

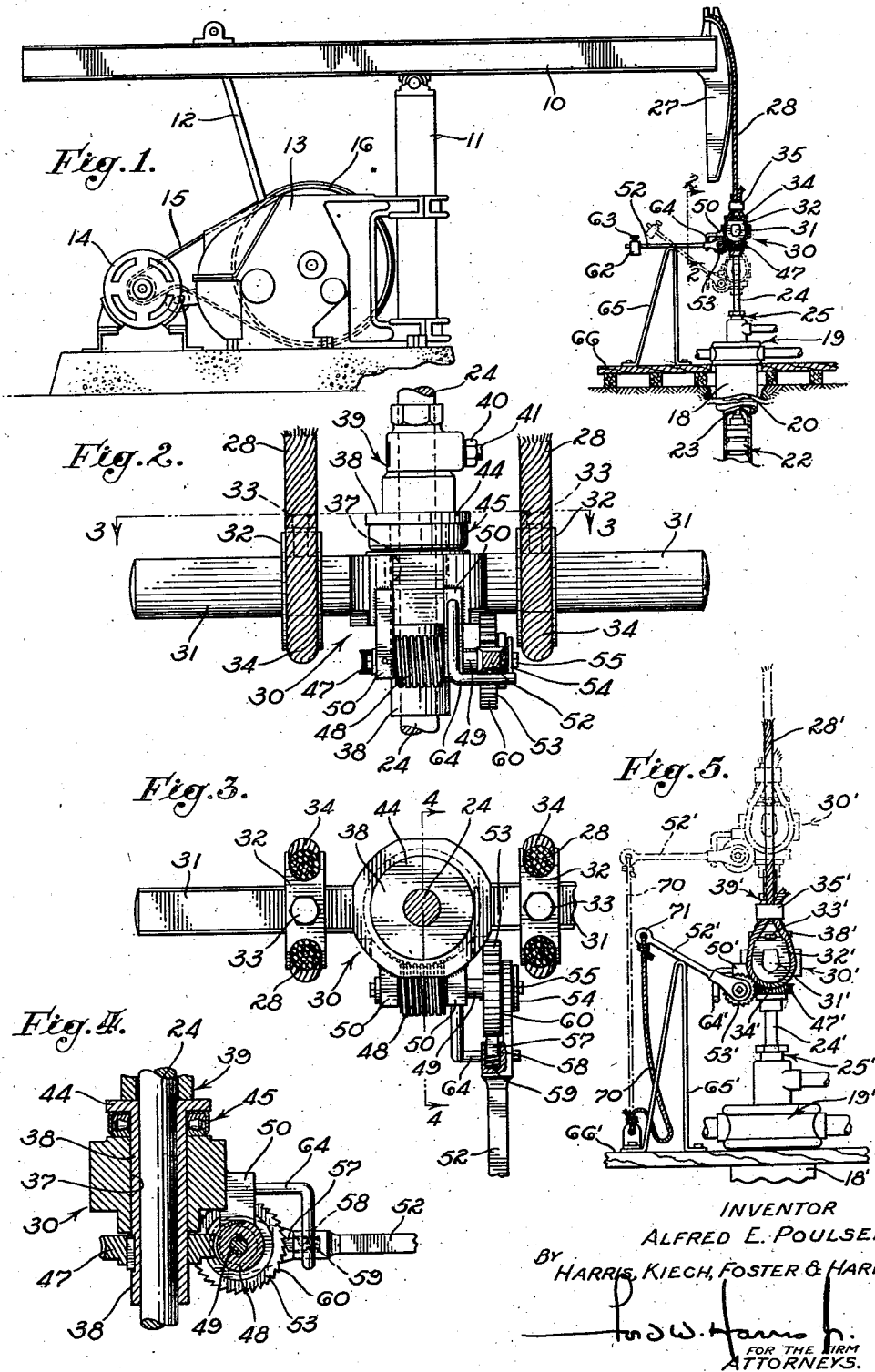
Nov. 21, 1939.

A. E. POULSEN

2,180,880

MEANS FOR ROTATING PUMP ROD IN A WELL

Filed July 5, 1938



INVENTOR
ALFRED E. POULSEN
BY HARRIS, KIECH, FOSTER & HARRIS
FOR THE FIRM
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,180,880

MEANS FOR ROTATING PUMP ROD IN A WELL

Alfred E. Poulsen, Los Angeles, Calif.

Application July 5, 1938, Serial No. 217,329

8 Claims. (Cl. 255-14)

My invention relates to oil well apparatus, with particular reference to pumping equipment, and is directed to improved means for rotating the string of rods in a well in the course of pump-

ing operations. of the rate of rotation relatively simple by arranging for a simple numerical relationship between the rate at which the string of rods is reciprocated and the rate at which the string of rods is rotated.

In a pumping outfit to which my invention is applicable, a deep well pump is actuated by a string of rods in the well tubing, the rods terminating in a polished rod that extends through the casing head at the well surface. The string of rods is reciprocated by some actuating means driven by a prime mover. A typical arrangement includes a horsehead on the end of a walking-beam having flexible means, such as a cable, operatively connected with the polished rod. It has heretofore been noted in the art that at certain dispositions of a string of pump rods there is often local friction between the rods and tubing, generally at one or more couplings in the tubing string. Should the string of rods be continuously operated in such unfavorable disposition over an extended period of time, the wear caused by the friction may become so serious as to necessitate replacement of couplings and rods and even replacement of portions of the tubing. To avoid such difficulties in the operation of well pumping equipment, means have heretofore been devised to continuously rotate the reciprocating string of rods to limit the proportion of operating time during which the string of rods is reciprocated at a wear-producing disposition. The general object of my invention is to provide an improved means for such purpose.

The above and other objects of my invention will be apparent in the more detailed description of my invention to follow.

In the drawing:

Fig. 1 is a side elevation of a typical well pumping unit incorporating my invention;

Fig. 2 is a side elevation on an enlarged scale of my invention partly in section, taken as indicated by the line 2-2 of Fig. 1;

Fig. 3 is a horizontal section taken as indicated by the line 3-3 of Fig. 2;

Fig. 4 is a vertical section taken as indicated by the line 4-4 of Fig. 3; and

Fig. 5 is a side elevation on a reduced scale of a modification of my invention.

For the purposes of this disclosure, I elect to describe my invention as incorporated in a pumping outfit that is characterized by a horsehead on the end of a walking-beam and by a pair of cables suspended from the horsehead for supporting the string of rods in the well, but it will be understood by those skilled in the art that the principles of my invention may be adapted to any means for actuating a string of rods, and may be adapted to any means for connecting the string of rods thereto.

Fig. 1 shows a typical pumping outfit that includes a walking-beam 10 mounted on a post 11, the walking-beam being driven by a connecting rod 12 that extends upward from mechanism in a housing 13. The mechanism in the housing is actuated by a prime mover, such as a motor 14, through the medium of a drive belt 15 extending to a pulley 16 on the side of the housing 13.

The well with which the pumping mechanism is associated has a casing 18 sealed by a casing head 19, the casing containing a string of tubing 20. At the lower end of the tubing is a pump 22 having a rod 23 that is part of a string of rods terminating in a polished rod 24, the polished rod slidingly extending through the packing gland 25 of the casing head in the usual manner.

In the typical construction shown in the drawing, the walking-beam is provided with a horsehead 27, from which depends a pair of spaced cables 28 for operative connection to the polished rod 24. Since the polished rod must be free to rotate, a rotatable connection is necessary between the polished rod and the cables 28. One

One of the objects of my invention is to provide a mechanism for rotating the string of rods that reciprocates with the rods and is actuated by engagement with a stop means in the course of such reciprocation. In the preferred form of my invention the mechanism for rotating the string of rods includes a driving arm adapted when reciprocated to actuate the mechanism, and the object of my invention is to arrange for such arm to be oscillated by means including a stop for deflecting the arm in one direction.

Usually, the string of rods is supported by a pair of cables from the horsehead of a walking-beam. One object of my invention is to provide a rotatable connection for the rods that includes adjustably spaced means for engagement by the cables.

A further object of my invention is to provide a simple and rugged rod rotating mechanism that may be readily adjusted for various rates of rotation. In the preferred form of my invention it is my purpose to make the computation

of the features of my invention is the provision of such a rotary connecting means that is adapted for connection with the two cables at adjustably spaced points.

5 The rotatable connection between the polished rod and the two cables may comprise a first member non-rotatably secured to the two cables and a second member for supporting the polished rod 24, the second member being rotatably connected to the first member. In the preferred form of my invention the first member comprises a yoke, generally designated 30, having two laterally spaced arms 31, each of which arms is slid-
10 ingly embraced by a stirrup 32 releasably held thereon by a suitable setscrew 33. The lower end of each of the cables 28 is formed into a loop 34 closed by a clamp 35, each of the loops extending around one of the stirrups 32. The stirrups 32 may be adjusted on the arms 31 as required to conform with the spacing between the two cables 28.

The yoke provides a vertical bore 37 in which is journaled a tubular member 38 that is dimensioned to receive the polished rod 24. The connection between the tubular member 38 and the polished rod is provided by a fitting 39 that embraces and releasably grips the polished rod, the fitting resting on the upper end of the tubular member 38. The fitting 39 shown in the drawing is a well-known type of grip adjuster, the clamping effect of which is controlled by a nut 40 on a gripping means 41. Interposed between the yoke 30 and a radial flange 44 at the upper end of the tubular member 38 is a suitable roller-bearing, generally designated 45, for supporting the tubular member 38 together with the string of rods in a freely rotatable manner.

Any suitable mechanism may be mounted on the yoke 30 for causing rotation of the tubular member 38, which rotation will be imparted to the polished rod 24. Thus, as suggested by the drawing, a worm gear 47 keyed to the lower end of the tubular member 38 may be driven by a complementary worm 48. The worm 48 is carried by a stub shaft 49 that is journaled in a pair of ears 50 extending from the yoke 30.

This mechanism for rotating the polished rod will, of course, reciprocate with the polished rod, and my invention contemplates the provision of means for driving the mechanism that will move bodily with the mechanism and be actuated by encountering stop means in the course of such reciprocation. Such a drive means, for example, may comprise a ratchet arm 52 rotatably mounted on the stub shaft 49 to cooperate with an adjacent ratchet wheel 53 that is keyed to the stub shaft, the ratchet arm being confined between the ratchet wheel and a washer 54 retained on the shaft by a nut 55. A detent member 57
50 mounted in a socket 58 of the ratchet arm is continuously pressed against the periphery of the ratchet wheel by a helical spring 59 in the socket, so that when the ratchet arm is swung in one direction, the detent will ride over the teeth 60 of the ratchet wheel without rotating the shaft 49, but when the ratchet arm is swung in the other direction, the detent will engage one of the teeth to cause the shaft to rotate. It is apparent that oscillation of the ratchet arm 52 will cause the tubular member 38 and the polished rod 24 to rotate.

In the preferred form of my invention shown in Fig. 1, the ratchet arm is constructed to swing downward by gravitation. To insure such gravitational movement, a weight 62 for the ratchet

arm may be adjustably retained thereon by a setscrew 63; and to limit the gravitational movement, say at a horizontal position of the ratchet arm, a rod 64 may extend as a finger from the yoke 30, the finger serving as a rest for the ratchet arm at the lowermost angular position thereof. The opposite or upward movement of the ratchet arm is caused by a stop means encountered during the downstroke of the pumping mechanism. Such a stop means, for example, may comprise a bar 65 or other upright member mounted on the well platform 66.

The operation of my device may be readily understood from the foregoing description. On the upstroke of the pumping mechanism, the ratchet arm 52 swings downward by gravity against the finger 64, the detent member 57 riding over the teeth 60 of the ratchet wheel 53 without causing the wheel to rotate. Since the stop means 65 lies in the path along which the ratchet arm is reciprocated, the downstroke of the pumping mechanism carries the ratchet arm against the stop means, the stop means interfering with the ratchet arm and causing relative movement between the ratchet arm and the polished rod by deflecting the ratchet arm upward as indicated in dotted lines in Fig. 1. The upward swing of the ratchet arm imparts rotation to the ratchet wheel 53 through the detent member 57, which rotation is transmitted to the worm 48 and thereby imparted to the worm gear 47 to cause the tubular member 38 and the polished rod 24 to rotate.

For a given number of pump strokes per minute, the amount of rotation imparted to the polished rod will depend on the gear ratio of the rotating mechanism and upon the angle through which the ratchet arm 52 is oscillated. I have found it convenient to design the rod-rotating mechanism with a thirty-to-one ratio and to provide forty-eight teeth on the periphery of the ratchet wheel 53, the virtue of such an arrangement being the ease with which the rate of rotation may be computed. Rotation of the ratchet wheel in one minute by an amount corresponding to one tooth will cause the polished rod to make one complete rotation in twenty-four hours. In other words, the number of pumping strokes per minute multiplied by the number of ratchet teeth traversed by the detent member 57 in one stroke equals the number of complete rotations imparted to the polished rod in twenty-four hours.

The ratchet arm shown in the drawing has a maximum oscillation range corresponding to nine teeth of the ratchet wheel, so that the number of revolutions imparted to the polished rod in twenty-four hours will be between one and nine times the reciprocations per minute of the pumping mechanism, the rate depending upon the position of the stop 65 relative to the path of reciprocation of the ratchet arm. At the lowermost operative level of the stop 65, the ratchet arm will be deflected by the stop sufficiently to rotate the ratchet wheel through an angle corresponding to one tooth, and on the upstroke the ratchet arm gravitating downward will cause the detent member to traverse one tooth of the ratchet wheel. The lowermost operative position of the stop, then, will cause the polished rod to rotate twelve times in twenty-four hours if the pump is operated at twelve strokes per minute. The arrangement may be adjusted to rotate the polished rod and multiple of twelve revolutions per twenty-four hours up to the multiple nine

by simply raising the stop means to engage the ratchet arm earlier in the downstroke.

The modified form of my invention shown in Fig. 5 corresponds for the most part with the preferred form just described, corresponding parts being indicated by corresponding prime numbers. A stop 65' cooperates with a ratchet arm 52' in the same manner as heretofore described. Instead of depending upon gravity for the downward movement of the ratchet arm, however, in this form of my invention I depend upon positive means which serves, in effect, as a stop cooperative with the ratchet arm on the upstroke of the pumping mechanism. This second stop means may be in the form of a flexible member such as a cord or cable 70 having its lower end anchored to the well platform and its upper end attached to an eye 71 in the end of the ratchet arm 52'. As the pumping mechanism nears the end of the upstroke, the cable 70 is placed under tension, pulling the ratchet arm 52' to a downward angle as indicated by dotted lines in Fig. 5. The cable should, of course, be adjusted to cause a downward movement of the ratchet arm corresponding to the upward movement of the arm imparted by the stop means 65', the extent of each movement, of course, depending upon the amount of rotation to be imparted to the string of rods.

My description will suggest to those skilled in the art various changes and modifications without departing from the spirit of my conception, and I reserve the right to all such changes and modifications that properly come within the scope of my appended claims.

I claim as my invention:

1. In oil well apparatus including a polished rod reciprocated by an actuator the combination therewith of means to intermittently rotate said polished rod, said means comprising: mechanism moving with the polished rod in a path of reciprocation, said mechanism being operatively connected with the polished rod for rotation thereof; driving means mounted to move with said mechanism along said reciprocation path, said driving means being operatively connected with the mechanism for driving the mechanism when moved relative thereto; and impingement means positioned in the path of reciprocation of said driving means for contact with said driving means to cause movement thereof relative to said mechanism for actuation of the mechanism, said impingement means being independent of said actuator and being adapted for contact with said driving member only along a limited zone of said reciprocation path whereby actuation of said mechanism is not affected by bodily movement of said mechanism outside of said zone.

2. The combination with a reciprocating actuator and polished rod driven thereby in oil well apparatus of means to rotate said polished rod, said means including: a revolvable connection between said polished rod and actuator to permit rotation of the polished rod; a ratchet mechanism operatively connected to said polished rod for rotation thereof; a drive member for said mechanism mounted to reciprocate up and down with the polished rod; and a fixed stop independent of and apart from said reciprocating actuator located in the path of reciprocation of said drive member to be struck by the drive member, thereby to cause movement of the drive member relative to said ratchet mechanism to drive the mechanism.

3. The combination with a reciprocating actuator and polished rod driven thereby in oil well

apparatus of means to rotate said polished rod, said means including: a revolvable connection between said polished rod and actuator to permit rotation of the polished rod; a ratchet mechanism operatively connected to said polished rod for rotation thereof, said mechanism reciprocating up and down with the polished rod; a lever for driving said mechanism, said lever being mounted on the mechanism to reciprocate up and down therewith and being disposed laterally of its path of reciprocation; and a fixed stop independent of and apart from said reciprocating actuator located in the path of reciprocation of said lever in a position to deflect said lever, thereby driving said mechanism.

4. The combination with a reciprocating actuator and polished rod driven thereby in oil well apparatus of means to rotate said polished rod, said means including: a revolvable connection between said polished rod and actuator to permit rotation of the polished rod; a ratchet mechanism operatively connected to said polished rod for rotation thereof, said mechanism reciprocating up and down with the polished rod; a lever for driving said mechanism, said lever being mounted on the mechanism to reciprocate up and down therewith and being disposed laterally of its path of reciprocation, said lever being weighted to gravitate pivotally to a given position; and a fixed stop independent of and apart from said reciprocating actuator located in the path of reciprocation of said lever in a position to deflect said lever pivotally upward from said given position as said lever moves downward along its path of reciprocation, thereby driving said mechanism.

5. The combination with a reciprocating actuator and polished rod driven thereby in oil well apparatus of means to rotate said polished rod, said means including: a revolvable connection between said polished rod and actuator to permit rotation of the polished rod; a ratchet mechanism operatively connected to said polished rod for rotation thereof, said mechanism reciprocating up and down with the polished rod; a lever for driving said mechanism, said lever being mounted on the mechanism to reciprocate up and down therewith and being disposed laterally of its path of reciprocation, said lever being weighted to gravitate pivotally to a given position; a stop carried up and down with said lever and cooperative therewith to limit said gravitational pivotal movement at said given position; and a fixed stop independent of and apart from said reciprocating actuator located in the path of reciprocation of said lever in a position to deflect said lever pivotally upward from said given position as said lever moves downward along its path of reciprocation, thereby driving said mechanism.

6. The combination with a reciprocating actuator and polished rod driven thereby in oil well apparatus of means to rotate said polished rod, said means including: a revolvable connection between said polished rod and actuator to permit rotation of the polished rod; a worm gear operatively connected with said polished rod; a worm engaged with said worm gear; a ratchet mechanism for rotating said worm; a drive member for said ratchet mechanism mounted to reciprocate up and down with the polished rod; and a fixed stop independent of and apart from said reciprocating actuator located in the path of reciprocation of said drive member to be struck by the drive member, thereby to cause movement of the drive

member relative to said ratchet mechanism to drive the mechanism.

5 7. A combination as set forth in claim 6 in which said drive member is a lever disposed laterally of its path of reciprocation to be deflected upward by impact against said stop, said lever being weighted to gravitate after each impact back to the position from which it is deflected by the impact.

8. A combination as set forth in claim 2 in which said ratchet mechanism includes gears having a gear ratio such that the polished rod will be completely rotated in twenty-four hours a number of times corresponding to the reciprocations per minute of the polished rod.

ALFRED E. POULSEN.