June 16, 1931. J. A. WINTROATH 1,810,332

MEANS FOR APPLYING TENSION ON SHAFT INCLOSING TUBING

Filed Aug. 30, 1926 2 Sheets-Sheet 1

Fig. 1.

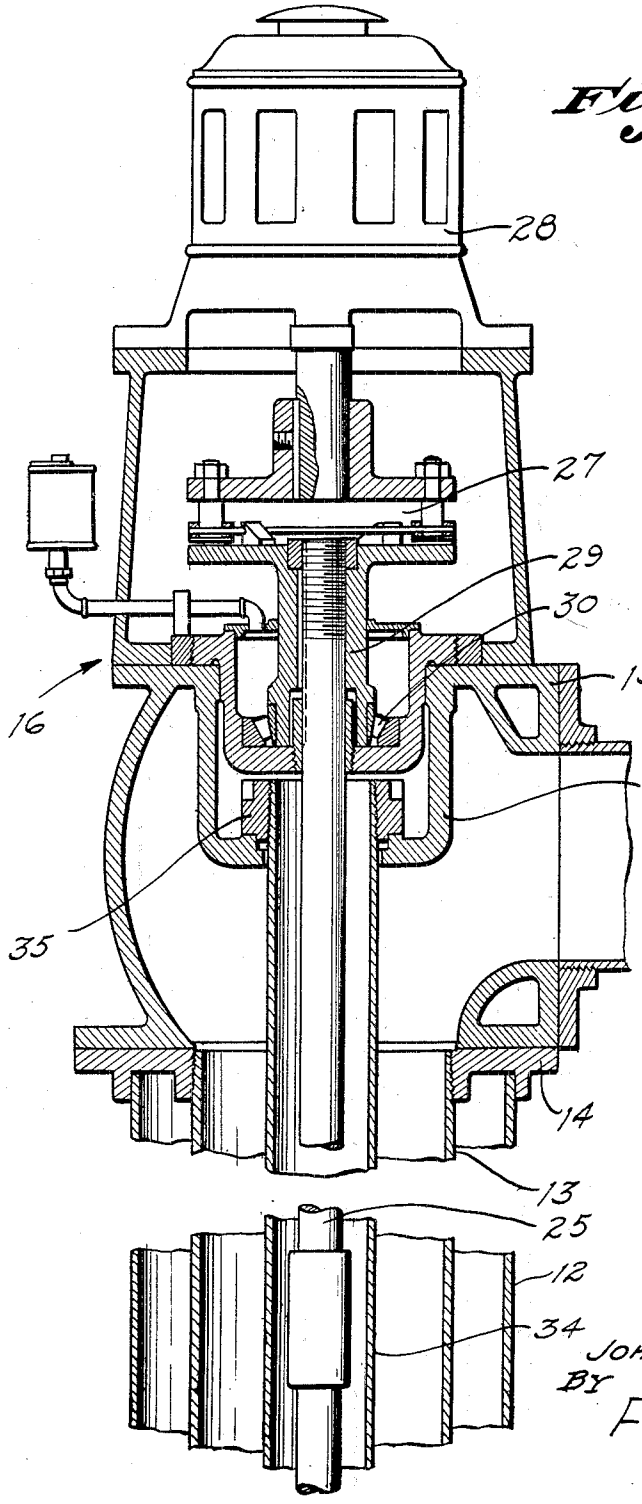
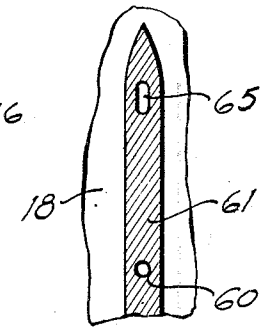


Fig. 4.



INVENTOR:
JOHN A. WINTROATH,
BY
Ford W. Harris
ATTORNEY.

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Fig. 2.

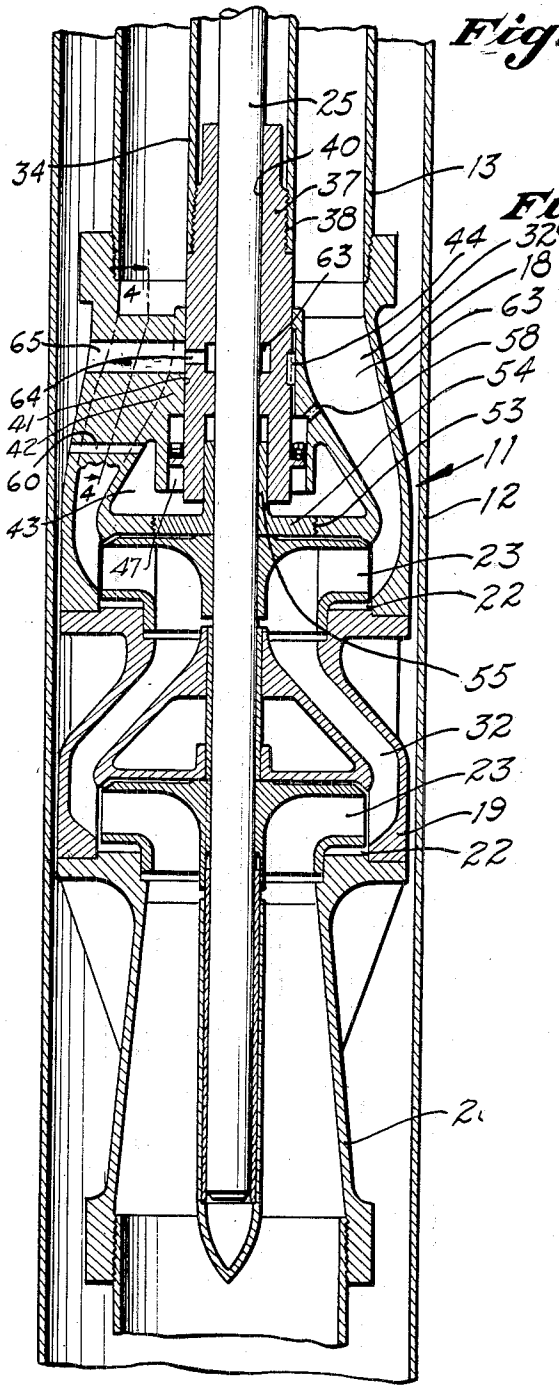


Fig 5.

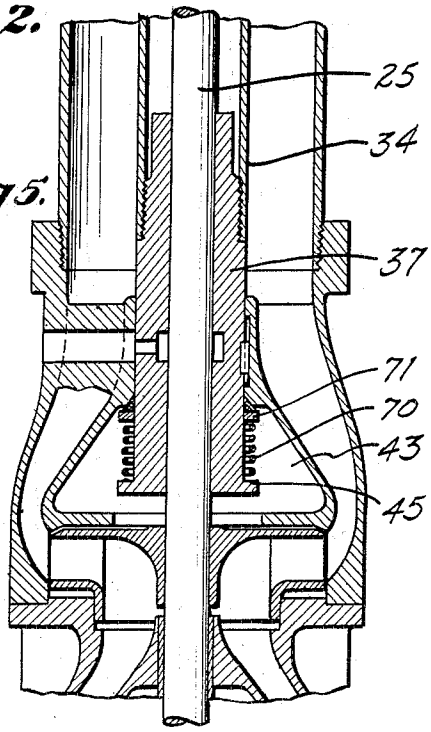
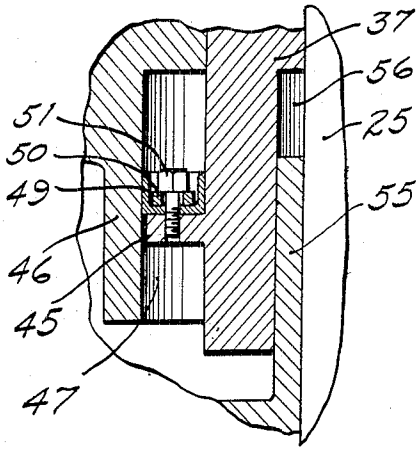


Fig. 3.



INVENTOR:
JOHN A. WINTROATH.,
BY Ford W. Harris
ATTORNEY.

Patented June 16, 1931 1,810,332

UNITED STATES PATENT OFFICE

JOHN A. WINTROATH, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO PEERLESS PUMP COMPANY, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA

MEANS FOR APPLYING TENSION ON SHAFT INCLOSING TUBING

Application filed August 30, 1926. Serial No. 132,387.

My invention relates to those types of turbine pumps having a pump head situated at the top of a well which is adapted to drive a pump section placed near the bottom of a well, the pump section being operated by means of a pump shaft which is connected to the pump section and the pump head. Surrounding the pump shaft is a shaft tubing carrying bearings for journaling the pump shaft. The lower end of the shaft tubing in the ordinary pump is rigidly connected to the upper end of the pump section and the upper end thereof extends into the pump head and has a nut screwed thereon, by means of which tension may be applied to the shaft tubing. The shaft tubing must be under proper tension so that it will be kept straight in order to properly support the pump shaft. The tension is applied to the shaft tubing by screwing the nut onto the upper end thereof. It is practically impossible to determine the amount of tension which is applied to the shaft in this manner and it frequently occurs that not enough tension is placed on the shaft tubing; consequently the pump shaft is not properly supported. The pump shaft will therefore be crooked and excessively strained. The amount of tension which should be placed on the shaft tubing varies according to the length of the pump. Pump installations of the character to which my invention relates vary from twenty to five hundred feet in length. It should be readily apparent that in the present means of applying tension to the shaft tubing there is no way of determining the amount of tension to which the shaft tubing is subjected. Furthermore, the tension on the shaft tubing will vary with temperature changes. Consequently if the proper amount of tension should be placed on the pump shaft at one temperature when the temperature changes, the tension will change proportionately.

It is an object of this invention to provide a pump of the character mentioned in which the shaft tubing will be automatically subjected to the proper tension.

Other objects and advantages of my invention will be apparent in the following description which is taken in connection with the drawings.

Referring to the drawings,

Fig. 1 is a vertical section of the upper end of a pump.

Fig. 2 is a vertical section of the lower end of the pump.

Fig. 3 is an enlarged fragmentary detail of the automatic tension applying means of the invention.

Fig. 4 is a section taken on the line 4—4 of Fig. 2.

Fig. 5 is a fragmentary section showing an alternative form of my invention.

Referring particularly to Figs. 1 and 2, 11 is a pump section which is situated near the lower end of a well in which a well casing 12 is placed. The pump section 11 is secured to the lower end of a column pipe 13 which extends upward to the surface of the ground where it is secured to a flange 14 of a body 15 of a pump head 16. In the drawings the pump section 11 is shown as comprising an upper casting 18, an intermediate casting 19 and a lower casting 20. All pump sections include upper and lower castings 18 and 20 and may include one or more intermediate castings 19 according to the depth of the pump and the amount of water which it is to pump. The castings 18 and 19 provide impeller chambers 22 in which impellers 23 are adapted to rotate. The impellers 23 are secured to a pump shaft 25 which extends upward through the column pipe 13, terminating at a point above the surface of the ground. The upper end of the pump shaft 25 extends through the pump head body 15 and has a flexible coupling 27 attached to the upper end thereof by means of which it is driven by a motor 28. The flexible coupling 27 is formed integral with a sleeve 29 which is supported by a thrust bearing 30 carried by the pump head 16. The thrust bearing 30 supports the weight of the pump shaft 25. When the pump shaft is set into operation by means of the motor 28 the impellers 23 are rotated and water is drawn from the well through the bottom member 20 and is forced through passages 32 of the sections 18 and 19 into the interior of the column pipe 13 by

means of which the water is conducted to the surface of the ground.

Surrounding the pump shaft 25 is a shaft tubing 34. The upper end of the shaft tubing 34 is threaded and a nut 35 is screwed thereonto. The nut 35 is supported by a cup-shaped portion 36 of the body 15. The lower end of the shaft tubing 34 has a plunger 37 threadedly secured thereto as indicated at 38. The plunger 37 has an opening 40 formed therethrough through which the pump shaft 25 extends and which serves as a bearing therefor. The lower end of the plunger 37 extends through an opening 41 formed in a core 42 of the upper casting 18. The bottom end of the plunger 37 extends into a chamber 43 provided by the core 42. The plunger 37 is locked from rotation by a key 44 which is shown in Fig. 2. Extending from the body of the plunger 37, as shown best in Fig. 3, is an annular flange 45. The core 42 has a downward extending cylindrical extension 46 which provides a cylindrical cavity 47 in which the annular flange 45 rests. Secured to the upper face of the flange 45 is a cup leather 49. The cup leather 49 is held in place by a metallic ring 50, the metallic ring 50 being secured in place by cap screws 51. The lower wall of the core 42, which lower wall forms the upper wall of the adjacent impeller chamber 22, is provided with a threaded opening 53 through which the plunger 37 may be installed in place. The opening 53 is closed by a nut 54 which has a tubular extension 55 which surrounds the pump shaft 25, this tubular extension 55 engaging the pump shaft 25 and serving as a journal therefor. The upper part of the tubular extension rests in an annular space 56 formed at the lower end of the plunger 37. There is a space, however, above the upper end of the tubular extension 55 in the space 56 so as to permit an axial movement of said tubular extension in said space 56.

The upper part of the cylindrical cavity 47, as shown best in Fig. 2, is connected by an opening 58 with the passage 32 of the upper casting 18. When the pump is in operation fluid may enter the upper part of the cylindrical cavity 47 and the pressure thereof will be exerted in a downward direction against the annular flange 45 of the plunger 37. The magnitude of this pressure depends upon the area of cross section of that portion of the cylindrical cavity 47 which surrounds the plunger 37; therefore, it will be seen that this pressure may be varied by changing the area of cross section of that portion of the cylindrical cavity 47 which surrounds the plunger 37, it being understood that the other parts must be correspondingly altered.

In view of the fact that some liquid will probably leak around the cup leather 49, I provide the upper casting 18 with an opening 60. This opening 60 is formed in a vane 61 which is connected to the core 42 and a shell 63 of the upper casting 18. This opening 60 connects the chamber 43 with the exterior of the pump section 11. This provides an exit and prevents a pressure from being built up in the chamber 43; therefore, there will be no danger of a pressure being built up which will offset the pressure above the flange 45, and thus place the plunger in a state of equilibrium which would result in no tension on the shaft tubing 34. The plunger 37 is provided with an annular cavity 63 which is connected by an opening 64 to a passage 65 formed in the vane 61 and which connects to the exterior of the pump section 11. This arrangement is provided to allow the escape of any liquid which would pass into the opening 40 of the plunger 37.

From the foregoing description it will be readily seen that my invention provides a hydraulic means for automatically placing a tension on the shaft tubing 34. This tension will be uniform at all times regardless of temperatures or any other extraneities. In my invention it is possible to accurately control the amount of tension which is placed on the shaft tubing 34. This is done by providing the cylindrical cavity 47 with a proper area of cross section. In short pumps where the tension required for the shaft tubing is small, the area of cross section of the cylindrical cavity 47 may also be small, and deep pumps where the tension must be greater the area of cross section of the cavity 47 may be greater.

In Fig. 5 I show an alternative form of my invention. In this form of the invention the plunger 37 is provided with the annular flange 45, the lower end of the plunger resting in the chamber 43. The difference in the two forms is as follows. The form now being described is not provided with a cylindrical cavity 47 and the plunger 37 is not provided with the cup leather 49 and the parts for securing it in place. Instead of this construction a coil spring 70 is provided which is compressed between the flange 45 and an upper ring 71 which surrounds the plunger 37 and engages an upper wall of the core 42. The spring places a resilient pressure on the flange 45 and thus places the shaft tubing 34 under tension. This form of the invention is mechanical whereas the first form of the invention is hydraulic. It should be noted, however, that both forms of the invention are automatic.

I claim as my invention:

1. In a pump the combination of: a pump head; a pump section suitably supported in a well; an impeller in said pump section; a pump shaft operatively connecting said pump head and said impeller; a shaft tubing surrounding said pump shaft; means for holding the upper end of said shaft tubing; and a

plunger attached to the lower end of said shaft tubing, said plunger being slidable in a chamber of said pump section, one face of said plunger communicating with a fluid passage of said pump section and the other face of said plunger communicating with the exterior of said pump section.

2. In a pump the combination of: a pump head; a pump section suitably supported in a well; an impeller in said pump section; a pump shaft operatively connecting said pump head and said impeller; a shaft tubing surrounding said pump shaft; means at said pump head for holding the upper end of said shaft tubing; means at said pump section for placing a tension on said shaft tubing; and means engaging said pump section for preventing the rotation of said shaft tubing relative to said pump section.

3. In a pump the combination of: a pump head; a pump section suitably supported in a well; an impeller in said pump section; a pump shaft operatively connecting said pump head and said impeller; a shaft tubing surrounding said pump shaft and supported by said pump head; a plunger secured to the lower end of said shaft tubing; walls forming a cylindrical cavity in which said plunger slides; walls forming a passage communicating between one face of said plunger and a fluid passage of said pump section; and walls forming a passage communicating between the other face of said plunger and the exterior of said pump section.

4. In a pump the combination of: a pump head; a pump section suitably supported in a well; an impeller in said pump section; a pump shaft operatively connecting said pump head and said impeller; a shaft tubing surrounding said pump shaft; a nut threaded to the upper end of said shaft tubing, said nut engaging a portion of said pump head; a plunger secured to the lower end of said shaft tubing; an annular flange on said plunger; walls forming a cylindrical cavity in which said flange slides; walls forming a passage communicating between one face of said flange and a fluid passage of said pump section; and walls forming a passage communicating between the other face of said flange and the exterior of said pump section.

5. In a pump the combination of: a pump head; a pump section suitably supported in a well; an impeller in said pump section; a pump shaft operatively connecting said pump head and said impeller; a shaft tubing surrounding said pump shaft; means for holding the upper end of said shaft tubing; and a plunger attached to the lower end of said shaft tubing, said plunger forming a bearing for said shaft and being actuated by fluid pressure in said pump to exert a downward force on said shaft tubing.

6. In a pump, the combination of: a pump section; a column pipe supporting said pump section; a shaft tubing secured in stationary relationship with said column pipe at one end thereof; and means operated by the fluid being pumped for pulling said shaft tubing relative to said column pipe.

7. In a pump, the combination of: a pump head; a pump shaft extending downward from said pump head; a shaft tubing surrounding said shaft and supported at its upper end; a bearing attached to the lower end of said shaft tubing; and means for exerting a downward force on said bearing, said bearing transmitting said downward force to said shaft tubing.

8. In a deep well pump, the combination of: a pump head; a pump section including a chamber in the upper end thereof; means for supporting said pump section in a well; an impeller in said pump section; a shaft operatively connecting said pump head and said impeller; a shaft tubing around said shaft, the upper end thereof being secured to said pump head; a plunger attached to the lower end of said shaft tubing and extending into said chamber; and means for exerting a resilient downward pressure on said plunger in said chamber to tension said shaft tubing.

9. In a deep well pump, the combination of: a pump head; a pump section positioned in a well; means for supporting said pump section in said well; an impeller in said pump section; a pump shaft operatively connecting said pump head and said impeller; a shaft tubing surrounding said shaft; means for holding one end of said shaft tubing; and means controlled by the pressure of the fluid pumped by said impeller for axially moving the other end of said shaft tubing to place a tension thereon.

10. In a deep well pump, the combination of: a pump head; a pump section positioned in a well; means for supporting said pump section in said well; an impeller in said pump section; a pump shaft operatively connecting said pump head and said impeller; a shaft tubing surrounding said shaft; means at said pump head for retaining the upper end of said shaft tubing; and fluid-actuated means cooperating between said pump section and the lower end of said shaft tubing for drawing downward on said shaft tubing relative to said pump section with a pressure proportional to the pressure of the fluid being pumped.

11. In a deep well pump, the combination of: a pump section supported in a well and defining a vertical opening and a cylindrical cavity; a shaft extending downward into said pump section; a shaft tubing supported at its upper end and extending downward in said well; a plunger secured to the lower end of said shaft tubing and slidable in said vertical opening; an annular flange on said plunger and slidable in said cylindrical cavity; and means operated by a rotation of said shaft for

forcing fluid into said cylindrical cavity for drawing downward on said plunger whereby a tension is placed in said shaft tubing.

12. In a deep well turbine pump, the combination of: a pump head; a pump section positioned in a well; means for supporting said pump section in said well; an impeller in said pump section; a pump shaft operatively connecting said pump head and said impeller; a shaft tubing surrounding said shaft; means at said pump head for retaining one end of said shaft tubing; and a plunger means connected to the lower end of said shaft tubing and slidable in a chamber of said pump section, there being a passage communicating between said chamber and the fluid pumped by said impeller.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 23 day of August, 1926.

JOHN A. WINTROATH.