Dec. 27, 1927. 1,654,329

J. B. HAWLEY, JR

WELL PUMPING APPARATUS

Filed Jan. 17, 1924 3 Sheets-Sheet 1

Fig. 1.

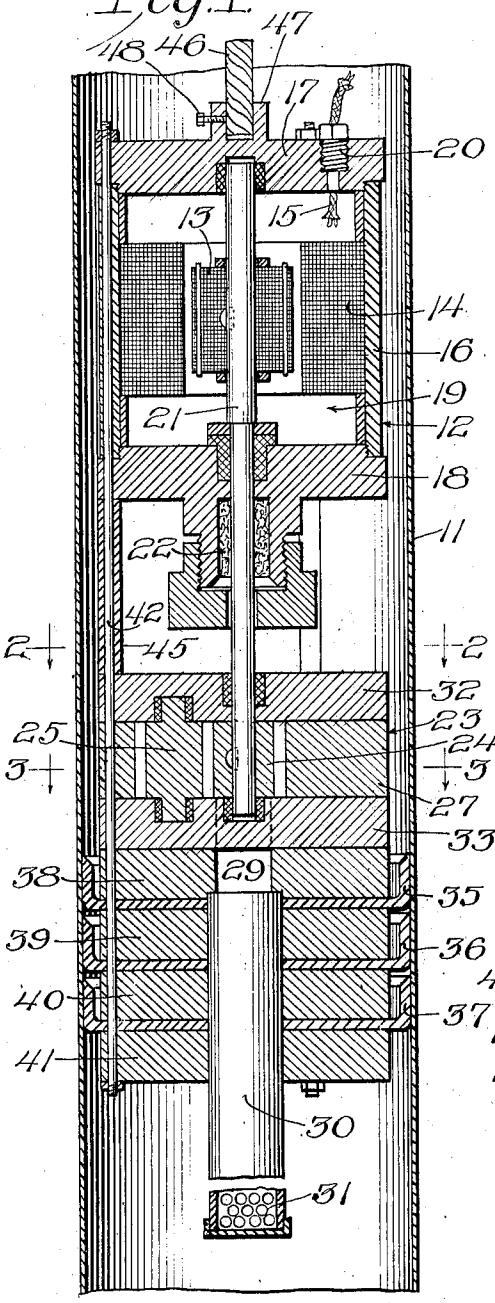


Fig. 2.

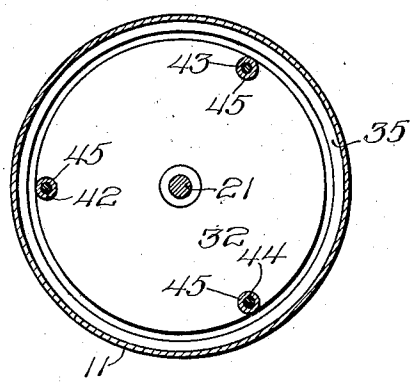
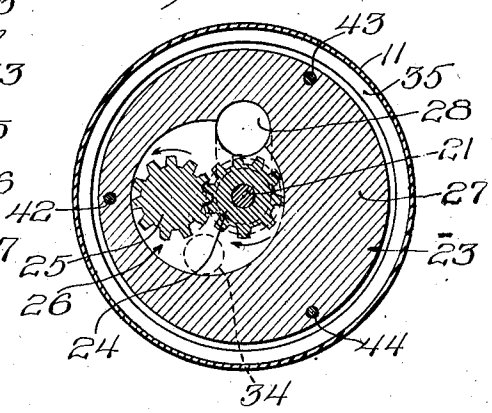


Fig. 3.



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Filed Jan. 17, 1924 3 Sheets-Sheet 2

Fig. 4.

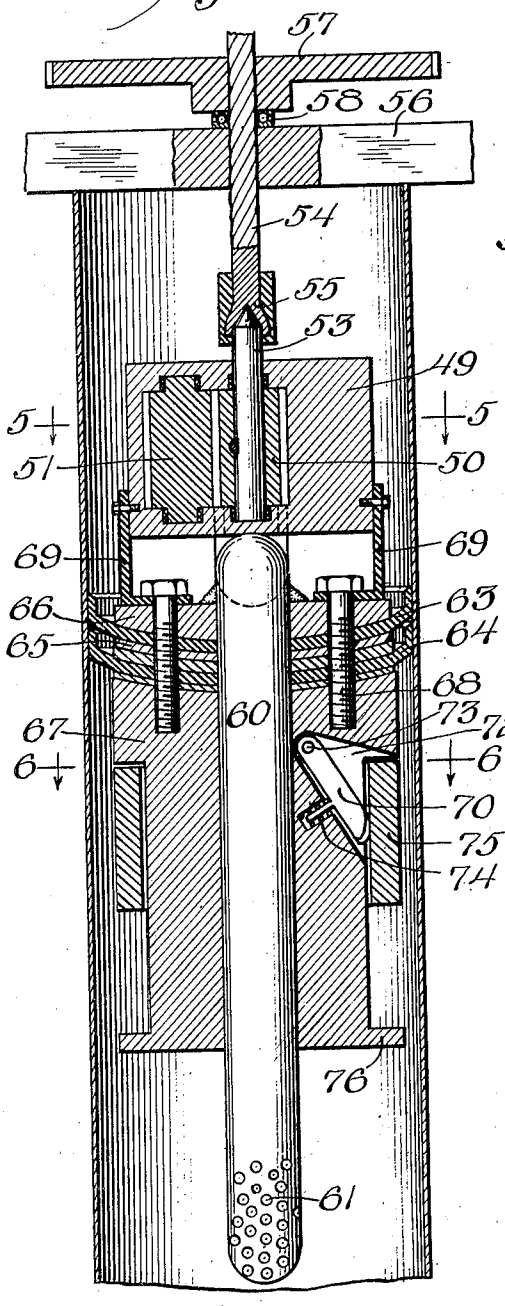


Fig. 5.

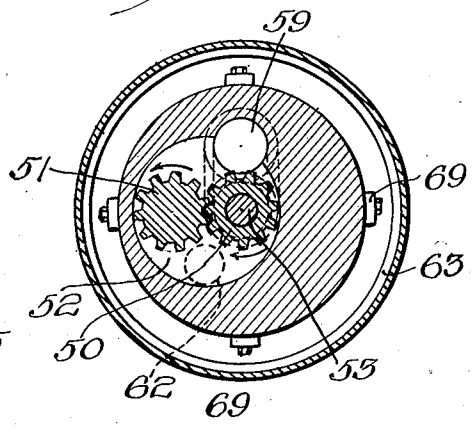
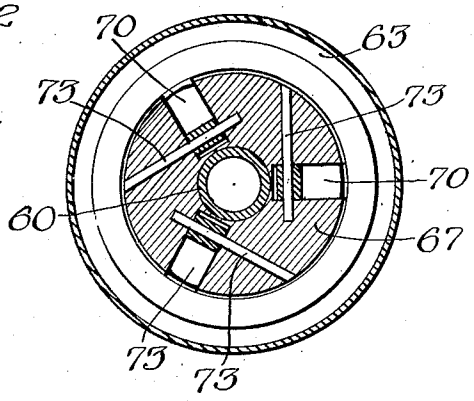


Fig. 6.



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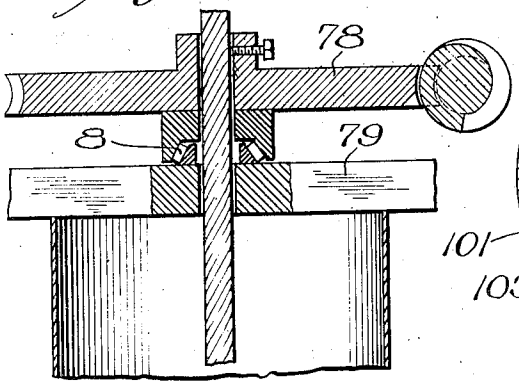
Dec. 27, 1927. 1,654,329

J. B. HAWLEY, JR

WELL PUMPING APPARATUS

Filed Jan. 17, 1924 3 Sheets-Sheet 3

Fig. 7.



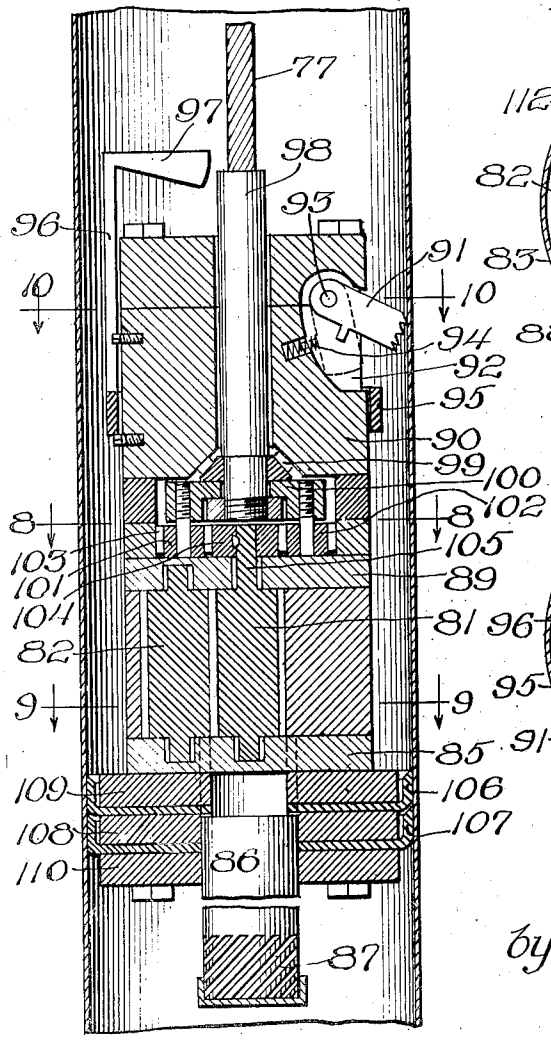


Fig. 8.

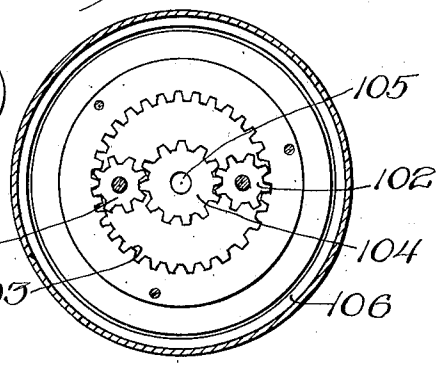


Fig. 9.

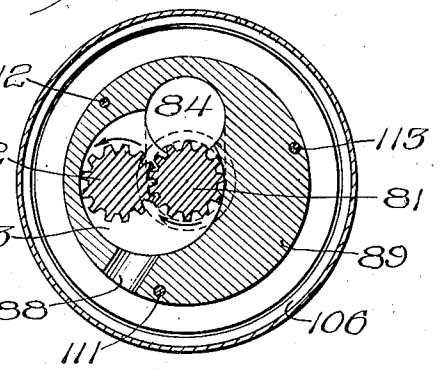
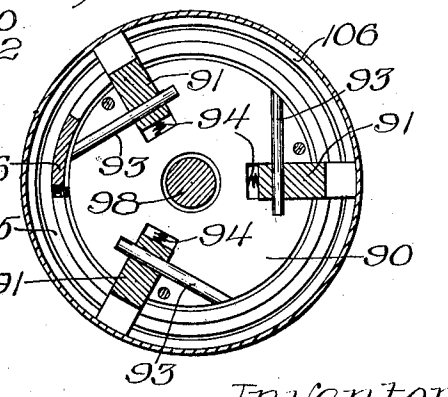


Fig. 10.



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UNITED STATES PATENT OFFICE.

JOHN B. HAWLEY, JR., OF FORT WORTH, TEXAS, ASSIGNOR TO HAWLEY INVENTIONS, INC., A CORPORATION OF DELAWARE.

WELL-PUMPING APPARATUS.

Application filed January 17, 1924. Serial No. 686,710.

The present invention has to do with improvements in well pumping apparatus. More particularly the invention has to do with improvements in apparatus for pumping oil and similar liquids from tubular wells.

The invention has reference to a pumping unit which is so constructed that it can be lowered to the proper point in the well and there secured in place in such a manner that it can thereafter proceed with its normal function of pumping the oil up through the well above.

Still more particularly the invention has to do with a self-contained pumping unit which is provided with a transverse partition which serves, when the pumping unit is in place within the well, to establish a more or less oil tight partition at the position of the pumping unit, the parts being moreover so arranged that the oil is drawn or pumped through this partition and delivered above the same, so that when the well casing above the partition has been completely filled with oil, the latter will be discharged from the top of the well continuously thereafter.

It is an object of the invention to provide a unit of the general class just above referred to which is furthermore so constructed that when it is lowered into position within the well casing, it will automatically lock itself to the well casing so as to be held rigidly against rotation or vertical displacement. It is nevertheless an object in this connection to provide an arrangement such that the pumping unit may be raised out of the well when necessary for replacement or repair.

It is a further object of the invention to make satisfactory provision for transmitting the necessary driving power down through the well to the pumping unit. A preferred arrangement is that in which the pumping unit itself is provided with an electric motor which drives the pump within the pumping unit. In this case the power is delivered from above by the use of an electric cable reaching down through the upper portion of the well. In this case the weight of the pumping unit and the column of oil sustained above it may be readily supported by a supplemental cable of steel or the like, and there is no rotative tendency on the part of the pumping unit. In such case the provision of means for locking the pumping unit at a given point within the well casing may be eliminated with satisfactory results.

I also contemplate the delivery of the necessary driving force to the pumping unit through the medium of a cable which is rotated by properly applied power at its upper end. Such cable when used may also serve the function of sustaining all or a portion of the weight of the pumping unit, but suitable means should be provided at the pumping unit itself for resisting the rotative tendency due to the rotation of the cable.

Other objects and uses of the invention will appear from a detailed description of the same, which consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings:

Figure 1 shows a longitudinal section through an electricaliy driven pumping unit embodying the features of the present invention;

Fig. 2 shows a transverse section on the line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 shows a transverse section on the line 3—3 of Fig. 1, looking in the direction of the arrows;

Fig. 4 shows a longitudinal section through another form of pumping unit which is driven by a rotative cable. In the construction of Fig. 4 the transverse partition is placed above the position of the locking dogs;

Fig. 5 shows a transverse section on the line 5—5 of Fig. 4, looking in the direction of the arrows;

Fig. 6 shows a transverse section on the line 6—6 of Fig. 4, looking in the direction of the arrows;

Fig. 7 shows a longitudinal section of another form of pumping unit which is also driven by the use of a rotative cable, but in this case the transverse partition is placed below the position of the locking dogs;

Fig. 8 shows a transverse section on the line 8—8 of Fig. 7, looking in the direction of the arrows;

Fig. 9 shows a transverse section on the line 9—9 of Fig. 7, looking in the direction of the arrows; and

Fig. 10 shows a transverse section on the line 10—10 of Fig. 7, looking in the direction of the arrows.

Referring first to the construction shown

in Figs. 1, 2 and 3, the well casing is designated by the numeral 11. In this construction the pumping unit includes an electric motor 12, preferably placed at the upper end of the pumping unit. This motor includes the armature 13 and field 14 which are supplied with electric current through the cable 15. The detailed construction of this motor is not illustrated nor referred to, since, manifestly, many different forms of motor, either direct or alternating current, may be used.

The motor is preferably mounted within an oil tight casing including the cylindrical member 16, the upper head 17, and the base block 18. These parts are preferably brought together in oil tight fashion, so that if desired the interior chamber 19 of the motor itself may be packed with a suitable lubricating and insulating oil. When the motor is of the alternating current type, the presence of this oil will in no wise interfere with a satisfactory operation thereof, and in many cases the commutator and brushes of a direct current motor will also operate with entire satisfaction within an oil bath. The electric cable 15 preferably passes through a stuffing box 20 at the point where it enters the motor unit so as to prevent the transfer of oil at this point.

The armature 13 drives the vertical shaft 21 whose upper end finds a bearing in the head 17, and whose lower end passes out through the base block 18 through a suitable stuffing box 22. This stuffing box will serve to effectively prevent interchange of oil along the motor shaft.

Beneath the motor unit is a pumping unit designated in its entirety by the numeral 23. The same is illustrated as comprising a gear pump having the central gear 24 meshing with a companion gear 25, both of said gears working within the pumping chamber 26 in the pump block 27. This chamber 26 receives oil from below through an inlet port 28 which in turn communicates with a transverse passage 29 beneath the gear pump itself. Such transverse passage 29 receives oil rising through a central tube 30, the lower end of which reaches below the pumping unit and preferably carries a strainer or screen 31 at its inlet end.

The pumping unit is closed at its upper side by a cap block 32, and also includes a base block 33 at its lower side. The port 28 is formed in the base block, and there is formed a discharge port in the cap block 32, said discharge port being designated by the dotted circle 34 in Fig. 3. The oil is discharged through said port upwardly above the pumping unit and rises through the well past the motor unit which is of smaller size than the well.

The central gear 24 of the pumping unit preferably lies directly below the motor shaft 21 with which it is conveniently connected by a direct drive.

Beneath the pumping unit there is established a transverse partition which extends across the well casing and serves to effectively prevent a return flow of the oil delivered above the pumping unit. This partition includes a series of upwardly facing cup leathers 35, 36 and 37 together with the intermediate spacer blocks 38, 39 and 40 and the base block 41. All of these blocks are conveniently drawn together in rigid fashion by a series of through bolts 42, 43 and 44, as clearly illustrated.

The through bolts above referred to also serve to join the motor and pumping units together, suitable spacer blocks 45 being placed on the through bolts and between the two units. When this construction is used the through bolts may also be carried clear up through the motor unit so as to draw its head and base blocks solidly into engagement with the shell 16. The oil delivered from the pumping unit finds its way freely between the spacer blocks 45 and thence up past the motor unit.

Owing to the considerable weight of the combined motor and pumping unit together with the column of oil above the same, I prefer to provide a cable 46 by which it may be sustained from the upper end of the well casing. This cable is conveniently connected into a collar 47 on the cap block 17 by the use of a set screw or the like 48.

In connection with this construction it will be noted that by initially filling the motor chamber 19 with suitable insulating and lubricating oil the hydrostatic pressure due to the column of oil standing above the partition is substantially balanced and only a very slight seepage can take place into the pumping unit past the stuffing box 22. This is an important feature when it is considered that in many cases these pumping units are used in very deep shafts, in some cases more than 2300 feet, so that the hydrostatic pressure exceeds 1000 pounds per square inch.

Referring to the construction illustrated in Figs. 4, 5 and 6, the pumping element 49 comprises a gear pump having the central gear 50 and the companion gear 51 working within a chamber 52. The central gear 50 is mounted on a drive shaft 53 which passes up through the head of the pumping element and is connected to the suspending cable 54 by a suitable coupling 55. This suspending cable reaches down through the well from the head thereof where it passes up through a supporting block 56 and is then connected to a drive gear 57. A suitable ball bearing 58 supports the drive gear above the block 56.

The oil is delivered to the gear pump through an inlet port 59 which reaches sidewise and connects with a central downward-

ly reaching tube 60. The lower end of the tube 60 is provided with suitable inlet openings and screens 61. The oil discharged from the gear pump rises through a port in the upper end of the pumping element and designated by the numeral 62.

By rotating the gear 57 and the supporting cable, the gear pump is driven. This creates a considerable rotative tendency in the casing of the gear pump and the same must be effectively resisted as otherwise the whole unit will turn around with the rotation of the cable.

Beneath the gear pump is placed a transverse partition which extends clear across the well casing and includes the cup leathers 63 and 64 separated by a spacer block 65. A cap block 66 is placed above the cup leather 63 and a base block 67 below the cup leather 64. A series of through bolts 68 serve to draw these parts rigidly together.

A series of lugs or other separating connectors 69 are placed between the pumping element 49 and the cap block 66.

A series of dogs 70, preferably three in number, are pivotally mounted within sockets 72 in the base member 67. These pivotal mountings are provided by pins 73. A spring 74 normally tends to project each dog into the working position wherein it lies at a slight angle below the horizontal, and wherein its outer locking edges engage firmly with the well casing. A collar 75 is initially placed around the dog 70 before the pumping unit is lowered into the well, and said collar is sustained against ordinary shock by the friction of the dogs against it. When the working position of the pumping unit is reached within the well, a violent shock is produced and the collar 75 is thus thrown down and releases the dogs. Ordinarily, the collar will fall upon and be sustained by a flange 76 at the lower end of the base block 67 so as to prevent said collar from dropping to the bottom of the well.

In the construction shown in Figs. 7, 8, 9 and 10, the pumping unit is also sustained and driven by a cable 77 whose upper end is secured to the driving gear 78. This driving gear is placed above the cross block 79 at the upper end of the well and may freely rotate by reason of the presence of the roller bearing 80.

In the present construction the pumping element includes a central gear 81 together with a companion gear 82 working within the chamber 83. The oil is drawn through an inlet port 84 in the base block 85, reaching said inlet port from an inlet pipe 86 having the screen 87 at its lower end. The oil is discharged from the pumping unit through a port 88 which leads sidewise through the cap block 89 of the pumping element.

Above the pumping element is placed a dog block 90 having the dogs 91 pivoted within the sockets 92 on the pivot pins 93. The springs 94 tend to project the dogs into the outer working position when they are released.

In order to hold the dogs within their sockets while the pumping unit is being lowered into the well a collar 95 is provided around the dog block 90. Said collar 95 has a downwardly reaching stem 96 at the upper end of which is the inwardly reaching arm 97 which can be struck by a body dropped down the well after the pumping unit is at the proper position.

The drive shaft 98 reaches through the dog block 90 and is driven and supported by the cable 77. This drive shaft also sustains the weight of the pumping unit and the superimposed column of oil through the medium of a roller bearing 99. A flange 100 on the lower end of the shaft 98 transmits the force to the roller bearing. This flange also carries a pair of drive pinions 101 and 102 which mesh with a stationary annular gear 103 which surrounds them. They also mesh with a pinion 104 on the upper end of the shaft 105 which reaches upwardly from the central gear 81 of the pumping element.

The transverse partition is established by a pair of cup leathers 106 and 107 together with an intermediate spacer block 108 and the cap and base blocks 109 and 110 respectively. A series of through bolts 111, 112 and 113 reach upwardly through the entire dimensions of the pumping unit and serves to secure all of the parts properly together.

While I have herein shown and described only certain embodiments in the features of my present invention, still I do not limit myself to the same except as I may do so in the claims.

I claim:

1. A well pumping unit comprising in combination a motor element and a pumping element in vertical alignment and of size suitable for convenient introduction into the well casing, a spacing means between said pump and motor elements, a transverse partition below said pumping element and having a passage for the flow of fluid to said pumping element, rods passing through said transverse partition, pumping element, spacing means, and said motor element, and means holding said rods in place whereby all of said elements are secured together as a unit.

2. In a well pumping apparatus, a pumping element of a size suitable for convenient introduction into a well casing, a transverse partition below said pumping element and insertable therewith into said well casing, said transverse partition comprising a plurality of apertured partition blocks and a plurality of apertured gaskets therebetween, and means for clamping said spacing blocks

and gaskets together and for securing said partition in fixed relation to said pumping element.

3. In a well pumping apparatus, a pumping element of a size suitable for convenient introduction into a well casing, a transverse partition below said pumping element and insertable therewith into the well casing, said partition comprising a plurality of spacing blocks and a plurality of gaskets therebetween having upwardly directed annular flanges, and means for clamping said blocks and gaskets together and for securing said partition in fixed relation to said pumping element.

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