M. E. LAYNE AND S. N. HALL.

WELL MECHANISM.

APPLICATION FILED SEPT. 8, 1920.

1,415,585.

Patented May 9, 1922.

2 SHEETS—SHEET 1.

FIG. 1.

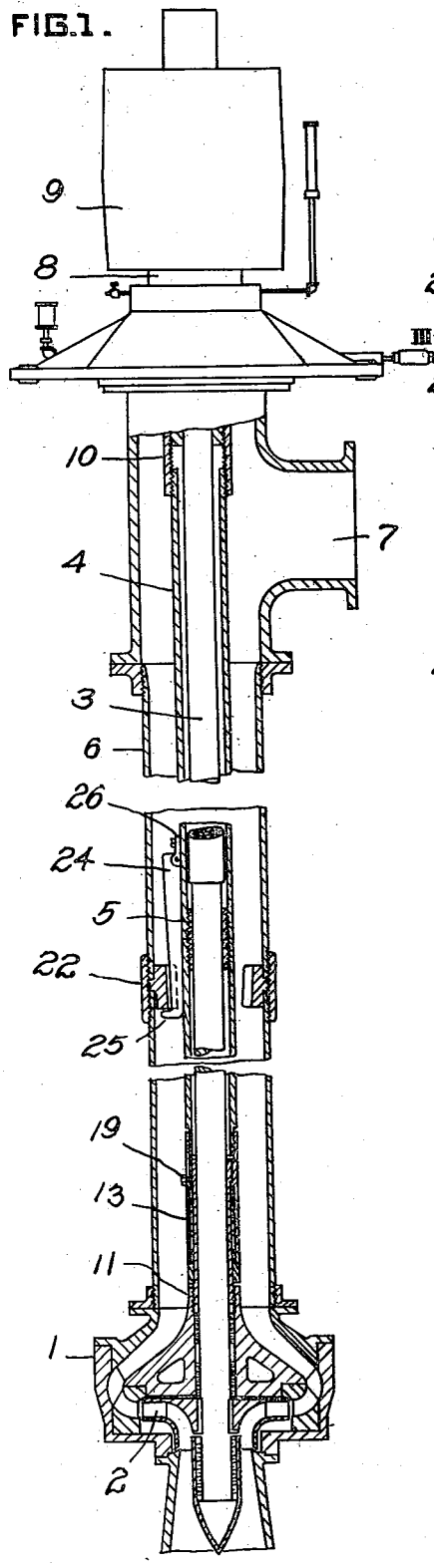


FIG. 2.

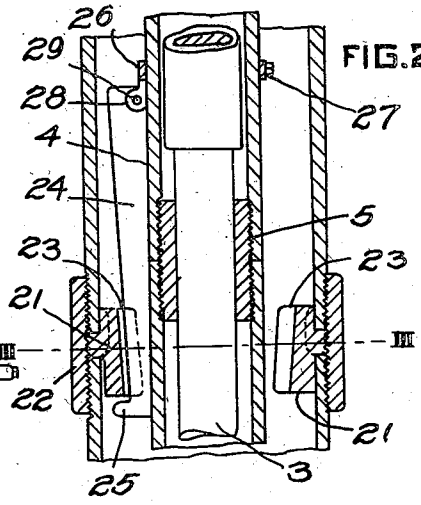


FIG. 3.

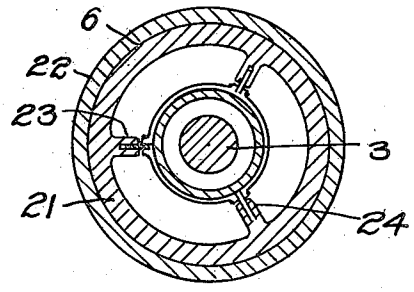
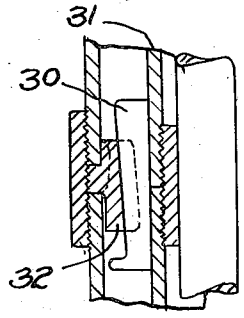


FIG. 2a.



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2 SHEETS—SHEET 2.

FIG.4.

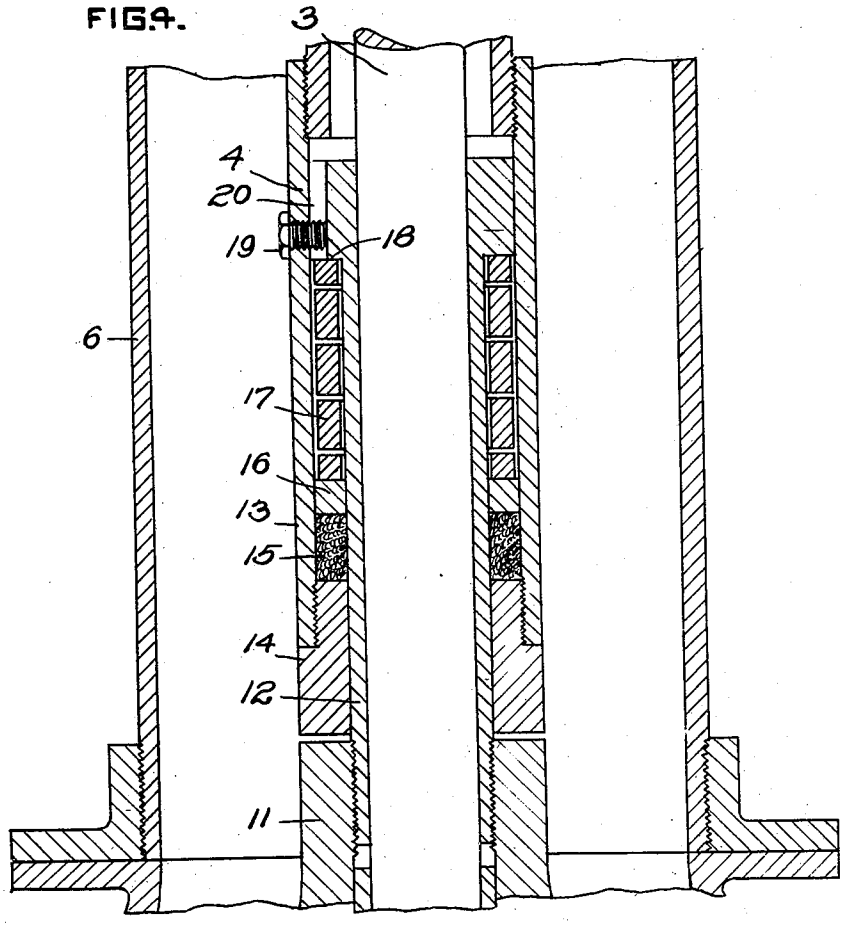
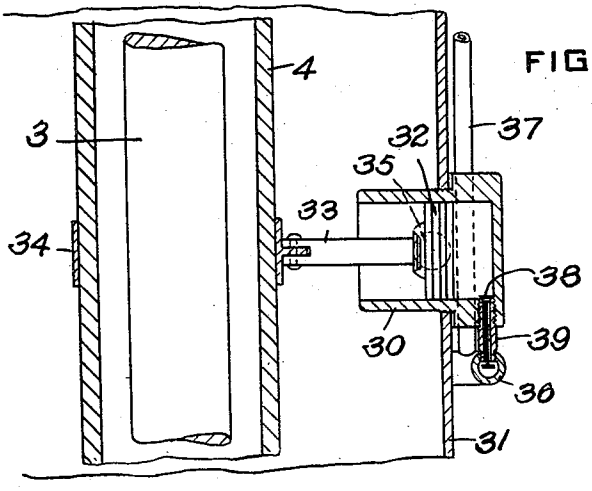


FIG.5.



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WELL MECHANISM.

1,415,585. Specification of Letters Patent. Patented May 9, 1922.

Application filed September 8, 1920. Serial No. 408,941.

To all whom it may concern:

Be it known that we, MAHLON E. LAYNE and SAMUEL N. HALL, both citizens of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Well Mechanism, of which the following is a specification.

The invention relates to well mechanism, and particularly to centrifugal pump mechanism involving the use of a pump placed in or adjacent the water of the well and transmission and discharge mechanism extending to the surface of the ground and comprising a vertical operating shaft surrounded by a protecting and bearing supporting casing, and a discharge casing surrounding the shaft casing. The invention has for its primary object the provision of a means for constantly maintaining the shaft casing under tension in order to prevent such casing getting out of alignment and causing its bearings to bind upon the drive shaft; and the provision of adjustable spaced means for supporting the shaft casing from the discharge casing to hold it against vibration, and so arranged that the holding means will automatically set themselves so that the shaft casing may be left straight regardless of any lack of trueness or straightness in the bore of the well and the discharge casing.

It often happens that the well bore is not straight and as a result, the discharge casing is correspondingly bent out of true. In such case, if the shaft casing is held concentric with the discharge casing by the usual spider or other bracing means, such shaft casing is bent out of true in correspondence with the shaft casing, thus causing the bearings in the shaft casing to bind upon the shaft and resulting in large losses of power and undue wearing of the bearings. Briefly stated, this difficulty is overcome in the present invention by the provision of automatically adjustable bracing means, taking the place of the spiders heretofore used, and permitting the shaft casing to assume a right line position regardless of whether it is concentric with the discharge casing or not. Certain embodiments of the invention are illustrated in the accompanying drawings wherein—

Figure 1 is an assembled sectional view of a pump embodying the invention. Fig. 2 is an enlarged vertical section at one of the bracing devices between the discharge and shaft casings. Fig. 2ª is a partial section through a modification. Fig. 3 is a section taken on the line III—III of Fig. 2. Fig. 4 is an enlarged vertical section just above the pump neck. And Fig. 5 is an enlarged vertical section showing modified form of bracing device.

Referring first to the general arrangement of Fig. 1 which illustrates an assembled pump embodying the invention hereinafter described, the principal parts may be enumerated as follows: 1 is the pump casing of a one stage pump in which are mounted the impellers 2 secured to the drive shaft 3; 4 is the shaft casing carrying the series of spaced bearings 5; 6 is the discharge casing secured to the pump casing and extending to the surface of the ground and having the lateral discharge outlet 7; 8 is a thrust bearing for supporting the weight of the shaft 3; and 9 is the belt pulley by means of which the drive shaft is operated.

It is desirable that the shaft casing 4 should be maintained under tension and supporting a portion of the weight of the pump in order to maintain it straight so that there is no bending tending to cramp the bearings 5 with respect to the shaft, and this result has heretofore been provided for by screwing up the connection 10 at the upper end of the shaft casing so that the weight of the pump is divided between the shaft casing and the discharge casing. This insures that the shaft casing will be under tension and straight when the pump is installed, but in the course of time the strain upon the shaft casing tends to loosen such casing at its threaded connections so that the shaft casing no longer sustains a part of the weight of the pump, the weight at such time being practically entirely taken by the discharge casing 6. This gives an opportunity for the shaft casing to buckle slightly and the feature now described is designed to overcome this difficulty and maintain the shaft constantly under tension. This is accomplished by the provision of a spring located at the bottom end of the shaft casing and arranged so that the spring pressure downward is constantly applied to the shaft casing.

The manner in which this is accomplished will be seen by reference to Fig. 4. As here illustrated the pump neck 11 is coupled to 11′

the lower end of the shaft casing 4 by means of a telescopic joint including the inner sleeve member 12 and the outer sleeve member 13. The sleeve member 13 carries at its lower end a collar 14 above which is placed the packing 15, the ring 16 and the relatively powerful coil spring 17. The upper end of the coil spring bears against a shoulder 18 carried by the inner sleeve member 12. In order to prevent the unscrewing of the sleeve 13 a stud bolt 19 is provided in the sleeve 13, such stud bolt having its inner end in engagement with slot 20 in the inner sleeve 19. In this manner tension is constantly applied to the shaft casing so that even after an extended period of use the shaft casing is maintained under tension. The extent of this tension may be adjusted from the collar 10 (Fig. 1) at the upper end of the shaft casing.

In order to brace the shaft casing from the discharge casing and provide for the automatic positioning of such bracing means the device shown in Figs. 2 and 3 is employed. Only one of these devices is shown in Fig. 1, but it will be understood that in the ordinary pump installation which may involve locating the pump anywhere from fifty feet to several hundred feet below the surface of the ground, a number of these devices will be employed and it will also be understood that the number of sections of shaft, shaft casing, and discharge casing as illustrated in Fig. 1, may be multiplied to meet conditions, the drawing showing, for convenience of illustration, a minimum number of such sections. As shown in Figs. 2 and 3, the bracing device comprises the ring member 21 secured to the coupling 22 and provided with a series of vertical guide ways 23 (Fig. 3) spaced in equal intervals around the ring. Mounted in these guide ways 23 are the wedges 24, such wedges being provided at their lower ends with the stop members 25 for use as hereinafter described. When not in use the wedges are supported from a ring 26 which may be secured to the shaft casing by means of the bolts 27. This ring is provided with a plurality of depended perforated lugs 28 and the perforated lugs are provided with wood pins 29 extending through perforations in the wedges, the purpose being to provide for a temporary support of the wedges.

In order to release the wedges so as to permit them to assume an operative position, the shaft casing 4 is moved upward at the connection 10, this being possible because of the slip connection heretofore described at the lower end of the shaft casing. This upward movement is continued until the stop members 25 on the wedges 24 engage the lower sides of the ring 21, after which the further upward movement of the shaft casing causes the wooden pins 24 to be sheared off, permitting the wedges 24 to drop to operative position, and it will be seen that, even though the shaft casing is not concentric with respect to the discharge casing, it will be locked or braced in the position which it occupied before the application of the wedges. This is important as in many cases the discharge casing is not perfectly straight and it would be undesirable to have the shaft casing correspond to this irregularity as this would cramp the bearings in the shaft casing with respect to the shaft. The arrangement, therefore, permits the shaft casing to remain perfectly true regardless of irregularities in the shaft casing and at the same time such shaft casing is securely braced from the discharge casing against lateral vibration incident to the use of the drive shaft revolving at a high rate of speed and transmitting a large amount of power. The importance of the expedient, of course, increases with the depth at which the pump is installed, as under such conditions the liability of irregularity in the bore of the well increases and the tendency of the drive shaft to whip or vibrate also increases.

The construction illustrated in Figs. 2 and 3 shows only one of a large number of possible embodiments involving the application of a bracing means which may be automatically adjusted to fit a condition in which it is not desirable to maintain the shaft casing concentric with the discharge casing throughout its length. Fig. 5, for instance, illustrates one means. In this construction the centering and bracing is accomplished by means of a series of preferably three cylinders 30 spaced around the circumference of the discharge casing 31 and provided with the pistons 32 carrying the piston rods 33. The ends of these piston rods are pivotally connected to a ring 34 mounted upon the shaft casing. The rear end of the piston rods have a ball and socket connection 35 with the pistons 32 so that the parts may adjust themselves in case the axis of the cylinder 30 does not come exactly in line with the center line of the ring 34. Pressure is applied behind the pistons 32 by means of a pipe 36 connected with a source of fluid pressure by means of the pipe 37 running upward to the surface of the ground. A check valve 38 is located in a connection 39 so that after fluid pressure has been applied any backward movement of the piston, aside from that due to leakage, is prevented. The fluid used is preferably oil and pressure is applied after the casings have been positioned in the well, the result being that the bracing device, comprising the three pistons at each elevation, automatically adjusts itself, the shaft casing being securely held, but without the application of any pressure tending to deform it or to cause it to conform itself to irregularities in the discharge

casing. It will be noted that this method of applying the bracing device does not require any movement of the shaft casing as is the case with the construction of Figs. 2 and 3, but on the other hand is somewhat more expensive.

Fig. 2a illustrates a modification in which the wedges 30 are made to assume their proper bracing positions by working the shaft casing 31 up and down. The wedges are mounted in guides 32 similar to those of Fig. 2.

What we claim is:

1. In combination in well mechanism, a pump, a discharge casing extending upwardly from the pump, a power transmission shaft extending upward from the pump, a shaft casing surrounding the shaft and provided with a series of spaced bearings for the shaft, and spring means constantly applying tension to said shaft casing.

2. In combination in well mechanism, a pump, a discharge casing extending upwardly from the pump, a power transmission shaft extending upward from the pump, a shaft casing surrounding the shaft and provided with a series of spaced bearings for the shaft, and spring means constantly applying tension to said shaft casing, and located adjacent the lower end of such casing.

3. In combination in well mechanism, a pump, a discharge casing extending upwardly from the pump, a power transmission shaft extending upward from the pump, a shaft casing surrounding the shaft and provided with a series of spaced bearings for the shaft, a slip joint between the pump and shaft casing, and spring means constantly applying pressure downward upon said shaft casing and tending to hold it straight.

4. In combination in well mechanism, a pump, a discharge casing extending upwardly from the pump, a power transmission shaft extending upward from the pump, a shaft casing surrounding the shaft and provided with a series of spaced bearings for the shaft, and a series of adjustable bracing means arranged at intervals along the length of the shaft casing and adapted to adjust themselves to varying positions and secure the shaft casing against lateral movement after such adjustment.

5. In combination in well mechanism, a pump, a discharge casing extending upwardly from the pump, a power transmission shaft extending upward from the pump, a shaft casing surrounding the shaft and provided with a series of spaced bearings for the shaft, wedge bracing devices between the casings and carried by the shaft casing, means for holding said devices in inoperative position, and means operable by the vertical movement of the casing for releasing said means and permitting the wedges to move to operative position at which time the shaft casing is held against lateral movement.

6. In combination in well mechanism, a pump, a discharge casing extending upwardly from the pump, a power transmission shaft extending upward from the pump, a shaft casing surrounding the shaft and provided with a series of spaced bearings for the shaft, and adjustable bracing means between the discharge and shaft casings operable after the casings are assembled.

7. In combination in well mechanism, a pump, a discharge casing extending upwardly from the pump, a power transmission shaft extending upward from the pump, a shaft casing surrounding the shaft and provided with a series of spaced bearings for the shaft, and unyielding self adjusting bracing means between the discharge and shaft casings.

8. In combination in well mechanism, a pump, a discharge casing extending upwardly from the pump, a power transmission shaft extending upward from the pump, a shaft casing surrounding the shaft and provided with a series of spaced bearings for the shaft, and unyielding self adjusting bracing means between the discharge and shaft casings, operable after the casings are assembled.

9. In combination in well mechanism, a pump, a discharge casing extending upwardly from the pump, a power transmission shaft extending upward from the pump, a shaft casing surrounding the shaft and provided with a series of spaced bearings for the shaft, and self adjusting bracing means between the discharge and shaft casings, operable from the surface of the ground after the casings are assembled.

10. In combination in well mechanism, a pump, a discharge casing extending upwardly from the pump, a power transmission shaft extending upwardly from the pump, a shaft casing surrounding the shaft and provided with a series of spaced bearings for the shaft, means for applying tension to the shaft casing, and a series of adjustable bracing means arranged at intervals along the length of the shaft casing and adapted to adjust themselves to varying positions and secure the shaft casing against lateral movement after such adjustment, and after tension has been applied to the shaft casing.

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