July 26, 1927. 1,637,078

F. F. HILL

LONG STROKE PUMPING MECHANISM

Filed Aug. 3. 1925 2 Sheets-Sheet 1

Fig. 1.

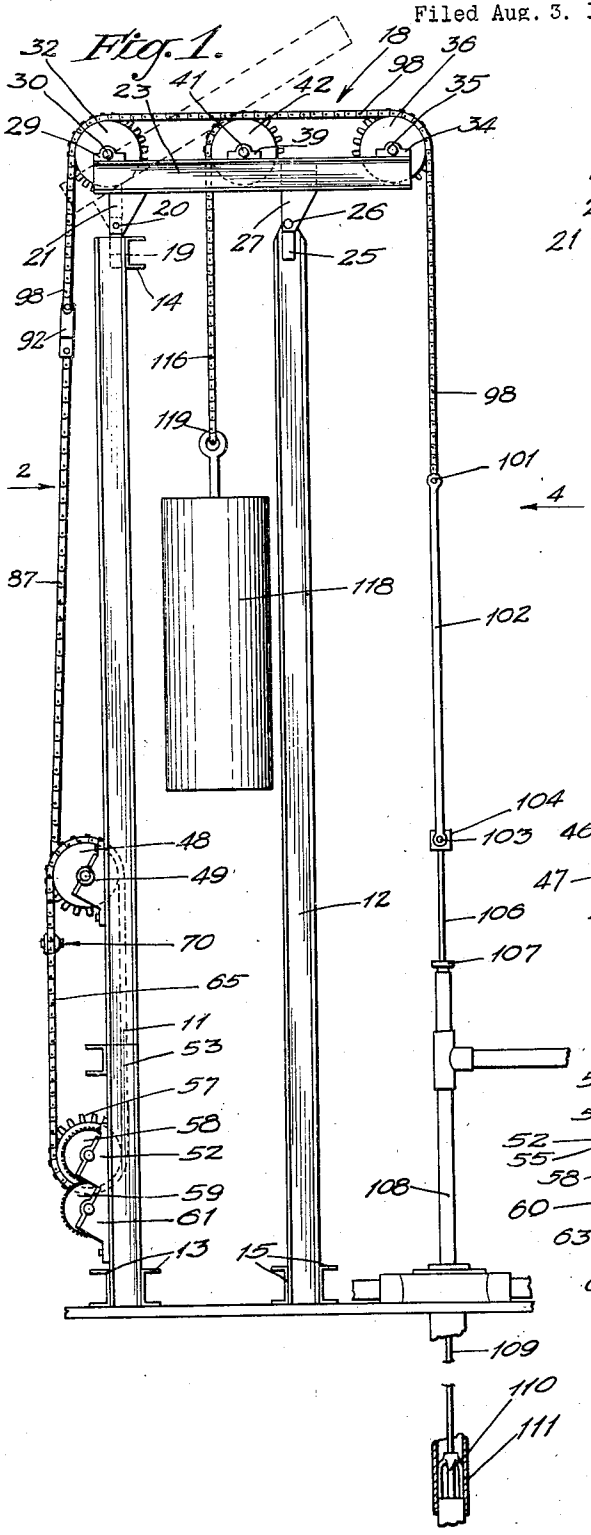
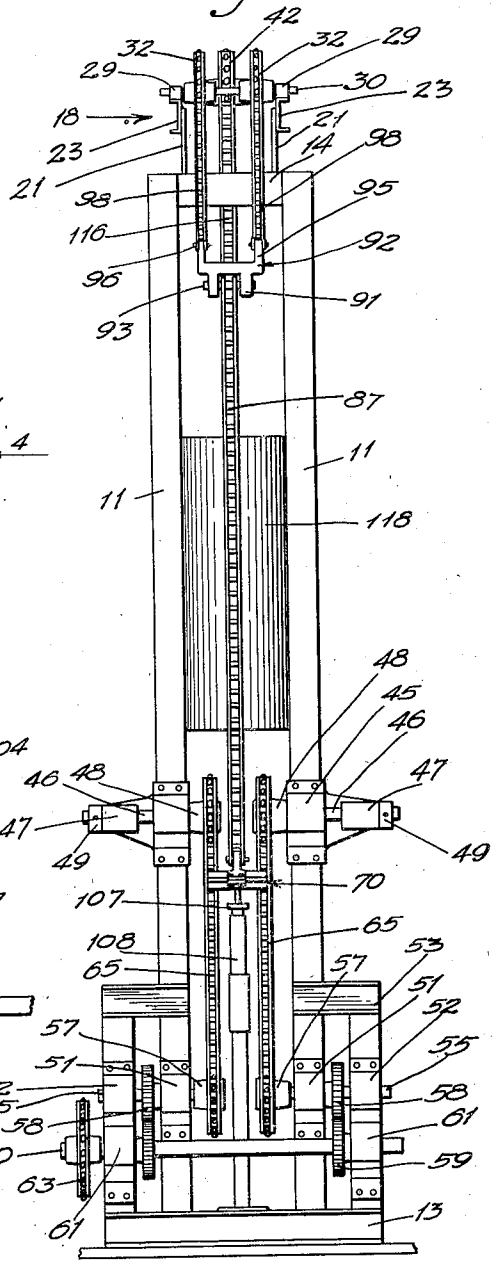


Fig. 2.



INVENTOR:
FRANK F. HILL,
BY
Fad W. Lamb
ATTORNEY.

July 26, 1927. 1,637,078

F. F. HILL

LONG STROKE PUMPING MECHANISM

Filed Aug. 3. 1925 2 Sheets-Sheet 2

Fig. 3.

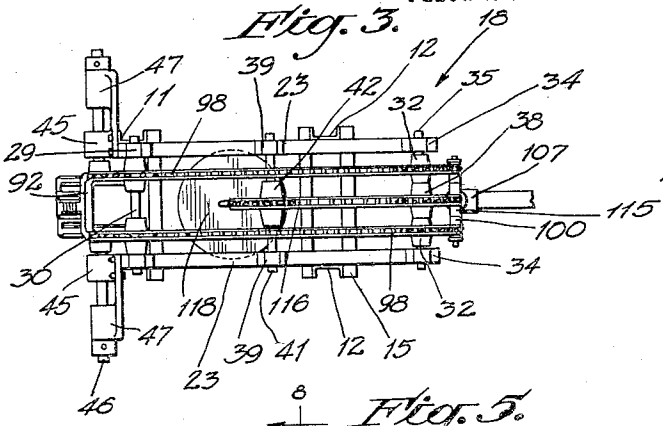


Fig. 4.

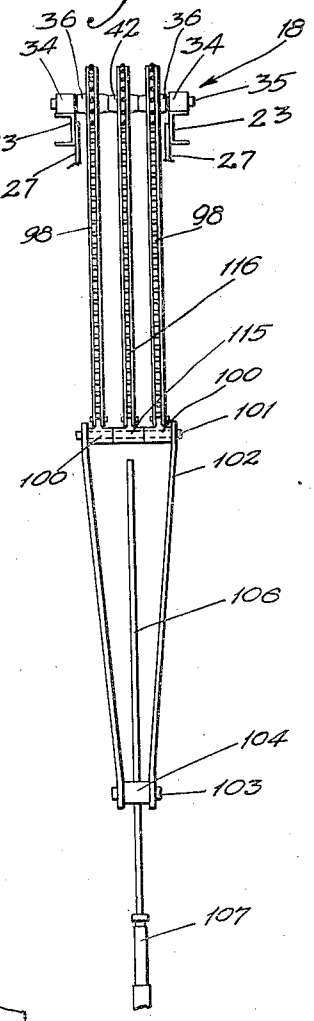


Fig. 5.

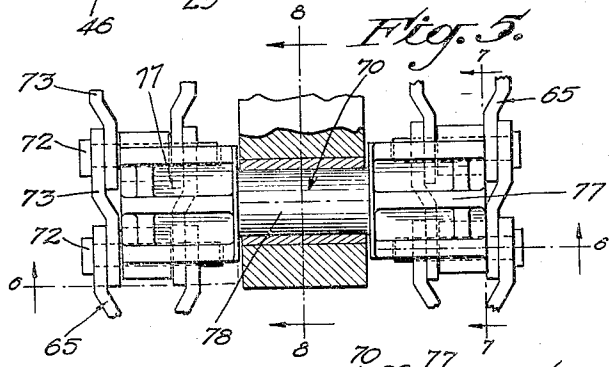


Fig. 6.

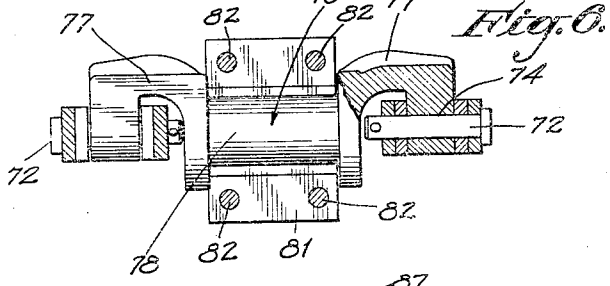


Fig. 8.

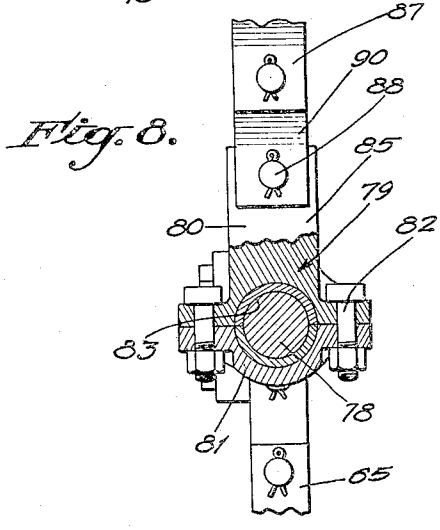
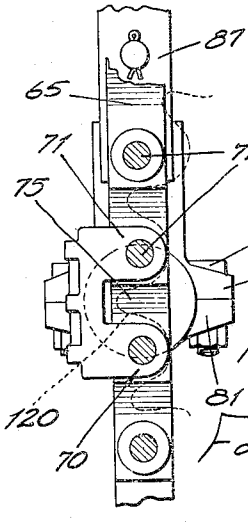


Fig. 7.



INVENTOR:
FRANK F. HILL,
By
Ford Wilmie
ATTORNEY.

Patented July 26, 1927. 1,637,078

UNITED STATES PATENT OFFICE.

FRANK F. HILL, OF LOS ANGELES, CALIFORNIA.

LONG-STROKE PUMPING MECHANISM.

Application filed August 3, 1925. Serial No. 47,773.

This invention relates to a novel form of pump operating mechanism. In the oil pumping industry it is found that it is often possible to increase the efficiency of the pump by lengthening the stroke of the plunger. The common form of walking beam construction cannot give a stroke of more than four feet, which stroke is much shorter than is sometimes desirable.

It is an object of my invention to provide a pump operating mechanism which will give the pump plunger a very long stroke.

It is another object of my invention to provide a long stroke pump operating mechanism having a counterbalance for reducing the power consumption of the pump operating mechanism.

It is another object of my invention to provide a pump operating mechanism which will not laterally deflect the polish rod.

It is also an object of my invention to provide a pump operating mechanism having novel means for converting rotary motion into reciprocating motion.

It is a still further object of my invention to provide a pump operating mechanism which will quickly accelerate the pump plunger to its maximum speed and uniformly operate it thereafter throughout almost the entire stroke.

It is also an object of my invention to provide a pump operating mechanism in which the stroke is adjustable.

It is an additional object of my invention to provide a pump operating mechanism which is so constructed that it may be easily removed from place so that the pump rods or tubing may be easily pulled from the well.

It is also an object of my invention to provide a pump operating mechanism having a crown which may be swung into raised extension.

It is another object of my invention to provide a novel connection means between the mechanism for converting rotary motion into reciprocating motion and a reciprocating member of my invention.

Other objects and advantages of my invention will be made evident hereinafter.

Referring to the two sheets of drawings in which I illustrate a preferred form of my invention,

Fig. 1 is an elevational view of a construction embodying the features of my invention.

Fig. 2 is an elevational view taken as indicated by the arrow 2 of Fig. 1.

Fig. 3 is a plan view of Fig. 1.

Fig. 4 is a fragmentary view of Fig. 1 taken as indicated by the arrow 4 of Fig. 1.

Fig. 5 is an enlarged fragmentary view showing the novel connection member of my invention.

Fig. 6 is a partially sectioned view taken as indicated by the line 6—6 of Fig. 5.

Fig. 7 is a sectional view taken as indicated by the line 7—7 of Fig. 5.

Fig. 8 is a vertical section taken as indicated by the line 8—8 of Fig. 5.

With reference to Figs. 1 to 3 inclusive of the drawings, my invention provides a supporting structure having rear vertical posts 11 and forward vertical posts 12. The lower ends of the rear vertical posts 11 are secured together by cross channels 13 and the upper ends are secured together by a cross channel 14. The lower ends of the forward posts 12 are secured together by cross channels 15.

A crown 18 is swingably attached to the upper end of the supporting structure. Members 19 are secured to the upper ends of the posts 11, which are pivotally secured by pins 20 to plates 21 which are attached to horizontally extending channels 23 of the crown 18. Members 25 are secured to the upper ends of the posts 12 which are secured by pins 26 to the plates 27 secured near the forward ends of the channels 23. Bearings 29 are mounted at the rear ends of the channels 23, supporting a shaft 30 on which rear reciprocating chain sprockets 32 are rigidly secured. Bearings 34 are supported at the forward ends of the channels 23, rotatably supporting a shaft 35 on which forward reciprocating chain sprockets 36 are rigidly secured. Also on the shaft 35 between the forward reciprocating chain sprockets 36 there is rigidly secured a forward counterbalance chain sprocket 38. Bearings 39 are supported near the central parts of the channels 23, rotatably supporting a shaft 41 on which a central counterbalance chain sprocket 42 is rigidly secured. The crown 18 is adapted for swinging into raised position. To accomplish this, the pins 26 are removed from place, which detaches the forward ends of the channels 23

from the forward posts 12. Suitable means are then employed for raising the front part of the crown 18 into raised extension, the crown swinging pivotally on the pins 20.

Bearings 45 are secured to the posts 11, which bearings carry the shafts 46. The shafts 46 also extend through outboard bearings 47, which are formed integral with the bearings 45. Driven sprockets 48 are secured on the inner ends of the shafts 46. Collars 49 are secured to the outer ends of the shafts 46 for locking them against axial movement. Bearings 51 are secured to the posts 11 at points below the bearings 45. Bearings 52 are secured on a frame 53 which is attached to the vertical posts 11 in alignment with the bearings 51. Shafts 55 extend through the pairs of bearings 51 and 52. Rigidly secured on the inner ends of the shafts 55 are drive sprockets 57 which are in alignment with the driven sprockets 48. Gears 58 are secured on the shafts 55 between the pairs of bearings 51 and 52. The gears 58 are engaged by gears 59, which are rigidly secured on a counter-shaft 60 which is supported by bearings 61 secured to the frame 53. A sprocket 63 is secured to an extending end of the shaft 60, by means of which the counter-shaft 60 may be driven. Extending between the pairs of drive and driven sprockets 57 and 48 are endless chains 65. When the counter-shaft 60 is rotated, the drive sprockets 57 are rotatably driven by means of the gears 59 and 58, which rotates the shafts 55. The endless chains 65 are thus driven over the drive and driven sprockets 57 and 48 continuously at a uniform rate of speed.

As shown clearly in Figs. 5 to 8 inclusive, a yoke 70 is attached to the endless chains 65. Fingers 71 of the yoke 70 are secured to the chains 65 by pivot pins 72 of adjacent links 73 of these chains. As clearly shown in Figs. 6 and 7, the pins 72 extend through the links 73 and through openings 74 formed in the fingers 71. Each of the pairs of fingers 71 has spaces 75 therebetween. The fingers 71 extend from arms 77 which project from opposite ends of a central journal 78 of the yoke 70. A bearing 79, comprising a block 80 and a cap 81 which are rigidly secured together by bolts 82, has a cylindrical opening 83 in which the journal portion 78 of the yoke 70 journals. An arm 85 of the block 80 is pivotally connected to the lower end of a connector chain 87, by means of a pin 88 which extends through the arm 85 and through a lower link 90 of the connector chain 87.

The upper end of the connector chain 87 is secured between the lugs 91 of an attachment member 92 by a pin 93. Arms 95 of the attachment member 92 are pivotally secured by pins 96 to ends of reciprocating chains 98.

As clearly shown in Figs. 1, 2 and 3, the reciprocating chains 98 extend over the rear and forward reciprocating chain sprockets 32 and 36. The forward ends of the reciprocating chains 98 are secured to bearings 100 which are carried on the shaft 101 supported at the upper ends of straps 102 which form a part of an elevator. The lower ends of the straps 102 are secured on trunnions 103 of a head 104. The head 104 is adapted to support a polish rod 106.

The polish rod 106 extends through a stuffing box 107 (Fig. 1) which is secured at the upper end of a pump tubing 108. Extending from the polish rod 106 is a string of sucker rods 109, to which a pump plunger 110 adapted to reciprocate in a pump barrel 111 is secured, the pump barrel being attached at the lower end of the pump tubing 108.

Between the bearings 100 on the shaft 101 there is placed a central bearing 115, to which the forward end of the counterbalance chain 116 is secured. The counterbalance chain 116, as clearly shown in Figs. 1, 2 and 3, extends over the forward counterbalance chain sprocket 38 and over the central counterbalance chain sprocket 42. A counterbalance weight 118 is secured to the rear end of the counterbalance chain 116 by means of an eye bolt 119.

The operation of my invention is substantially as follows. The counter-shaft 60 is rotatably driven by means of a chain, not shown, which may be extended to the sprocket 63. The endless chains 65 are driven through a continuous path at a uniform rate of speed, as previously described. The connector chain 87 being attached to these endless chains 65 by means of the yoke 70 and the bearing 79 moving therewith, the lower end of the connector 87 follows the same path as the endless chains 65. The yoke 70 is so constructed that it may be carried by the endless chains 65 and not present interference to their moving over the drive and driven sprockets 57 and 48.

As clearly shown by dotted lines 120 in Fig. 7, teeth of either of the sprockets 57 or 48 extend into the opening 75 between the fingers 71 when the portions of the chains 65, to which the yoke 70 is secured, pass over these sprockets. The reciprocating chains 98, being secured to the upper end of the connector chain 87, are reciprocated with the connector chain, these reciprocating chains 98 riding over the rear and front reciprocating chain sprockets 32 and 36. The elevator being connected to the forward ends of the reciprocating chains 98 is moved therewith and the pump plunger 110 is reciprocated by means of the string of sucker rods and the polish rod 109 and 106 respectively. The weight that the polish rod 106 imposes upon the reciprocating chains 98

is counterbalanced by the counterbalance weight 118 and the power consumption of the pumping mechanism is thus greatly reduced.

As shown in Fig. 1, the forward reciprocating chains 98 and sprockets 36 are so mounted that the pull of the reciprocating chains 98 is co-axial with the polish rod 106 and there will therefore be no lateral deflection in the polish rod. This eliminates considerable wear, both on the polish rod 106 and on the stuffing box 107, such as is present in the ordinary walking beam which swings the upper end of the polish rod through an arcuate path.

The means of my invention for converting rotary motion into reciprocating motion is especially adapted for use in my pump operating mechanism. As shown clearly in Fig. 1, the vertical travel of the yoke 70 extends almost entirely the complete orbit of its motion. At the end of the vertical travel of the yoke, it decelerates in vertical motion when it comes into engagement with either of the sprockets 48 or 57, and then accelerates in vertical travel, reaching its maximum as it leaves either of the sprockets 48 or 57. The time taken for deceleration and acceleration in vertical direction occupies a very small period of time in respect to the entire cycle of motion; therefore, the pump plunger 110 will be driven by means of my pump operating mechanism at a maximum and uniform speed throughout nearly the entire length of its stroke, this being favorable to an efficient operation of the pump. The yoke and bearing arrangement 70 and 79 permits a connection of the connector chain 87 to the endless chains 65 without any interference to the operation of the endless chains of the drive and driven sprockets. The fingers 71 of the yoke 70 are secured on adjacent pivot pins 72 of the link 73 and do not interfere with the entering of teeth between these fingers into the spaces 75.

The mechanism is especially designed to provide an exceptionally long stroke for a reciprocating pump plunger. The length of the stroke may be varied by changing the distances between the drive and driven sprockets 57 and 48; in other words, by lengthening the orbits of the endless chains 65. When it is necessary to pull the pump from the well, the entire mechanism may be taken from the derrick or the crown 18 may be swung into raised position so as to give free space above the pump tubing 108 that it may be removed from the well.

I claim as my invention:

1. An apparatus of the class described comprising: a supporting structure adapted to be mounted in a derrick substantially to one side of the well axis thereof; a flexible reciprocator movably supported by said supporting structure, said flexible reciprocator comprising a plurality of flexible members adapted to travel over pulleys supported by said supporting structure; means for attaching one end of said flexible reciprocator to a polish rod in said derrick; mechanism for reciprocating said reciprocator supported by said supporting structure, said mechanism comprising a rotatable drive member, a rotatable driven member, an endless member extending around said drive and driven members, and means for driving said drive member in order to continuously move said endless member; and means for joining said reciprocator to said endless member, said reciprocator being reciprocated by said endless member.

2. An apparatus of the class described comprising: a supporting structure adapted to be mounted in a derrick; a flexible reciprocator movably supported by said supporting structure; means for attaching one end of said flexible reciprocator to a polish rod in said derrick; mechanism for reciprocating said reciprocator supported by said supporting structure, said mechanism comprising a rotatable drive member, a rotatable driven member, an endless member extending around said drive and driven members, and means for driving said drive member in order to continuously move said endless member; means for joining said reciprocator to said endless member, said reciprocator being reciprocated by said endless member; and counterweight means for conuterbalancing the weight imposed upon said reciprocator by said polish rod, said counterweight means being attached to said reciprocator between said reciprocating mechanism and said polish rod.

3. An apparatus of the class described comprising: a supporting structure; a crown so secured to the upper end of said supporting structure as to be disposed to one side of the axis of an adjacent well; reciprocating chain sprockets supported by said crown; reciprocating chains extending over said reciprocating chain sprockets; an elevator connected to said reciprocating chains, said elevator being adapted to support a polish rod; a connector attached to said reciprocating chains; a pair of drive sprockets; means for driving said drive sprockets; a pair of driven sprockets; a pair of endless chains extending over said pairs of drive and driven sprockets, said endless chains being continuously moved over said drive and driven sprockets at a uniform rate of speed; and means for joining said connector to said endless chains, thus reciprocally moving said reciprocating chains.

4. A combination as defined in claim 3 also comprising: counterweight chain sprockets supported by said crown; a counterweight chain extending over said counterweight sprockets, one end of said counterweight

chain being attached to said elevator; and a counterweight attached to the other of said counterweight chains.

5. A combination as defined in claim 3 in which said crown is secured to said supporting structure so that it may be vertically swung.

6. An apparatus of the class described comprising: a supporting structure; a crown secured to the upper end of said supporting structure; reciprocating chain sprockets supported by said crown; reciprocating chains extending over said reciprocating chain sprockets; an elevator connected to said reciprocating chains, said elevator being adapted to support a polish rod, a connector attached to said reciprocating chains; a pair of drive sprockets; means for driving said drive sprockets; a pair of driven sprockets; a pair of endless chains extending over said pairs of drive and driven sprockets, said endless chains being continuously moved over said drive and driven sprockets at a uniform rate of speed; a yoke comprising a central journal, arms extending from said journal, and fingers extending from said arms, said fingers being secured to said endless chains; and a bearing member journalled on said journal and rigidly secured to said connector.

7. A combination as defined in claim 6 in which each arm of said yoke has a pair of fingers which are attached to the pivots of adjacent links of said endless chains, said fingers being separated so that they will not interfere with the passage of said endless chains over said drive and driven sprockets.

8. A combination as defined in claim 1 in which said supporting structure has a crown for supporting said pulleys, said crown being vertically swingable.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 27th day of July, 1925.

FRANK F. HILL.