Sept. 15, 1942. D. E. HUMPHREY 2,296,164

PUMP ROD ACTUATOR

Filed Oct. 4, 1940

Fig. 1.

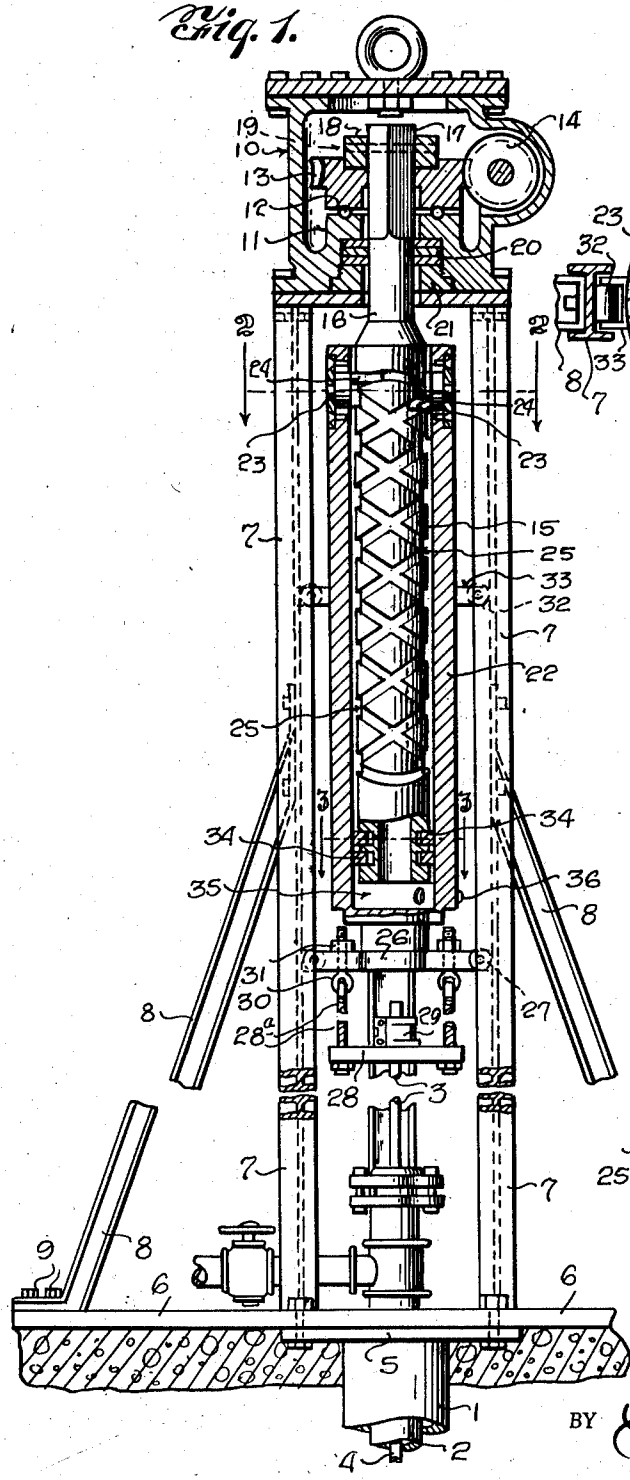


Fig. 2.

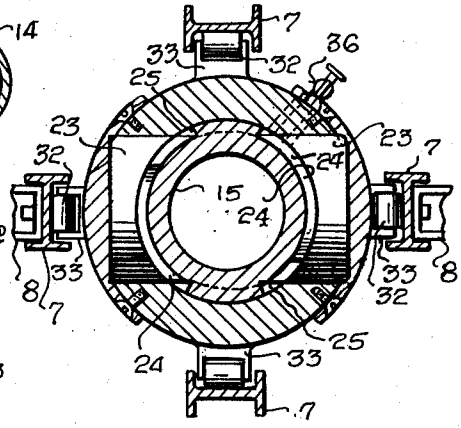


Fig. 3.

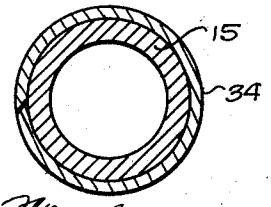
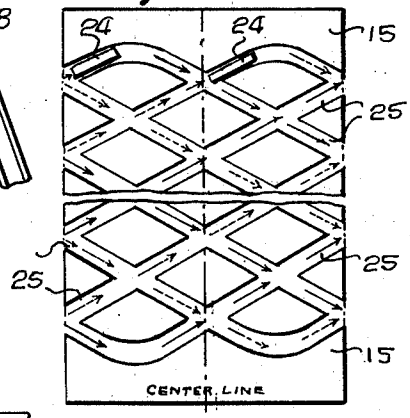


Fig. 4.



Dee E. Humphrey
INVENTOR.

BY

ATTORNEY

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PUMP ROD ACTUATOR

Dee E. Humphrey, Dallas, Tex.

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3 Claims. (Cl. 74—57)

This invention relates to oil field equipment and it has particular reference to surface equipment for reciprocating sucker rods in a well for pumping the same.

The principal object of the invention is to provide a new and novel reciprocating or reversible mechanism for actuating pump rods in a well or for other uses to which such means may be adapted, said means consisting of a cylindrical or tubular body, the outer surface of which is provided with twin sets of double helix grooves or channels with a pair of diametrically opposed tracers constrained to travel therein by non-rotatable means when the body is rotated.

Another object of the invention is to provide a frame in which the aforesaid elements operate and which frame constitutes also a guide for maintaining strict perpendicular movement of the reciprocating or rod string actuating element.

Another object of the invention resides in the provision of valve means located in the rod string reciprocating element in such a manner as to provide not only a means to predetermine the speed of reciprocation of the rod string but also to function as a shock absorber medium to prevent undue strain on the sucker rod assembly when it reaches its lower limit of movement in the well.

Broadly, the invention utilizes the principle of extended multiple rectilinear movement brought about by cooperating elements, one of which is provided with twin sets of double helix grooves in which operate a pair of tracers mounted in diametrically opposed relationship in one end of a tubular body, as stated, the said tracers being capable of travelling in the groove and automatically reverse their relative angularity at each extreme limit of movement in the grooves of the tubular or cylindrical element. Thus, in affording the dual suspending means for the reciprocating element, through the medium of the pair of tracers, the assembly when arranged in accordance with this invention affords a structure of sufficient sturdiness and durability, capable of lifting a column of fluid in a well since the fluid above the travelling valve, combined with the weight of the sucker rods, is the only weight necessary to be borne by the reciprocating assembly. Moreover, without the interrelated but separate grooves with their respective tracers, true concentric relationship of parts would be impossible without damaging friction, which would render the improved mechanical movement impractical for the purposes intended and defined herein.

With the foregoing objects as paramount, the invention has particular reference to its salient features of construction and arrangement of parts which will become manifest as the description proceeds, taken in connection with the accompanying drawing, wherein:

Figure 1 is a vertical sectional view of the invention in position for operating the sucker rods in a well.

Figure 2 is a transverse section of line 2—2 on Figure 1.

Figure 3 is a transverse section on line 3—3 on Figure 1, and

Figure 4 is a diagrammatic development of a tubular or cylindrical member, showing the shape and arrangement of the grooves, two in number, with the travel of the respective tracers.

Continuing with a more detailed description of the drawing, the reference numeral 1 designates a well casing in a well in which the well tubing 2 is suspended. The polished rod 3 is connected in the conventional manner with the sucker rod assembly 4 in the tubing and which carries the conventional travelling valve, not shown.

The casing 1 has a flange 5 thereon, on which is disposed a base 6 of necessarily heavy material and is bolted to the flange 5 or otherwise suitably secured thereto for convenient removal without sacrificing the required sturdiness. Superimposed upon the base 6 is the frame of the invention and which is preferably comprised of a plurality of vertically disposed and diametrically arranged I-beams 7. These beams are supported in a manner similar to that shown in Figure 1, that is, by means of angular braces 8, the lower ends of the latter being bolted at 9 onto the base 6.

Mounted upon the tops of the uprights 7 is a drive assembly which, in the present case, is shown to consist of a housing 10 provided with an integral and internal boss 11, affording a lower race for balls 12 and on which rests and on which thereby is mounted a worm gear 13. Worm 14 is provided for operating the gear 13 and may be driven in any suitable manner and by any suitable means such, for example, as an electric motor mounted adjacent the housing 10 at the top of the frame.

An elongated, spirally grooved body 15 is provided adjacent its upper end with a cylindrical portion 16 and its extreme upper end is squared at 17 in the manner shown. A collar 18 embraces the squared portion 17 and is itself square to conform with a similarly shaped recess in the top surface of the gear 13. It is preferred that

the collar 18 as well as the upper extremity 17 of the body 15 be bored to receive a pin 19 so that there will be no possibility of the body 15 dropping from its suspension. Packing 20 surrounds the cylindrical portion 16 of the body within the housing 10 and this packing is held in position by a retaining collar 21.

From the foregoing it is apparent that when the worm 14 is rotated, the gear 13 will likewise be rotated since its teeth mesh with those of the worm. Upon rotation of the gear 13, the body 15 will be rotated at a speed determined by the speed ratio of the related driving parts.

Surrounding the body 15 is a tubular member 22 which will be hereinafter referred to as the reciprocating member. The reciprocating member is provided adjacent its upper end with suspension tracers 23. The bodies of the members are cylindrical in shape and are journaled in correspondingly shaped recesses in the member 22. The tracers are provided with protuberances 24 and are integral with concaved surfaces of the bodies 23 so as to conform with the contour of the body 15. The protuberances or ribs 24 are likewise similarly formed on their outer edges which contact with the base of the two sets of intercrossing grooves 25 provided in the body 15. It is preferred that the area of the protuberances 24 at the point of contact with the base of their respective grooves 25 be of the maximum amount permitted for proficient operation. The lower end of the reciprocating member 22 is provided with means for receiving the upper end of the polished rod 3 and in the present case consists of a cross-head 26, connected to the member 22 and provided with guide rollers 27, lying in the confronting channels of I-beams 7. The rod 3 extends through an aperture in a yoke 28, suspended by rods or cables 28a from the cross-head 26. A rod clamp 29 is mounted on the rod 3 above the cross-head 26 in order that rod 3 will be reciprocated when the member 22 is actuated. The rods or cables 28a by which the yoke 28 is suspended is connected to the cross-head 26 by means of eye bolts 30, held by nuts 31.

In order that the reciprocating member 22 as well as the body 15 will always remain in perpendicular relationship with the base, the rollers 27 of the cross-head 26 are aided by rollers 32 which are mounted in bifurcated extensions 33, extending radially outward from the exterior wall of the reciprocating member 22.

These rollers serve the further function of preventing rotation of the reciprocating member 22 as its actuating body 15 is rotated since these rollers are disposed in the channels of the I-beams confronting the reciprocating member 22 as are the rollers 27. It is understood that the rollers may be supplanted by other types of devices for the same purpose which is to reduce friction to the minimum.

The lower end of the body 15 is grooved circumferentially, as shown in Figures 1 and 3, and these grooves receive expansion rings 34 to frictionally engage the inner walls of reciprocating member 22. Thus, there is provided a substantially air-tight chamber 35 within member 22 and below the body 15. It is apparent that as the member 22 ascends, air will be drawn into the chamber 35, to release which a valve 36 is provided. This valve is adjustable so as to predetermine the speed of reciprocation of the member 22 and may be of such construction as to be automatic in its function to open the chamber 35 to maintain atmospheric pressure in this chamber 35 on the upward stroke of the member 22 but to reduce the discharge opening to resist maximum discharge of air on the downward stroke of the member 22, thereby providing a cushioning means to prevent transmission of undue shocks to the sucker rod assembly.

Since the foregoing description has included the structure and relationship of parts combined with the operation thereof, it is believed that the operation of the device as a whole is sufficiently clear as to render further description of operation unnecessary.

Manifestly, the construction as shown and described is capable of some modification and such modification as may be construed to fall within the scope and meaning of the appended claims is also considered to be within the spirit and intent of the invention.

What is claimed is:

1. Reciprocating apparatus for pump rods in a well, a frame mounted vertically above said well, a hollow grooved body rotatably suspended in said frame, each groove in said body forming a continuous double helix, a tubular member concentrically embracing said body and of greater length than the grooved portion of said body, a pair of tracers rotatably mounted in one end of said tubular member for relative angular reversement at their limit of travel and arranged in diametrically opposed relationship and receivable in the groove of said body to suspend the tubular member for extended rectilinear movement and return, the joint surfaces of said tracers in contiguous relationship with said body being equal to substantially three-fourths the circumference of said body, means carried by said tubular member and engageable with said frame to hold said tubular member against other than reciprocal movement and means carried by the lower ends of said latter member for suspending said pump rods for reciprocation when said grooved body is rotated whereby to elevate fluid through the latter.

2. Reciprocating apparatus for a pump rod string in a well, a frame disposed vertically above said well, an elongated, hollow cylindrical body suspended vertically in said frame having twin continuous, double helix grooves therein, a pin integral with and extending upwardly from said body and carrying a gear, means engaging said gear to rotate the same, a tubular member surrounding and reciprocable on said body, a pair of oppositely disposed tracers rotatably carried by said tubular member and having protuberances receivable by and arranged to travel in respective grooves of said body whereby to suspend said tubular member and impart thereto an extended rectilinear movement and return, the contacting surfaces of said tracers jointly extending substantially three-fourths the distance around said body, means carried by the lower end of said tubular member for receiving and retaining the polished rod of said rod string to effect reciprocation of the latter, whereby to elevate fluid through said body when the latter is rotated, means for holding said tubular member against rotation when said body is rotated and valve means in said tubular member to regulate the air entering and leaving the chamber in said tubular member below said body during operation.

3. A well pumping apparatus comprising a supporting frame mounted vertically on the ground above a well, a hollow body suspended

in said frame provided with twin, double helix grooves, means for rotating said body, a tubular member surrounding and reciprocable on said body, sealing rings surrounding the lower end of said body and frictionally engaging the internal wall of said tubular member to form an air tight chamber, valve means for controlling the ingress and egress of air with respect to said chamber as said body and tubular member are actuated, rotatable means carried by said latter member in opposed relationship to engage the respective grooves of said body to effect extended rectilinear movement of said tubular member and return and means carried below the chamber of said tubular member for receiving and retaining the end of a rod string in a well for reciprocation when said body is rotated to effect upward passage of fluid through said hollow body.

DEE E. HUMPHREY.