many instances of sufficient magnitude to make the cooling of the bearing an important problem. For

this purpose passages 41 may be provided in bearing supporting bracket 5, surrounding bearing housing 19. These passages may be located intermediate of the ventilating openings 64, provided in member 5, for the motor ventilation. The air drawn into the motor thus serves to cool the lubricant and the bearing.

The normal motor ventilation may be obtained by means of fans, 42 and 43, mounted on the rotor, which serve to blow the air over the stator windings 44, and over the exterior surfaces of the stator laminations 45. The air travels downward through passage 46, formed between the stator laminations and an exterior shell 47; through openings 48 in the lower part of the stator; and out of the motor through openings 49, provided in the adapter bracket 4.

Fig. 2 illustrates the manner in which the motor is supported by the discharge head. Adapter bracket 4 is provided with a flanged surface 50 which rests on flanged surface 51 of discharge head 52. An external cylindrical surface 53 is formed on discharge head 52 for contacting internal cylindrical surface 54 formed on adapter bracket 4. Cylindrical surfaces 53 and 54 are formed coaxial with the pump and rotor shafts. The contact of these surfaces thus serves to maintain the motor structure in proper coaxial relation to the pump structure.

Column pipe 55 may be secured to the discharge head by suitable means, such as the screw coupling 56. The liquid being pumped flows through the discharge head into the discharge pipe 57.

Pump shaft 14 may be enclosed by oil tube 58, through which lubricant may be supplied to the bearings which radially support the pump shaft. Oil tube 58 may also serve to support the radial bearings which may be provided for the pump shaft at intervals along the length of the column pipe. Oil tube 58 may be secured to the discharge head by means of the coupling assembly 59. Coupling assembly 59 may be provided with a bushing 60 which serves as a bearing for the pump shaft.

Discharge head 52 may be provided with apertures 61 through which the ventilating air from the motor may be exhausted. Apertures 61 also provide access to bolts 62 by which the motor is secured to the discharge head.

The pump shaft is shown joined with a coupling 63 directly above coupling assembly 59. The use of this construction is of particular utility where relatively large motors are used. Coupling 63 may be secured onto the portion of the pump shaft which extends into the well. The motor may then be set into place. After the motor is in position, the short length of pump shaft, above coupling 63, may be dropped through the hollow rotor shaft and then may be fastened to the coupling. This obviates the necessity of lowering the motor over the extending portion of the pump shaft.

I claim:

1. In a vertical rotary pump mechanism, a vertical electric motor having a stator and a rotor, a shaft connected to the rotor, a thrust bearing for supporting the rotor and its asso-

ciated parts, and means for axially adjusting the position of said shaft with respect to said bearing, said motor also having a stationary housing, open at the top, and a weather proof cover for said housing, said cover being vertically adjustable with respect to said housing and having means to support said thrust bearing.

2. In a vertical rotary pump mechanism, a vertical electric motor having a stator and a rotor, a shaft connected to the rotor, a thrust bearing for supporting the rotor and its associated parts, and means for axially adjusting the position of said shaft with respect to said bearing, said motor also having a stationary housing, open at the top, and a weather proof cover for said housing, said cover and said housing being threadedly secured together whereby rotation of said cover serves to adjust it vertically with respect to said housing, said cover having means to support said thrust bearing.

3. In a vertical rotary pump mechanism, a vertical electric motor having a stator and a rotor, a shaft connected to the rotor, a thrust bearing for supporting the rotor and its associated parts, and means for axially adjusting the position of said shaft with respect to said bearing, said motor also having a stationary housing, open at the top, a weather proof cover for said housing, said cover and said housing being threadedly secured together whereby rotation of said cover serves to adjust it vertically with respect to said housing, said cover having means to support said thrust bearing, and locking means optionally to prevent rotation of said cover.

4. In a vertical rotary pump mechanism, a vertical electric motor having a housing, a stator and a rotor, a shaft connected to the rotor, a thrust bearing for supporting the rotor and its associated parts, and means for axially adjusting the position of said shaft with respect to said bearing, said housing having a stationary upper member terminating in an open cylindrical well at the top thereof, a weather proof cover for said housing having a central portion adapted to telescopically engage said well, means to support said thrust bearing on the cover, and means to adjust the position of the cover vertically with respect to the housing.

5. In a vertical rotary pump mechanism, a vertical electric motor having a housing, a stator and a rotor, a shaft connected to the rotor, a thrust bearing for supporting the rotor and its associated parts, and means for axially adjusting the position of said shaft with respect to said bearing, said housing having a stationary upper member terminating in an open cylindrical well at the top thereof, a thread formed on the inner surface of said well, a weather proof cover for said housing, a hollow central portion on said cover having an exterior thread adapted to engage the thread of said well, whereby rotation of said cover serves to alter its vertical position with respect to the housing, and means in said central portion to support said thrust bearing.

GEORGE T. PFLEGER.