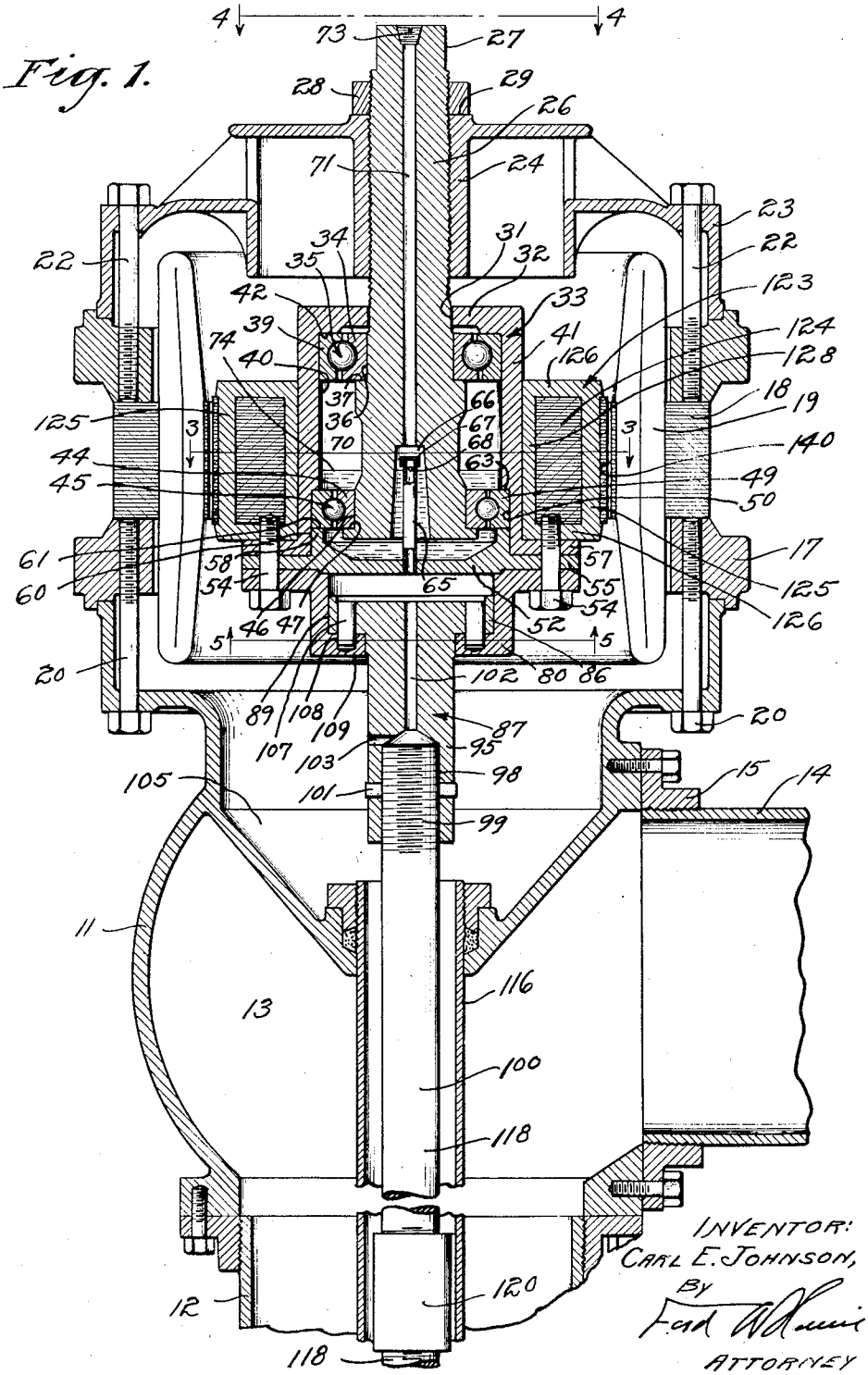
March 5, 1929. C. E. JOHNSON 1,704,362

VERTICAL TURBINE PUMP HEAD

Filed July 16, 1925 3 Sheets-Sheet 1

Fig. 1.



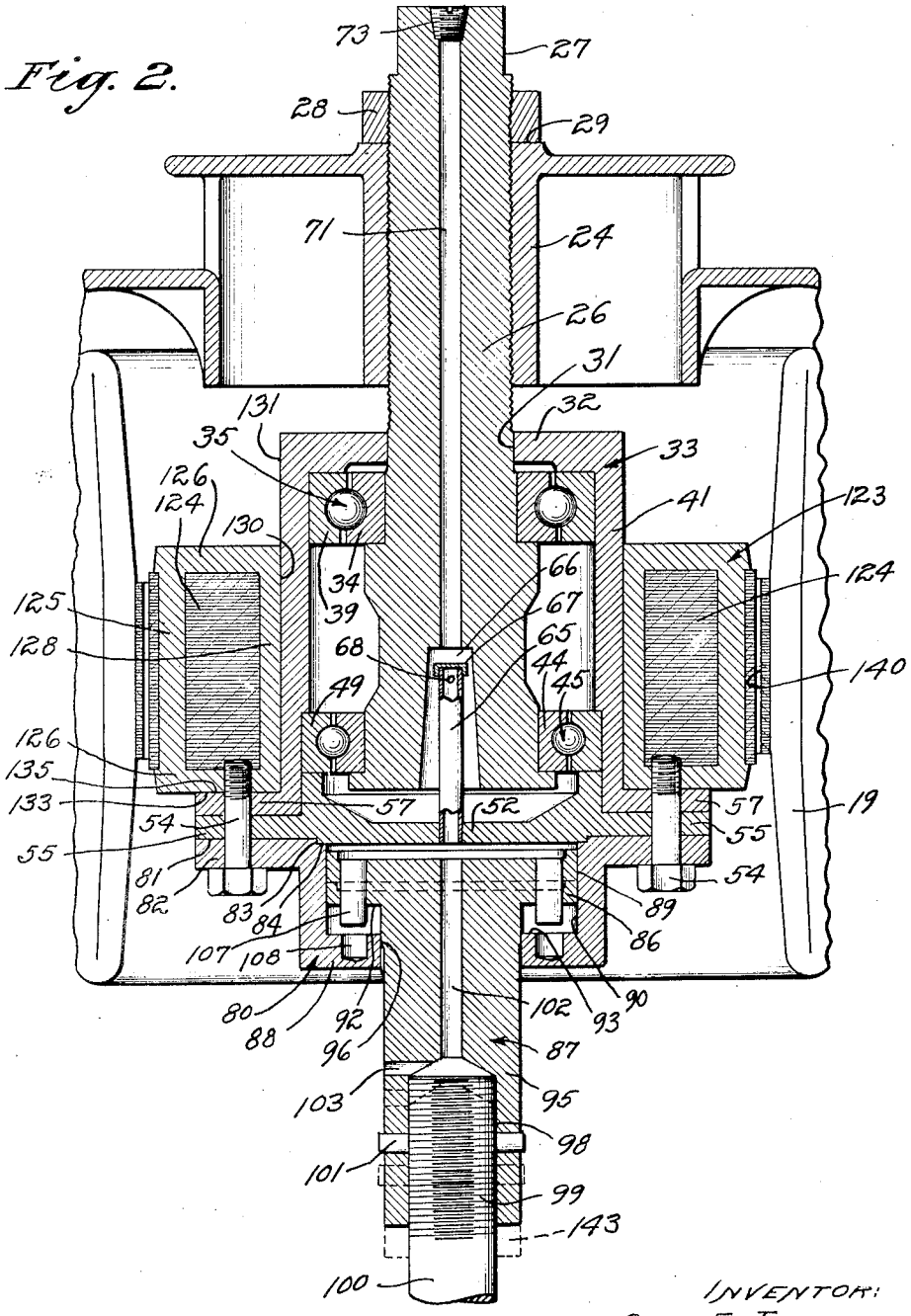
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VERTICAL TURBINE PUMP HEAD

Filed July 16, 1925 3 Sheets-Sheet 2

Fig. 2.



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Fig. 4.

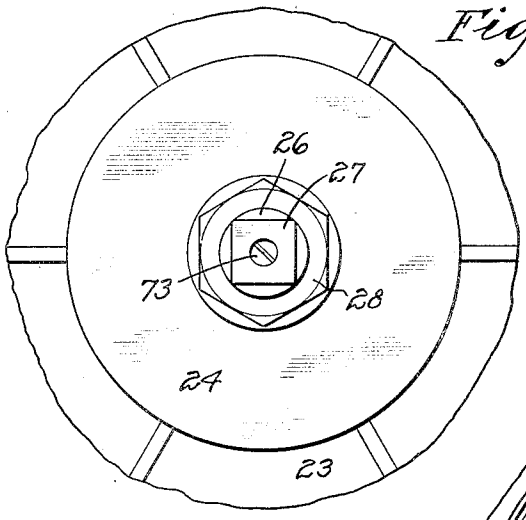


Fig. 3.

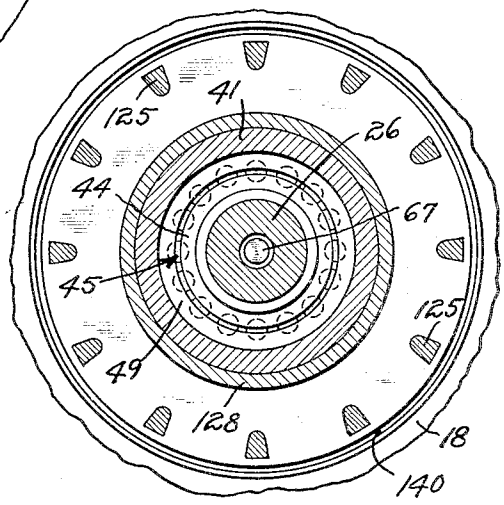
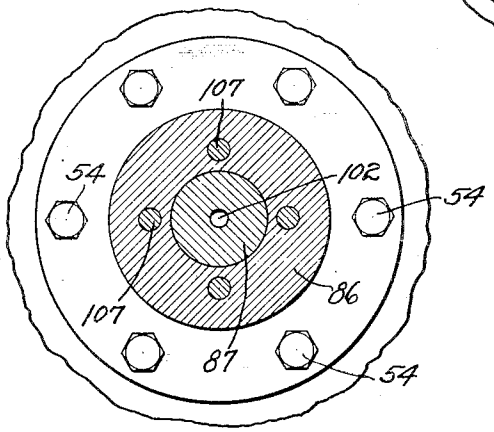


Fig. 5.



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UNITED STATES PATENT OFFICE.

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VERTICAL-TURBINE-PUMP HEAD.

Application filed July 16, 1925. Serial No. 43,941.

My invention relates to vertical turbine irrigation pumps and relates particularly to an electric motor which is adapted for use in a turbine pump, or other construction which has similar motor requirements.

A common form of a vertical turbine 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 surface of the ground where it is attached to a pump 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 pump head. In the direct-connected type of pump head the pump shaft is connected to the rotor shaft of a motor carried by the pump head by which the pump shaft is driven.

It is an object of my invention to provide a vertical turbine pump having a motor which supports the pump shaft as well as driving it.

It is a further object of my invention to provide a vertical turbine pump having a motor in which the rotor is directly connected to the pump shaft.

In a vertical turbine pump it is necessary to properly adjust the pump shaft in an axial or vertical direction so that the impellers of the pump section will not scrape against any parts of the pump and cause attrition.

It is also an object of my invention to provide a vertical turbine pump having a motor which possesses means for axially adjusting the pump shaft from the top of the motor.

It is a still further object of my invention to provide a pump of the character mentioned having means permitting an axial adjustment of the pump shaft while the pump is in operation.

It sometimes occurs that a motor, due to improper connection of electric wires, is driven backwards. This revolves the pump shaft in a reverse direction which results in a tendency for the lengths of shafting of the pump shaft which are connected together by couplings to unscrew and disconnect from one another.

It is another object of my invention to provide a means for disconnecting the motor from the pump shaft when the lengths of shafting of the pump shaft start to unscrew.

A further object of my invention is to provide a motor having a central vertically adjustable arbor on which the rotor of the motor is adjustably mounted.

It is a still further object of my invention to provide a motor having a rotatable bearing housing which surrounds a part of the central arbor, in which housing the bearings are placed and to which housing a rotor is secured.

It is a still further object of my invention to provide novel oil means.

Other objects and advantages of the invention will be made manifest hereinafter.

Referring to the three sheets of drawings in which I illustrate a preferred form of my invention and which are solely for the purpose of illustration:

Fig. 1 is a vertical sectional view through a vertical turbine pump head housing a motor construction of my invention.

Fig. 2 is an enlarged fragmentary sectional view of the motor of my invention, this view showing the arrangement of the parts of my invention when the rotor of the motor is disconnected from the pump shaft.

Fig. 3 is a horizontal section taken through the motor of my invention, this view being taken substantially on a line 3—3 of Fig. 1.

Fig. 4 is a fragmentary plan view of the pump head, this view being taken substantially as indicated by the line 4—4 of Fig. 1.

Fig. 5 is a horizontal cross section taken substantially as indicated by the line 5—5 of Fig. 1.

With attention to Fig. 1 of the drawings, 11 denotes a pump head body to which is secured the upper end of a column pipe 12. The interior 13 of the body 11 connects with the column pipe 12 and a discharge pipe 14 having a flange 15 which is secured to the body 11. A stator 17 having a core 18 and a primary winding 19 is secured to the upper part of the body 11 by means of suitable cap screws 20. Cap screws 22 are provided for securing an upper casting 23 to the upper part of the stator 17. The casting 23 provides an upper vertical bracket in the form of a cylindrical and internally threaded hub 24.

Threadably extended through the upper bracket 24 is a vertical arbor or stem 26 having a polygonal portion 27 formed at the upper end thereof to accommodate a suitable wrench for rotating the arbor 26. A lock nut 28 is threaded on the upper part of the arbor

26, being adapted to engage an upper face 29 of the upper bracket 24 in order to lock the arbor 26 in place.

The lower part of the arbor 26 passes through a cylindrical opening 31 of a radial wall 32 of a hollow quill or bearing housing 33. An inner race 34 of a thrust bearing 35 engages a cylindrical face 36 and a radial face 37 of the arbor 26. An outer race 39 of the thrust bearing 35 engages an inner cylindrical face 40 of a cylindrical wall 41 of the bearing housing 33 and a radial annular face 42 of the radial wall 32. An inner race 44 of a radial bearing 45 engages a cylindrical face 46 and a radial face 47 formed on the arbor 26 near the lower end thereof. An outer race 49 of the radial bearing 45 engages an internal cylindrical face 50 of the cylindrical wall 41 of the bearing housing 33. As clearly shown in Fig. 1, and in Fig. 2, the radial bearing 45 is of an internal diameter which is somewhat larger than the internal diameter of the thrust bearing 35. Therefore, it may be passed down into position around the annular radial face 37 formed on the arbor 26 in the upper part of the bearing housing 33.

The lower end of the bearing housing 33 is closed by a blind flange or plate 52 which is secured to the bearing housing 33 by cap screws 54 which extend through a flange 55 of the plate 52 and an annular radial plate portion 57 of the bearing housing 33 which extends from the lower end of the cylindrical wall 41. A cylindrical projection 58 of the plate 52 extends upwardly into the interior of the housing 33. An outer cylindrical face 60 of this projection 58 engages the cylindrical face 50 of the cylindrical wall 41 and an upper end 61 of the projection 58 engages the outer race 49 of the radial bearing 45, clamping it against an annular shoulder 63 of the cylindrical wall 41 of the bearing housing 33.

An oil drain tube 65 extends up vertically from the center of the plate 52 into a cavity 66 formed at the lower end of the arbor 26. The upper end of the oil drain tube 65 is closed by a cap 67 and has an opening 68 formed near the upper end thereof. Lubricating oil for the thrust and radial bearings 35 and 45 is supplied to the interior of the housing 33 which forms a bearing chamber 70, through an axial passage 71 which extends from the upper end of the arbor 26 to the cavity 66. The upper end of the passage 71 is normally closed by a plug 73. Oil which is poured into the bearing chamber 70 reaches a level as indicated at 74 and any additional oil will flow from the chamber 70 through the oil drain tube 65 passing thereinto through the opening 68 of the drain tube 65.

A coupling flange 80 is secured against a lower face 81 of the plate 52 by the cap screws 54 which extend through an annular radial web 82 of this coupling flange 80. The coupling flange 80 is centralized with respect to the axis of the arbor 26 by a cylindrical projection 83 of the plate 52 which extends into an annular recess 84 of the coupling flange 80. A head 86 of a coupling hub 87 rests in a cup portion 88 of the coupling flange 80. A cylindrical face 89 of the head 86 may engage a cylindrical face 90 of the cup portion 88 and a radial face 92 of the head 86 engages an annular face 93 of the cup portion 88, whereby the coupling hub 87 is supported by the coupling flange 80. A hub portion 95 of the coupling hub 87 extends through a cylindrical opening 96 of the cup portion 88 and provides a threaded socket 98, into which an upper threaded end 99 of a pump shaft 100 is secured. The upper end 99 of the pump shaft 100 is rigidly retained in the socket 98 by a pin 101.

Any oil which drains through the oil drain tube 65 may pass through an axial opening 102 and a radial opening 103 of the coupling hub 87 to an oil chamber 105 of the body 11.

As shown in Figs. 1, 2 and 5, the head 86 of the coupling hub 87 carries axially extending pins 107 which are circularly arranged around the axis of the coupling hub. The lower ends of the pins 107 are adapted to extend into an accommodating cavity 108 formed in a radial wall 109 of the cup portion 88 of the coupling flange 80. The common engagement between the pins 107 and the walls of the cavities 108 provides driving engagement with the coupling flange of the coupling hub.

As shown in Fig. 1, the pump shaft 100 extends through an oil tube 116 to a pump section (not shown) which is situated near the bottom of the well. The pump shaft 100 is generally composed of lengths of shafting 118 which are usually secured together by couplings 120.

Surrounding the bearing housing 33 is a rotor 123 which is secured in place by the cap screws 54. As shown clearly in Figs. 1, 2 and 3, the rotor 123 comprises a laminated core 124 having conductor bars 125 and end rings 126. The conductor bars and end rings 125 and 126 are cast integral with an inner cylindrical wall 128 which extends concentrically inside the core 124. As shown in Figs. 1 and 2, an inner cylindrical face 130 of the wall 128 engages an outer cylindrical face 131 of the cylindrical wall 41 of the bearing housing 33. A lower annular face 133 of the lower end ring 126 is clamped in engagement with a housing annular face 135 of the plate portion 57 of the blind flange 52. The cap screws 54, as clearly shown in Figs. 1 and 2, serve to clamp the rotor 123, the bearing housing 33, the blind flange 52 and the coupling flange 80 together, the cap screws 54 threading into the lower end ring 126 of the rotor 123. The rotor 123 is situated in a cylin-

drical opening 140 of the core 18 of the stator 17. The core 124 of the rotor 123 is made somewhat longer than the core 18 of the stator 17 so that the rotor may be moved axially without removing the core 124 from the core 18 of the stator 17.

The operation of my invention is substantially as follows:

Before putting the pump into operation it is desirable to axially adjust the pump shaft 100 so that the pump impellers secured at the lower end thereof in the pump section of the pump will not engage adjacent parts of the pump section. This is accomplished by first loosening the lock nut 28 and then rotating the arbor 26 in order to advance it in a proper direction. The rotation of the arbor 26 is conveniently accomplished by use of a wrench placed on the polygonal portion 27 at the upper end of the arbor 26. When the arbor 26 is moved axially the rotor is moved therewith and the pump shaft being supported thereby is likewise moved.

After a proper adjustment of the pump shaft is obtained the pump may be set in operation. The stator 17 is supplied with electricity and the rotor 123 is driven thereby. The rotor rotates on the thrust and radial bearings 35 and 45 around the lower end of the arbor 26 and the pump shaft 100 rotates therewith, turning impellers in the pump section in a manner to elevate water through the column pipe 12 into the chamber 13 of the body 11, the water passing therefrom through the discharge pipe 14.

Lubricating oil in the oil chamber 70 is splashed so that the thrust bearing 35 receives sufficient lubrication.

If the motor is improperly connected so that it will run in a reverse direction there is a possibility that couplings 120 of the pump shaft 100 may be unscrewed. If this occurs the upper end of the pump shaft 100 will move upwardly when the lengths 118 start to unscrew from the couplings 120 due to the fact that the lower end of the pump shaft 100 is locked against axial movement to an appreciable extent by the impellers of the pump which are situated between bearings of the pump section. When the upper end of the pump shaft 100 moves upwardly the coupling hub 87 is moved from a position shown in full lines in Fig. 1 and in dotted lines 143 in Fig. 2 into a position shown by full lines in Fig. 2.

It will be noted that at this time the pins 107 are removed from their positions in the cavities 108 and the coupling hub 87 is disconnected from the coupling flange 80. In this manner the rotor of the motor is disconnected from the pump shaft 100 and may revolve freely while the pump shaft remains still. By such a provision as this the sections of the pump shaft will not be completely uncoupled and considerable damage, which sometimes results from such a disconnection as this, is avoided.

Lubricating oil, as previously described, may be conveniently supplied to the bearing chamber 70 through the passage 71 in the arbor 26 and this may be done while the pump is in operation.

An axial adjustment of the pump shaft 100 may be accomplished while the pump is in operation, thus eliminating a shutting down of the pump which, in the present type of pumps known to the inventor, is necessary.

From the foregoing description it will be seen that my invention utilizes only one set of bearings, eliminating a separate set of bearings for supporting the pump shaft 100. In the ordinary direct-connected pump heads it is customary to have bearings for supporting the weight of the pump shaft and to have separate bearings for rotatably supporting the rotor of the motor of the pump. In these present types of pump heads great care must be exercised in aligning the rotor shaft and the pump shaft or else considerable trouble will be had in the flange coupling which is generally employed for securing the pump and the motor shafts together.

In the pump of my invention the alignment of the rotor and pump shaft is automatically obtained, due to the fact that they are rigidly and concentrically secured together and due to the fact that they are suspended from a single bearing arrangement. The construction of my invention makes the vertical adjustment of the pump shaft very easy, it being merely necessary to adjust the vertical position of the arbor 26. This is conveniently done from the top of the pump and may be done if desired while the pump is in operation.

By providing the novel automatic disconnecting means between the pump shaft and the rotor much damage is avoided, due to a disjoining of lengths of shafting in the pump shaft in event that the motor should be run in a reverse direction which sometimes occurs when the motor is improperly hooked up with an electric circuit.

I claim as my invention:

1. A motor, adapted to be placed above and to drive a vertical shaft, comprising: a stationary frame; an arbor secured in said frame; a rotor; means for rotatably supporting said rotor on said arbor; means connecting said rotor to said vertical shaft; a stator secured in said stationary frame in such a position that it can drive said rotor; and means for vertically adjusting the position of said arbor in said frame.

2. A motor as in claim 1 also comprising: means by which the rotor supports said vertical shaft.

3. A motor as in claim 1 also comprising: means for preventing small changes in the mutual position of said stator and rotor from

materially affecting the electrical performance of the rotor.

4. A motor as in claim 1 also comprising: means forming a hollow chamber surrounding the lower end of said arbor; and friction reducing means in said chamber between said arbor and said rotor, said chamber being so formed as to retain lubricant and to distribute same to said friction reducing means.

5. In combination: a substantially vertical shaft which is to be driven; a rotor of an electric motor; means for securing said rotor to said shaft; a hollow quill rotatable with the upper end of said shaft; a stem projecting downwardly into said quill; means for supporting said quill on said stem; and a stationary structure in which said stem is supported.

6. In combination: a substantially vertical shaft which is to be driven; a rotor of an electric motor; means for securing said rotor to said shaft; a hollow quill rotatable with the upper end of said shaft; a stem projecting downwardly into said quill; means for supporting said quill on said stem; and a stationary structure in which said stem is vertically adjustable.

7. In a pump driving mechanism the combination of: a pump shaft having a vertical axis; a rotor to which power may be applied, said rotor being secured to said shaft; a stationary frame; a stationary member supporting the weight of said shaft therefrom; and means for adjusting the vertical position of said stationary member with relation to said frame.

8. In a pump driving mechanism the combination of: a pump shaft having a vertical axis; a rotor to which power may be applied, said rotor being secured to said shaft; a stationary frame; a stationary member extending to a point above said rotor and supporting the weight of said shaft; and means above said rotor for adjusting the vertical position of said stationary member with relation to said frame.

9. In a pump driving mechanism, the combination of: a frame structure; an arbor adjustable relative to said frame structure; a rotor rotatably mounted on said arbor; and a shaft rotated by said rotor, said shaft being axially adjustable by adjusting said arbor.

10. In combination: a frame structure; an arbor carried by said frame structure so as to be axially adjustable therein; a rotor journalled on said arbor so as to be rotatable thereon but not axially movable thereon; and a shaft driven by said rotor and axially aligned with said arbor, said shaft being axially adjustable by axially adjusting said arbor.

11. In combination: a frame structure; an arbor threaded relative to said frame structure; a rotor journalled on said arbor so as to be rotatable thereon but not axially movable thereon; and a shaft driven by said rotor and axially alinged with said arbor, said shaft being axially adjustable by rotating said arbor relative to said frame structure.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 9th day of July, 1925.

CARL E. JOHNSON.