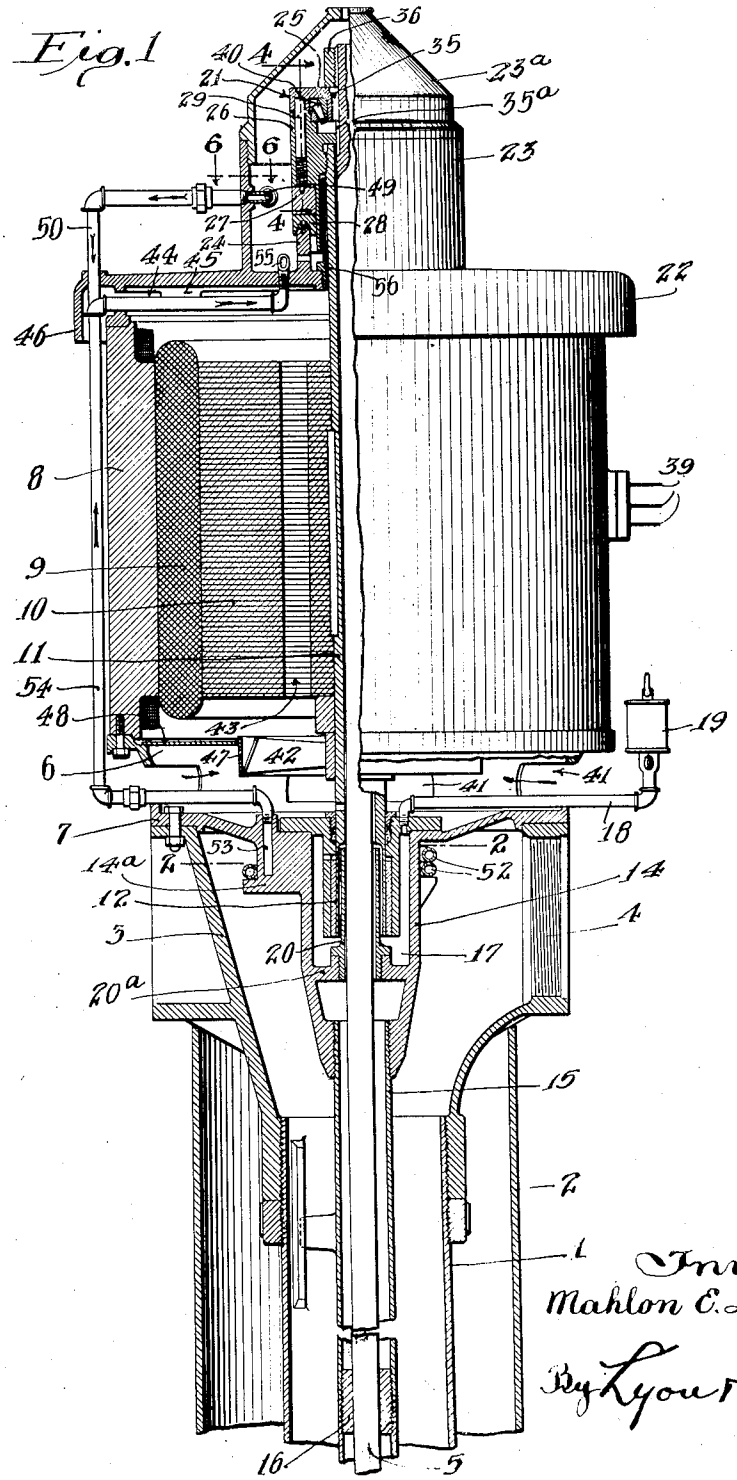
Sept. 17, 1929. M. E. LAYNE 1,728,685

ROTARY PUMP MECHANISM

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Fig. 1



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Fig. 2

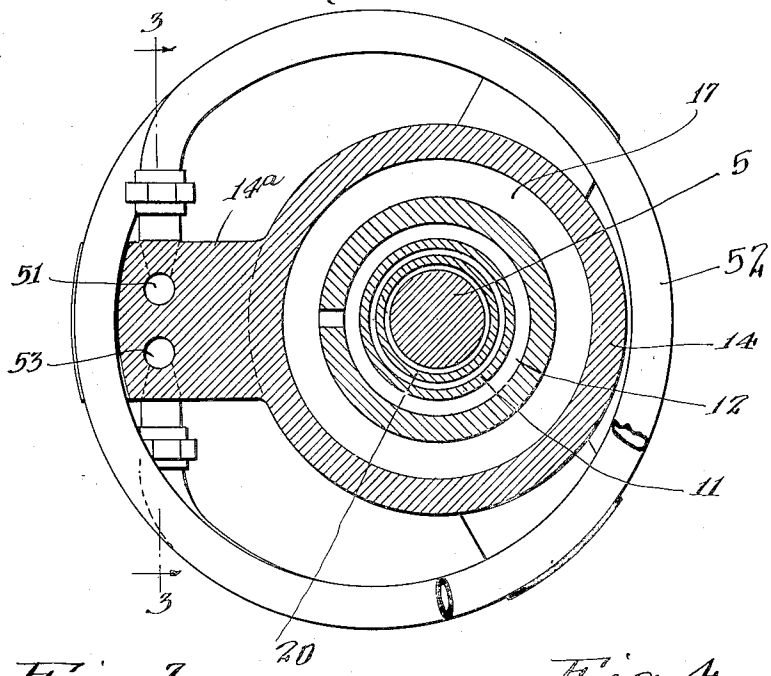


Fig. 3

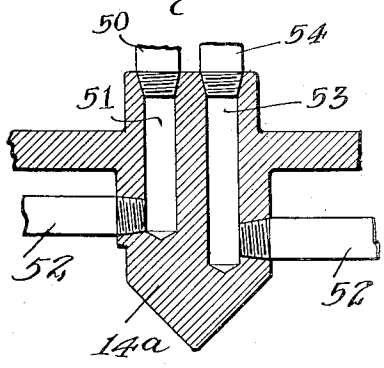
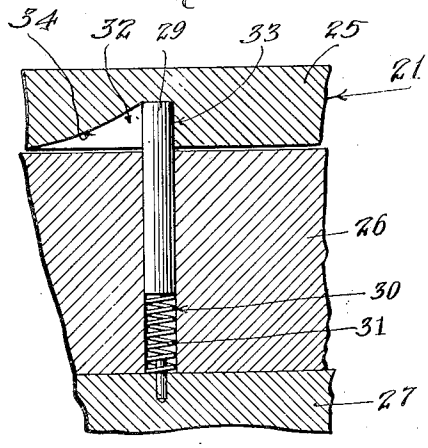


Fig. 4



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Fig. 5

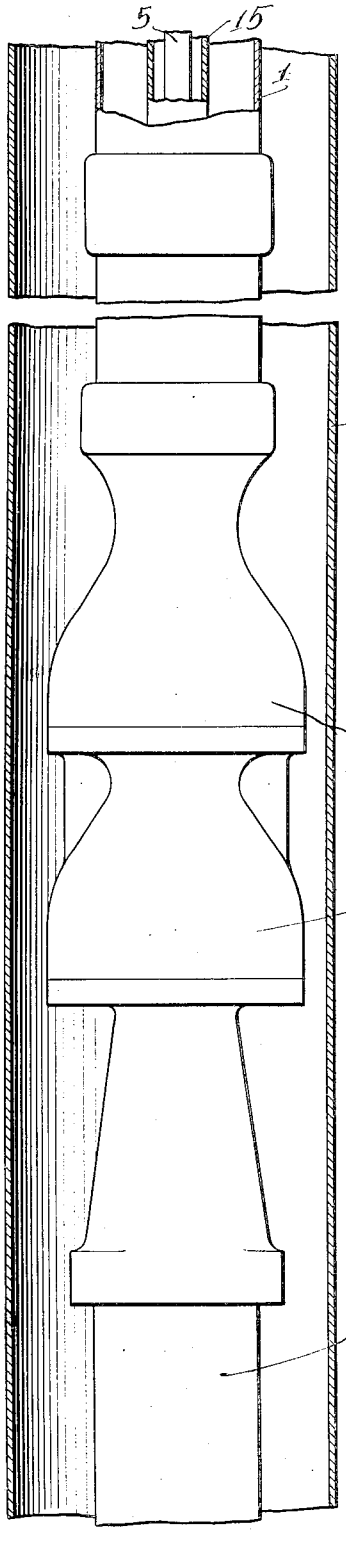


Fig. 6

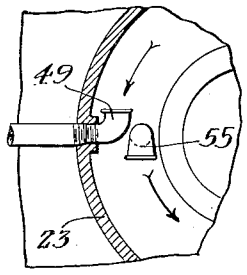
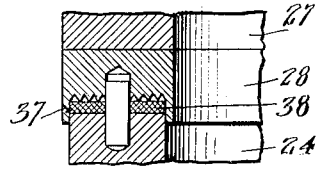


Fig. 7



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ROTARY PUMP MECHANISM

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Fig. 8

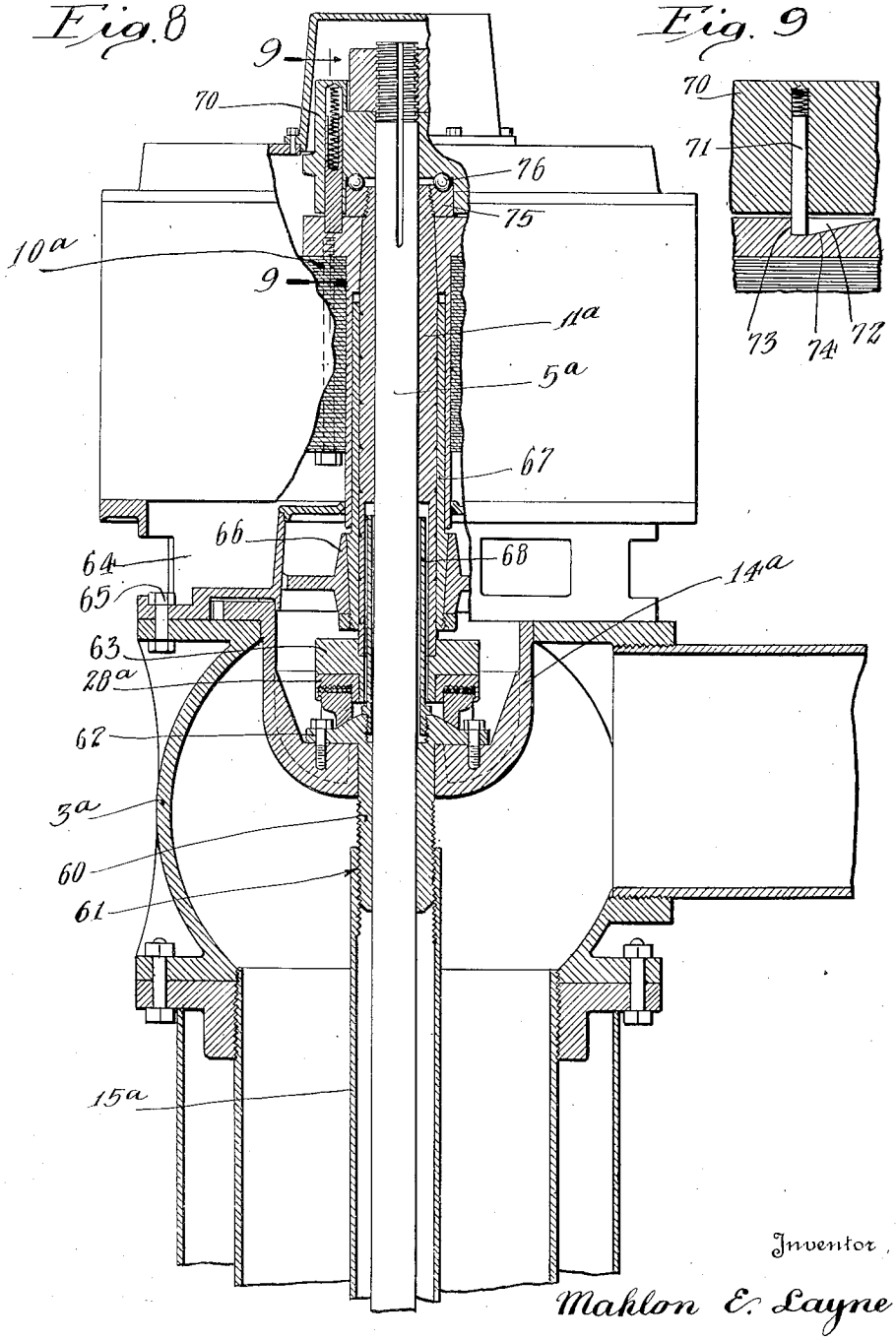


Fig. 9

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UNITED STATES PATENT OFFICE

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ROTARY PUMP MECHANISM

Application filed May 8, 1923. Serial No. 637,487.

This invention relates to rotary pump mechanism, and refers particularly to the type of rotary pump mechanism employed in deep water wells and which type of mechanism employs an electric motor for driving the rotary pump.

The general object of this invention is to provide a rotary pump mechanism of a compact and economic construction which will result in the elimination of much of the construction heretofore necessary in driving a rotary pump by an electric motor and which will permit a more ready adjustment of the pump and actuating shaft thereof and which will permit an electric motor to be more readily alined with the actuating shaft of the pump and be set closer to the casing head of the pump than the customary rotary pump mechanism, resulting in a lower structure less inclined to vibrate during operation.

More specifically one of the objects of this invention is to provide a rotary pump mechanism in which the electric motor is alined with the actuating shaft of the pump by having the actuating shaft extending through the driving or operating shaft of the motor which is of hollow or quill construction, whereby the motor may be automatically alined on being slipped over the actuating shaft and be set closer to the casing head of the pump mechanism and eliminate much of the construction heretofore found necessary in coupling an electric motor with a rotary pump.

Another object of this invention is to provide a rotary pump mechanism in which the rotary pump may be supported closely over and preferably by the discharge casing of the pump.

Another object of this invention is to provide a rotary pump mechanism in which the actuating shaft may be longitudinally adjusted to center the impellers in the pump without necessitating a removal of the electric motor employed in driving the pump.

Another object of this invention is to provide a rotary pump mechanism in which the combined longitudinal thrust of the driving parts of the electric motor and the actuating shaft of the pump may be received by a single thrust bearing which will thus aid in maintaining the shaft of the motor and actuating shaft of the pump in alinement in the mechanism.

Another object of this invention is to provide a rotary pump mechanism with a swivel connection between the shaft of an electric motor and the actuating shaft of the pump and provide the mechanism with a one-way connection or coupling between the shafts which one-way connection is positioned above the electrical motor and readily accessible for repair or adjustment without the necessity of removing the motor from the mechanism.

Another object of this invention is to provide a rotary pump with an improved form of radial thrust bearing.

Another object of this invention is to provide a rotary pump mechanism, in which an electrical motor, and a belt driven pulley may be readily substituted one for the other to drive the pump.

Various other objects and advantages of this invention will be understood from the following description of the accompanying drawings wherein there is set forth a number of preferred embodiments of the invention. The invention includes various novel combinations of parts, the objects and advantages of which will be more readily understood from the accompanying drawings. Such drawings, however, are but illustrations of the invention which invention is capable of numerous embodiments and is not limited to the embodiments hereinafter shown.

In the drawings:

Figure 1 is a vertical section taken through the upper end of the discharge casing and pump head of a rotary pump mechanism embodying the invention, and illustrates a motor with its connection to the actuating shaft of the pump, the upper portion of the view being shown partially in section and partially in elevation.

Fig. 2 is a horizontal section taken upon the line 2—2 of Figure 1, and upon an enlarged scale.

Fig. 3 is a vertical section taken on the line 3—3 of Figure 2.

Fig. 4 is an enlarged vertical section taken on the line 4—4 of Figure 1.

Fig. 5 is a vertical section taken through a well casing illustrating diagrammatically a pump and its connection to the driving means of the mechanism.

Fig. 6 is a horizontal section taken on the line 6—6 of Figure 1.

Fig. 7 is an enlarged vertical section through the lower portion of the step bearing or thrust bearing which in this embodiment is used to support the pump shaft and rotary parts of the motor.

Figs. 8 and 9 refer to a second embodiment of the invention in which

Fig. 8 is an elevation of a motor and its connection to the actuating shaft of the pump, the figure being largely in vertical section.

Fig. 9 is a section on the line 9—9 of Figure 8.

In the drawings the rotary pump is indicated at 101. Such pump may include one or more stages 102 which are adapted to draw water in from an inlet pipe 103 connected to the bottom of the pump and discharge the water through a discharge casing 1 connected to the top of the pump. The discharge casing 1 extends vertically from the pump to the top of the well and serves to support or suspend the pump 101 in the bottom of the well. The construction of the rotary pump may be any customary or preferred form of pump well known in the art and need not here be described. The pump is generally positioned within a well casing 2.

The discharge casing 1 of the pump is connected at the top of the well with a casing head 3 which may have the usual laterally disposed discharge neck 4. In the preferred form of the invention the motor is supported directly over the casing head 3, preferably being supported by the head 3 and located closely adjacent the head. The stationary or fixed parts of the motor are supported on a base 6 which is bolted or otherwise secured to an upper cover 7 of the casing head 3. The pump 101 is provided with an actuating or pump shaft 5 which extends vertically from the pump through the discharge casing 1 and casing head 3. A cup-shaped oil reservoir 14, which is preferably integral with the cover 7, extends down into the casing head 3 and serves to support the radial bearing of the mechanism in position to be cooled by the discharge water of the pump. The lower end of the reservoir 14 is screw-threaded to a casing 15 extending from the reservoir 14 to the pump 101 and enclosing the actuating shaft 5. The casing 15 serves as a support for the bearings 16 of the actuating shaft 5 and protects the bearings 16 from contact with the discharge water of the pump and acts as a conduit or chamber for lubricant to be furnished to the bearings 16.

The interior of the reservoir 14 provides a chamber 17 which may be supplied with oil by a pipe 18 leading from a suitable oil cup 19. The reservoir 14 is provided with an inwardly directed annular flange 20ª to which is screwed a sleeve 20, which sleeve extends upwardly and surrounds the shaft 5 having a clearance with the shaft so that the upper end of the sleeve 20 provides an overflow point for lubricant to pass down the shaft enclosing casing 15 to the bearings 16.

The electric motor is preferably of induction type. Said motor includes a rotary drive member 10 which is carried by a hollow member or quill power shaft 11 which thus comprises the driving or power shaft of the mechanism and imparts the power necessary to drive the pump 101. In the motor shown the rotary drive motor 10 includes a suitable armature and the stationary parts of the motor include a field magnet in the form of a ring carrying coils 9. The winding of the coils of the motor may be any customary or preferred winding, which is not shown in detail.

The hollow operating shaft 11 of the electric motor extends down into the oil reservoir 17 enclosing the sleeve 20, and is provided with a radial bearing member 12 which is supported by the cover 7 and serves also as a cover for the oil chamber 17. The bearing 12 serves as an alinement or radial bearing for the operating shaft 11 of the motor, the weight of the member 10 and the actuating shaft 5 of the pump is supported by bearings disposed above the motor. The stationary ring 8 of the motor supports a cover or bonnet 22. Said bonnet 22 is provided with a portion extending upwardly to form a dome 23. The actuating shaft 5 and hollow operating shaft 11 of the motor extends up into the interior of the dome 23. The bonnet 22 further provides an annular flange 24 inside the dome 23, which flange 24 supports a bearing ring 28. A rotary wearing ring 27 rests upon the ring 28 and supports a collar 26. The collar 26 in turn is screwed or otherwise attached to the hollow operating shaft 11 of the motor and serves to support the weight of the hollow shaft 11 and member 10 upon the bearing ring 28. The collar 26 likewise serves to support the weight of the actuating shaft 5 of the pump. For this purpose the upper end of the shaft 5 carries a driven collar 25 which rests or is supported by the collar 26. Preferably a swivel connection is provided between the collars, for which purpose a cone race 40 is provided between the collars. This cone race permits a one way drive

connection between the hollow operating shaft 11 of the motor and actuating shaft 5 of the pump. The lower driving collar 26 is provided with a vertically guided driving dog 29, see Figure 4. This dog seats in a guide way 30 and is pressed upwardly by a coil spring 31 positioned in the bottom of the guideway. The under face of the upper driven collar 25 is provided with a recess 32 disposed to cooperate with this driving dog 29. Said recess has a substantially vertical shoulder 33, an oppositely disposed inclined face 34. By this construction when the driving dog 29 is forced against the face 33 it forces the collar 25 to rotate with the collar 26 and thereby couples the actuating shaft 5 of the pump to the hollow shaft 11 of the motor. If the motor is reversed and the driving dog 29 rotated against the inclined face 34 of the collar 25, the driving dog will be forced downwardly in the guideway 31 and will not drive the collar 25. Thus the motor is coupled to the actuating shaft 5 in only one direction which prevents accidents or damage to the mechanism which might be caused as explained in the copending application of Albert L. Roco and Mahlon E. Layne, serial No. 637,421, filed May 8, 1923.

Preferably the collar 25 secured to the shaft 5 is so connected to permit a vertical or longitudinal movement of the shaft 5 through the collar while preventing the rotation of one with respect to the other. This is accomplished by providing an elongated key way 35ª in the actuating shaft 5 in which a key 35 may slide while locking the collar 25 to the shaft 5 and preventing relative rotation of these parts. This permits the actuating shaft 5 to be longitudinally adjusted in the mechanism to properly center the impellers in the pump 101. A nut 36 is screw-threaded to the top of the shaft 5 to effect the desired vertical or longitudinal adjustment of the actuating shaft 5.

The bearing 28 may be of any customary or preferred construction of a thrust bearing. In this embodiment of the invention, it is illustrated as constructed in accordance with my copending application, Serial No. 704,837, filed April 5, 1924, in which as shown, in Figure 7, the bearing ring 28 is provided with a recess or pocket 37 on its under side which is of annular form and receives the upper end of the annular bearing support 24 and in this pocket is placed a plastic material 38 such as lead. When the parts 28 and 24 are assembled together, a pressure greater than any pressure thereafter to be supported by the bearing is exerted upon the ring 28 upon a true surface to effect a permanent alinement of the ring 28.

To circulate air through the motor while it is in operation, the motor base 6 of the mechanism is provided with openings 41 through its sides and a fan 42 is mounted upon the driving shaft 11 of the motor below the motor and within the base. In operation of the mechanism the rotation of this fan 42 will draw air through the openings 41 and force the air upwardly through the openings 43, which extend longitudinally through the driving member 10. The air will be discharged through suitable openings 44 provided in a circular web 45 of the bonnet 22. The bonnet 22 is provided with an over-hanging apron 46 which enables the circulated air to pass downwardly and out over the edge of the ring 8 of the motor. To assist the fan 42 in impelling the air upwardly through the motor, the bottom of the motor is covered with an annular plate which has a center aperture communicating with a casing 47 surrounding the fan 42. To lubricate the bearings and parts positioned above the motor oil is maintained within the dome 23. This oil is cooled by automatically circulating through pipes 50 and 54. The rotation of the collar 6 will drive the oil through a connection 49 to the pipe 50, which leads the oil down to a vertical duct 51 formed in a boss 14ª in the shaft-housing 14 (see Figures 2 and 3). A pipe 52 connects with this duct 51 and is coiled around the exterior of the reservoir 14 and the other end of the coil is connected with a second vertical duct 53 (see Figure 3). This duct in turn connects with the pipe 54 through which the oil passes upwardly and through the bottom of the dome 23 connecting within the dome with an inlet nozzle 55. The mouth of the nozzle 55 projects in a direction in which the oil is removed by rotation of the collar 26. In this manner the oil in the upper dome of the motor may be circulated through and cooled by the water being pumped through the casing head 3.

Referring to Figures 8 and 9 a modified construction is shown. In these figures the pump head 3ª of the pumping mechanism is provided with a cup-shaped cover 14ª which acts as an oil reservoir for bearings and parts contained therein. A cylindrical bearing blocks 60 fits in the bottom of the cup shaped cover 14ª and is provided with exterior threads 61 at its lower end to which the customary shaft enclosing casing 15ª of the pump is screwed. The bearing 60 is provided inside the cup shaped cover 14ª with an annular flange 62 which seats at the bottom of the cover 14ª and is preferably bolted thereto.

28ª indicates a bearing shoe that serves as a thrust bearing of the mechanism rotatably supporting a fixed bearing block 63. This thrust bearing may be similar to the thrust bearing of the first form of the invention or any other preferred form.

64 indicates an annular motor stand which is preferably directly supported on the top of the pump head 3^a and held by bolts 65 thereto. The motor is preferably directly supported by the stand 64 so as to be positioned closely to the pump head. The motor may have any customary or preferred form of winding. A rotatable driving member, indicated by 10^a of the motor is mounted upon a hollow or quill driving shaft 11^a, which shaft encloses an actuating shaft 5^a of the pump mechanism.

In this embodiment of the invention the longitudinal thrust of both the motor and actuating shaft of the mechanism is received by a bearing disposed below the motor. The stand 64 is provided with inwardly extending annular members 66 which support a bearing sleeve 67 at its lower end. Said bearing sleeve extends upwardly into the motor and engages the driving shaft or power member 11^a of the motor thereof to receive the radial thrust. The hollow power member 11^a extends through the annular bearing support 66 and is connected with the upper bearing block 63 of the thrust bearing which thus receives the vertical thrust of the power member 11^a and the part supported thereby. Below the rotor 10^a the power member 11^a is provided with an annular recess around the actuating or pump shaft 5^a into which a sleeve 68 extends which is screwed into the bearings 60. Said sleeve 68 acts to retain the lubricant in the cup 14^a and maintain the lubricant above the wearing surfaces of the bearing block 63 and bearing shoes 28^a also around a substantial part of the sleeve bearing 67.

The actuating shaft 5^a may be directly keyed or otherwise coupled with the driving shaft 11^a. Preferably, however, these shafts 5^a and 11^a are provided with a one-way connection so that the shafts are only coupled in the direction proper for operating the pump. For this construction a drive-collar 70 is keyed to the actuating shaft 5^a. Said collar 70 is provided with a driving dog 71 which engages a recess 72 in the driving member 10^a of the motor. Said recess is constructed with a vertical wall 73 and an inclined wall 74 so that the driving member 10^a of a motor will only drive the collar 70 when rotated to force the vertical face 73 against the driving dog. A nut 75 is screwed to the upper end of the hollow operating shaft 11^a of the motor which mounts roller bearings 76 engaging the collar 70, which bearings 76 permit the motor to reverse without driving collar 70 and thereby the actuating shaft 5.

While the construction of the pump mechanism herein described is well suited for the purpose of this invention, various modifications and changes may be made without departing from the spirit of the invention. This invention is not limited to the specific embodiment or methods of embodiment shown, but is of the scope set forth in the accompanying claims.

I claim:

1. In a pump, the combination of a discharge casing leading up from the well, a casing head connected with the upper end of the casing, a motor supported above the casing head, an actuating shaft extending up through the casing and through the motor, a collar carried by the upper end of the shaft, a bearing supporting the collar, and a one-way driving connection for driving the collar from the motor.

2. In a pump mechanism, the combination of a casing leading up from the well, a casing head connected with the upper end of the casing, a motor supported above the casing head, an actuating shaft extending up through the casing and through the motor, a collar carried by the upper end of the shaft, a one-way driving connection for driving the collar from the motor, and a swivel connection between the collar and the motor permitting a free relative backward rotation of the motor with respect to the actuating shaft.

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