Aug. 29, 1939. L. R. THRASHER 2,171,460

DEEP WELL MOTOR PUMP

Filed June 18, 1938 2 Sheets-Sheet 1

Fig. 1.

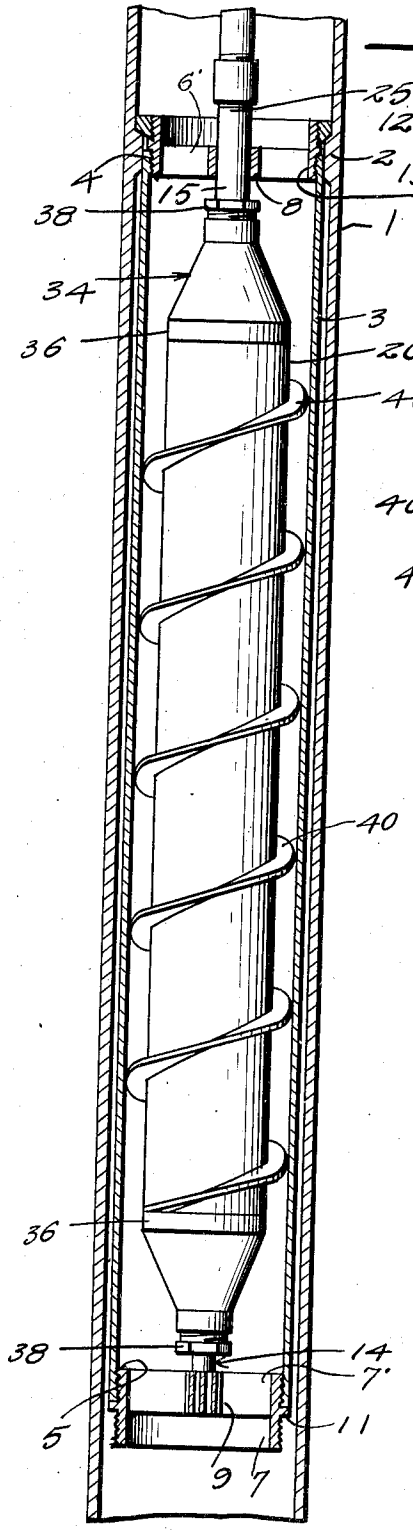


Fig. 5.

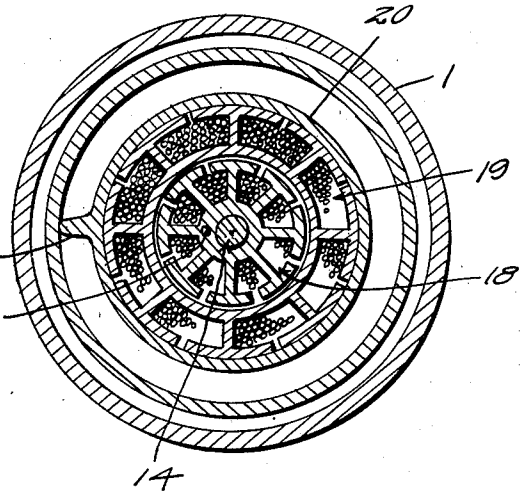
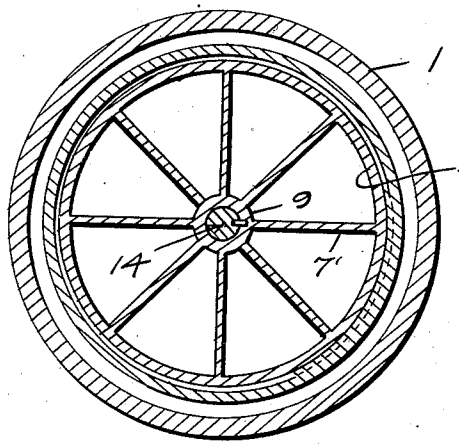


Fig. 6.



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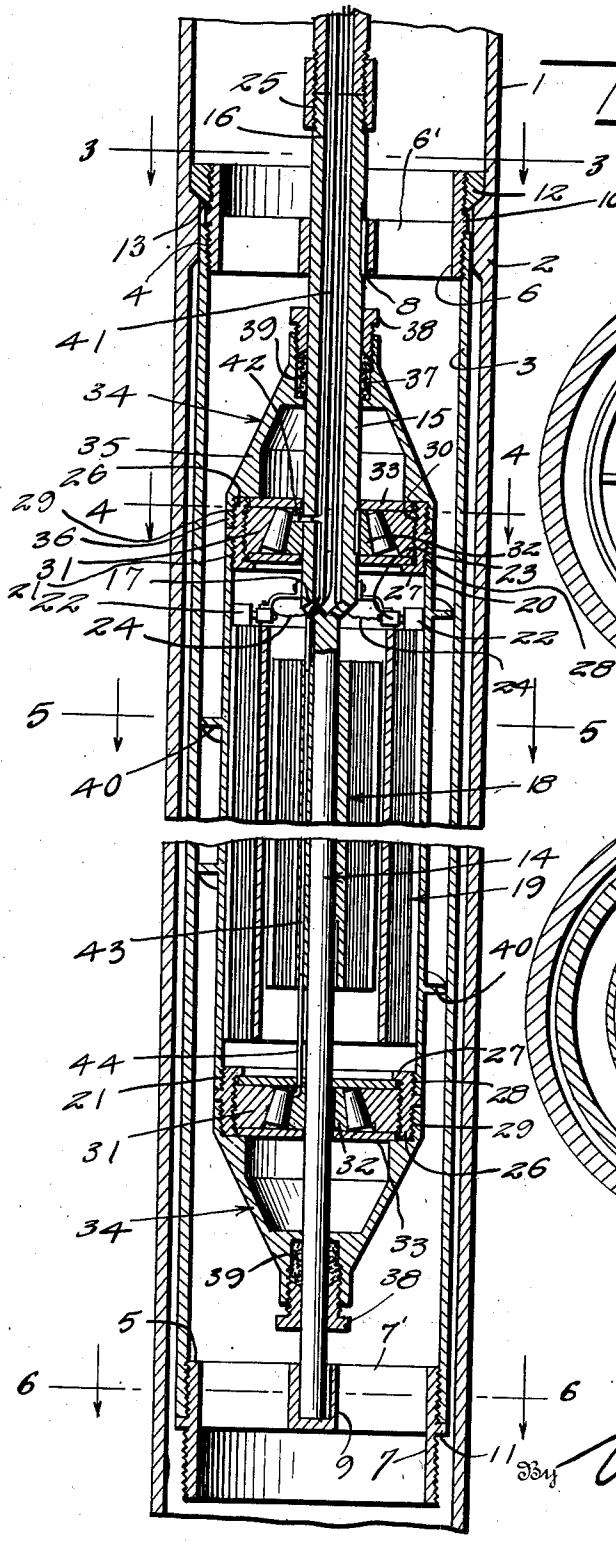


Fig. 2.

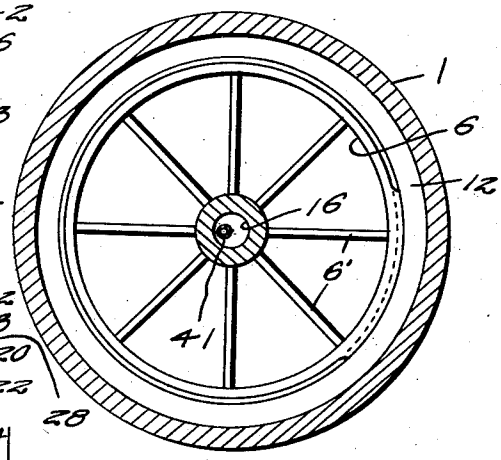


Fig. 3.

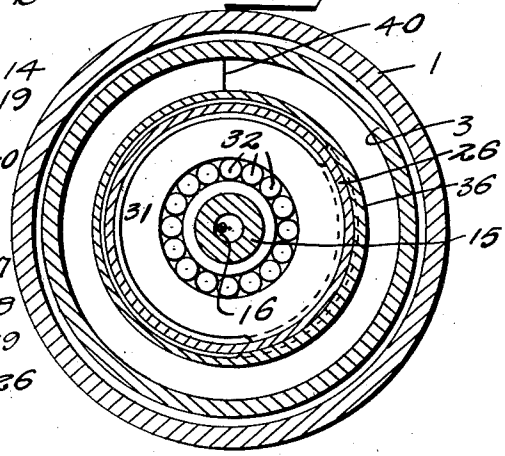


Fig. 4.

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DEEP WELL MOTOR PUMP

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Application June 18, 1938, Serial No. 214,541

4 Claims. (Cl. 103—87)

This invention relates to the class of wells and pertains particularly to improvements in pumping devices for the same.

The present invention has for its primary object to provide an improved pump unit for insertion into deep wells to effect the forced flow of water therefrom, the pump being particularly designed for introduction into a well pipe or casing which serves as the discharge pipe for the pumped fluid.

Another object of the invention is to provide a pumping unit for suspension in a well pipe or casing with novel means for forming a tight joint or connection between the casing of the pump and the well casing so that fluid pumped from the lower part of the well casing through the pump casing will be forced to travel upwardly through the pump casing and cannot seep back between the pump and well casings and thus reduce the efficiency of the pump.

Still another object of the invention is to provide a deep well pump in which the pumping unit comprises a long straight cylindrical body housing and forming a part of a rotor or field unit for a stationary armature of an electric motor and, in addition, provides a carrying means for a spiral or helical blade which operates as a screw to force the fluid upwardly from the lower part of the well in which the pump device is suspended.

Still another object of the invention is to provide in a deep well pump motor a novel means of securing a motor and screw unit centrally within a casing for the motor through which the well fluid is forced by the motor operated screw.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming part of this specification, with the understanding, however, that the invention is not to be confined to any strict conformity with the showing of the drawings but may be changed or modified so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings—

Figure 1 is a view partly in elevation and partly in longitudinal section of the pumping unit, embodying the present invention, showing the same in a well casing.

Figure 2 is a longitudinal sectional view of the entire unit and casing, on an enlarged scale and transversely broken at the central portion.

Figure 3 is a sectional view on the line 3—3 of Figure 2.

Figure 4 is a sectional view on the line 4—4 of Figure 2.

Figure 5 is a sectional view on the line 5—5 of Figure 2.

Figure 6 is a sectional view on the line 6—6 of Figure 2.

Referring now more particularly to the drawings, the numeral 1 generally designates the lower part of a well casing or pipe in which the improved pump and motor unit embodying the present invention is mounted. The mounting for this pump and motor unit is effected through the medium of a circular or an annular shoulder 2 secured within the lower part of the well casing 1 for engagement by an annular part of the pump and motor unit which will be hereinafter specifically described.

The pumping unit embodying the present invention comprises the relatively long cylindrical shell or casing 3 which is of an overall diameter substantially equaling the interior diameter of the well casing shoulder 2 so that the shell or casing 3 may slip through this shoulder to allow the lower end of the pump unit to extend a substantial distance therebeneath.

The shell 3 is provided at its upper and lower ends with interior screw threads 4 and 5 respectively and threaded into the ends of this shell are the upper and lower exteriorly threaded spider rings 6 and 7 respectively, each of which has a series of wide, thin spokes 6′ and 7′ extending radially therein from the hubs 8 and 9. The spokes of the spiders 6 and 7 are arranged with their wide faces vertical so that a minimum of interference will be had therefrom with the passage of fluid therebetween. The spiders 6 and 7 have their threaded exterior surfaces divided by the centrally arranged unthreaded portions 10 and 11, which portions serve to limit the threading of the spiders into the ends of the shell 3.

The upper spider 6 has threaded about its upper end the collar 12 which has an inclined lower edge or shoulder 13 which is designed to seat upon the upper edge of the well casing carried shoulder 2 when the pump casing or shell 3 is lowered into the well. Thus, these two shoulders cooperate to suspend the pumping unit in the well casing at the desired elevation and, in practice, it is preferred that the shoulder 2 be disposed in the well at or just below the level of the water therein.

The numeral 14 designates generally a shaft which has its lower end in and keyed to the hub

9 of the lower spider 7. A portion of this shaft starting at the upper end thereof is of enlarged diameter, as indicated at 15, and has a passage 16 formed longitudinally therethrough and terminating at its lower end in the lateral openings 17. The upper portion of this enlarged part 15 of the shaft extends through and is keyed to the hub 8 of the upper spider 6.

Just below the enlarged portion 15 of the shaft 14 there is mounted on the shaft a slotted or laminated unit 18 which forms the body of and carries the electric windings for the stator or stationary portion of an electric motor. This stator unit 18 extends throughout the length of the major portion of the smaller part of the shaft 14 and is fixed thereto so that it cannot turn. Encircling the stator unit of the motor is a rotor unit 19 which carries the necessary electric wires for the rotor of the motor and which turns about the stator. This rotor unit 19 is inserted into the elongated tubular housing 20 and is fixed to the housing so that the housing will turn with the rotor. This housing 20 is of greater length than the rotor 19 and projects at its ends above and below the ends of the rotor and has the interior surface at each end screw threaded, as indicated at 21. Beneath the threaded upper end of the housing 20 there is fixed to the upper end of the rotor unit the annular commutator 22 which is coupled with the wiring of the rotor unit in the usual manner and the shaft 14 supports in a suitable manner at the lower end of the enlarged portion 15 thereof, the commutator brushes 23 which contact the commutator and which are connected with electric wires 24 which pass therefrom through the openings 17 and into the passage 16 to lead to the top of the well through suitable supporting means connected with the upper end of the shaft 14. Such supporting means may be in the form of a cable joined in a suitable manner with the threaded part 25 of the shaft or a supporting pipe.

In the upper and lower ends of the housing 20, there are secured the rings 26 each of which has an inturned flange 27 at its inner end and is provided with the two groups of screw threads 28 and 29 extending respectively from their inner and outer ends and with the interior screw threads 30 which extend the entire interior length of the ring. The threads 28 at the inner ends of the rings connect with the threads 21 of the housing 20 and threadably secured in each ring is a bearing unit consisting of an outer portion 31 which carries suitable screw threads for engagement with the threads 30 of the adjacent ring and an inner cone portion 32 which encircles and is secured to the shaft 14. The upper bearing unit, of course, encircles the enlarged portion 15 of the shaft 14 but it is secured to the shaft so that the cone portion of the bearing will remain stationary with the shaft while the outer or ring portion 31 may turn thereabout, as hereinafter described. Covering the ends of each bearing are plates 33, the inner ones of which engage the inturned flanges 27 of the encircling rings 26, while the outer ones are maintained in place by conical caps 34, about to be described.

The caps 34 close the upper and lower ends of the housing 20 and each is in the form of a conical body 35 having an interiorly threaded flange 36 about its wider end which threadably engages with the threads 29 of the adjacent ring 26. When the cap bodies 34 are secured in position they will bear against the adjacent outer ones of the pairs of plates 33 and secure these plates in place so that in each bearing unit the portions 31 and 32 will be held in place between the plates 33.

The outer or reduced end of each of the conical caps is provided with a packing receiving cup 37 and threaded in the outer end of each cup is a nut 38 which surrounds the adjacent portion of the shaft and compresses packing material 39 in the cup which prevents leakage of fluid from within the shell or casing 3 to the interior of the housing 20.

Encircling the housing 20 and extending throughout the length of the same is a spiral propeller blade or screw 40, the outer edge or periphery of which works in close proximity to the inner surface of the shell 3.

When the pump is to be placed into service it is lowered by a suitable cable or pipe attached at 25 to the upper end of the shaft 14, into the well casing 1 until the suspension ring 12 comes to rest upon the supporting shoulder 2 in the well casing. As previously stated, the electric wires 24 leading to the parts of the motor pass down the cable and through suitable water tight connections into the tubular upper end 15 of the shaft or if the motor is lowered by a pipe supporting means, then the wires may be run unprotected except for the usual insulation thereon, through the suspension pipe.

In order that the bearing units at the upper and lower ends of the housing 20 may be properly lubricated a suitable small oil tube 41 may be run down through the unit supporting pipe into the tubular upper end 15 of the shaft 14 and connected, as at 42, with the upper bearing. This pipe 41 may be continued down to the upper end of the stator unit 18 and connected with the oil passage 43 formed through this unit. At its lower end this oil passage may be connected with the short tube 44 which will conduct the oil to the lower bearing unit. While one specific means has been shown and described for effecting the oiling or lubrication of the bearings it is to be understood that the invention is not to be limited to this manner of oiling the device but other methods may be employed if found suitable.

From the foregoing it will be readily apparent that when the pumping unit is lowered to the position shown in the lower end of a well casing and electric current supplied to the motor, the housing 20 will be rotated with the rotor unit 19 turning the conical caps 34 at the ends of the casing around the shaft 14 and also turning the spiral blade or screw 40. This will operate the screw to force water or other liquid from the lower part of the well upwardly through the shell 3 and into the upper part of the well casing 1 and continued operation of the screw will establish a continuous flow of liquid through the casing or discharge at the top thereof.

Because of the long straight formation of the rotating part of the device with the screw thereabout the lifting of the water is accomplished smoothly and more efficiently than is the case with pumps in which the water or other fluid must be forced over and around irregular parts of the structure. Therefore, the unit will operate smoother and more efficiently than other devices. In addition, the novel manner of suspending the unit in the well casing insures the passage of all of the fluid from the well, the casing serving as a discharge pipe.

The anti-friction bearing units in the upper and lower ends of the housing **20** are shown with the tapered rollers thereof arranged in an upwardly directed cone. The two bearings are disposed in this manner so that the load will be evenly divided between them when the pump device is used in normal vertical position, as shown in Figure 1. Should it be desired to use this pumping unit in a horizontal position, the lower bearing would be reversed so that the taper of the rollers would be downwardly or opposite to the direction of taper of the rollers of the upper bearing unit.

I claim—

1. A well pumping unit for a well having a tubular casing extending thereinto, comprising a tubular shell extensible into the casing and having a constant interior diameter, means for suspending the shell in the casing, a shaft fixed in and extending centrally longitudinally through said shell, the shaft extending at its upper end bevond the top of the shell, means at the upper end of said shaft for attaching a suspension and lowering element thereto, an electric motor having a central stationary armature encircling said shaft and secured thereto and a rotor enclosing the armature, a casing encircling the rotor and having its ends tapered in toward and having water tight connection with said shaft, bearings in the ends of the casing and encircling the shaft and coupling the casing therewith for suspension thereon, means for supplying current to said motor through the suspension means and through the upper end of the shaft to effect the rotation of the rotor, and a screw encircling said rotor casing and having its periphery in close proximity with the interior of the tubular shell.

2. A well pumping unit for insertion into the tubular casing of a well, comprising a tubular shell adapted for insertion into the casing, a spider member secured in each end of said shell and comprising an exteriorly threaded annulus having a central hub portion and spokes connecting the hub with the annulus, a collar threadably secured about the annulus in the upper end of the shell and adapted to engage a supporting shoulder within the well casing to suspend said shell therein, a shaft extending centrally through the shell and having its ends secured in said hubs, said shaft having a portion of its upper end tubular, a motor armature fixed to the shaft below said tubular portion thereof, a motor field unit encircling the armature for rotation thereabout, a casing having said field unit secured therein and having its ends extended beyond the ends of the field unit, said last casing being interiorly threaded at both ends, a bearing unit threadably secured in each end of said last casing and having an outer ring portion and an inner portion, said inner portion being fixed to the shaft, a conical cap encircling said shaft at each end of the field unit casing, each of said caps having one end threadably secured to the adjacent bearing unit, packing means in the other end of each cap and encircling the shaft, electric current conducting wires extending through the tubular portion of said shaft into the armature casing for connection with the armature, and a helical blade encircling and extending throughout the length of said armature casing and having its periphery in close proximity to the interior wall of said shell.

3. A pumping unit for a well having a tubular casing extending thereinto, comprising a shell of elongated tubular form adapted to be inserted into the casing, said shell being open at its ends, means forming a pair of shaft supporting members upon the axial center of the shell, a shaft extending longitudinally through the shell and connected with and held therein by said members, said shaft having an upper end portion of tubular form and apertures leading laterally from the interior of the tubular portion to the exterior of the shaft, means at the upper end of said shaft for attaching a tubular suspension element thereto, an electric motor having an armature surrounding and fixed to the shaft below the tubular portion thereof and a field unit encircling the armature, a casing of elongated tubular form having said field unit inserted thereinto whereby the casing and field unit may turn around the armature, a cap for the upper end of said casing encircling the tubular portion of the shaft, a cap for the lower end of the casing and encircling the lower end of the shaft, bearing units between and coupling the caps with the adjacent ends of the casing, the bearings being in encircling relation with the shaft facilitating the turning of the casing about the shaft, a helical screw formed about the exterior of the casing, and electric current conducting means extending through the tubular portion of the shaft from said tubular suspension means and into said casing through said lateral openings for connection with the elements of the motor.

4. A pumping unit for a well having a tubular casing extending thereinto, comprising a shell of elongated tubular form adapted to be inserted into the casing, the shell being open at its two ends, means facilitating suspension of the shell within the casing, a spider unit secured within the shell at each end, one of said units having a central bearing socket and the other and upper unit having a tubular bearing, the tubular bearing and bearing socket being axially alined upon the axial center of the shell, a shaft extending longitudinally through the shell and having one end supported in the bearing socket, the other end of the shaft passing through the tubular bearing, means for facilitating the attachment of a suspension element to the said other end of the shaft, said shaft at the said other end thereof being tubular throughout a portion of its length, the tubular portion terminating at its inner end in laterally directed apertures leading to the exterior of the shaft, an electric motor having an armature surrounding and secured to the shaft below said apertures and a field unit encircling the armature, an elongated tubular casing having said field unit secured therein whereby the casing and unit may turn around the armature, an interiorly flanged ring in each end of the casing and projecting from the same, a cone-like cap for each end of the casing encircling and secured to the projecting end of a ring, the shaft extending through the tapered portion of the casing and having a water-tight connection therewith, and a bearing unit within and engaging against the flange of each ring and including two concentrically disposed portions encircling the shaft, the inner portion being secured to the shaft to turn therewith, the outer portion being secured to the ring to turn therewith, electric current conductors extending through the tubular portion of the shaft and through said apertures for connection with the armature of the motor, and a helical screw formed about the exterior of the casing.

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