Aug. 25, 1942. R. C. WILLIAMSON 2,294,061

ROTATABLE PUMP-TUBING HANGER

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Fig. 1.

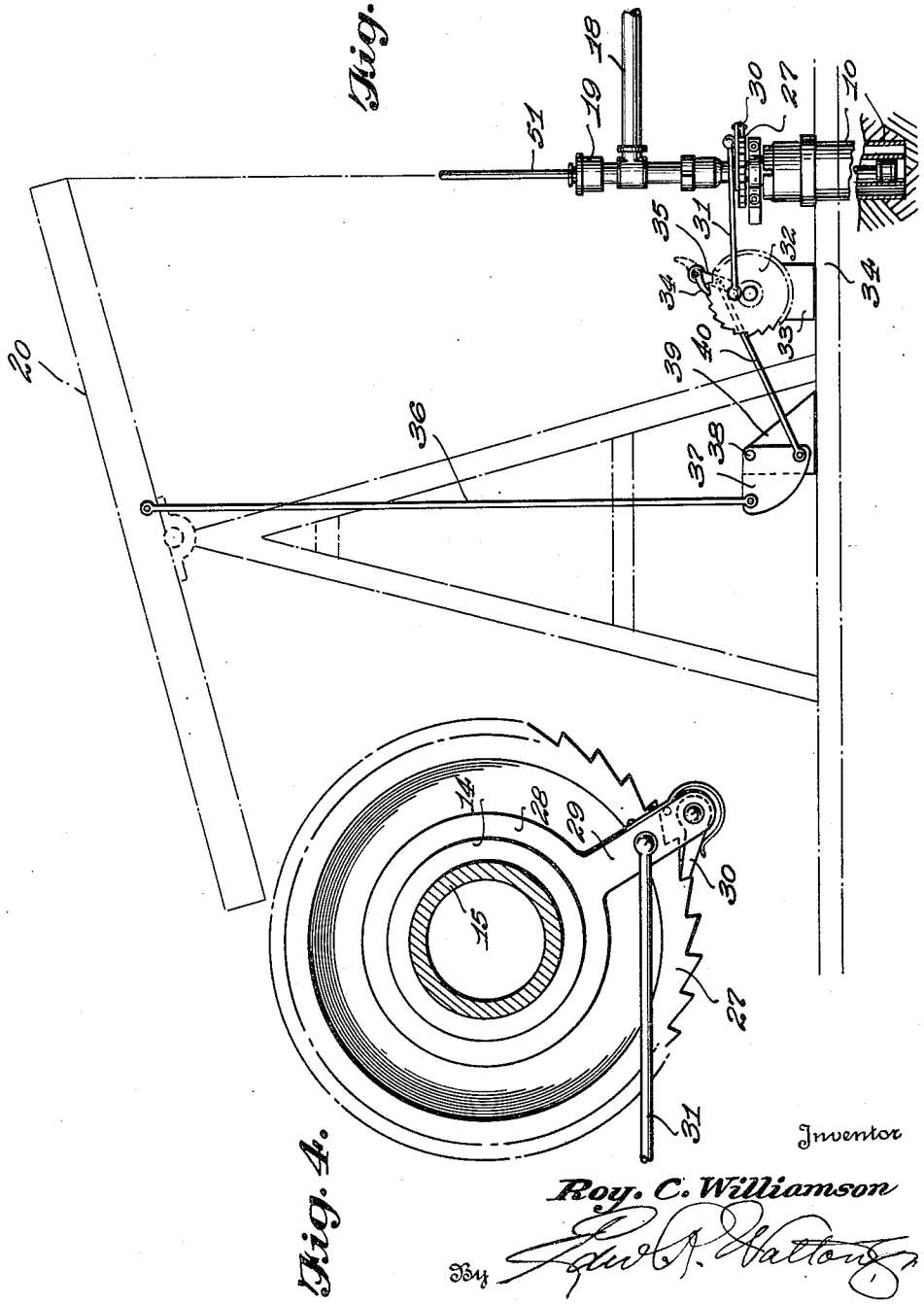

Fig. 4.

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Fig. 2.

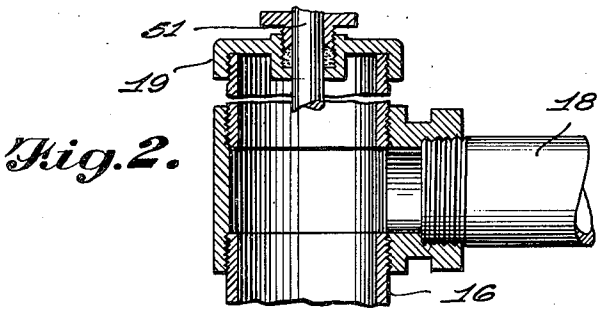

Fig. 5.

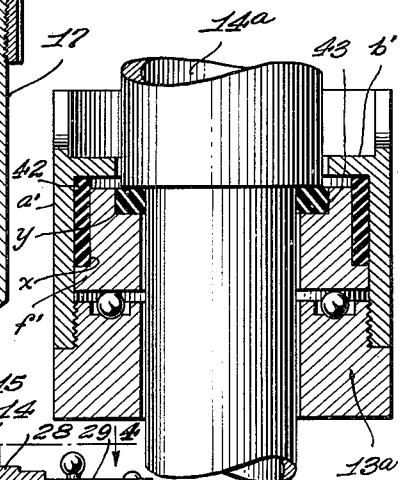

Fig. 3.

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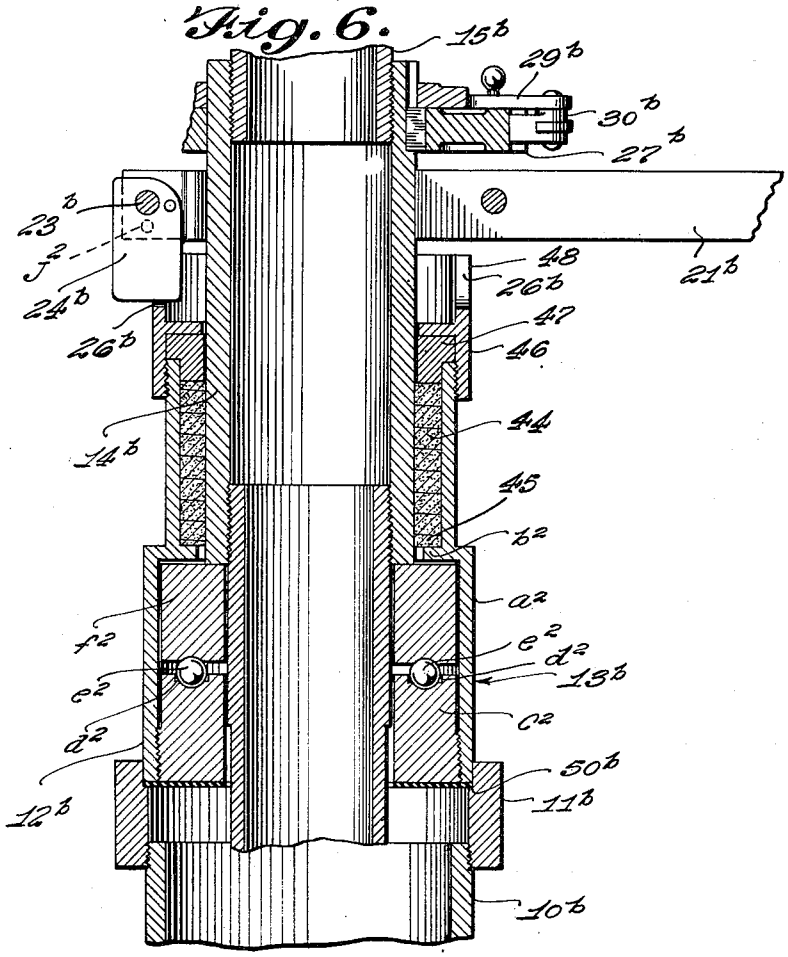
Fig. 6.



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ROTATABLE PUMP-TUBING HANGER

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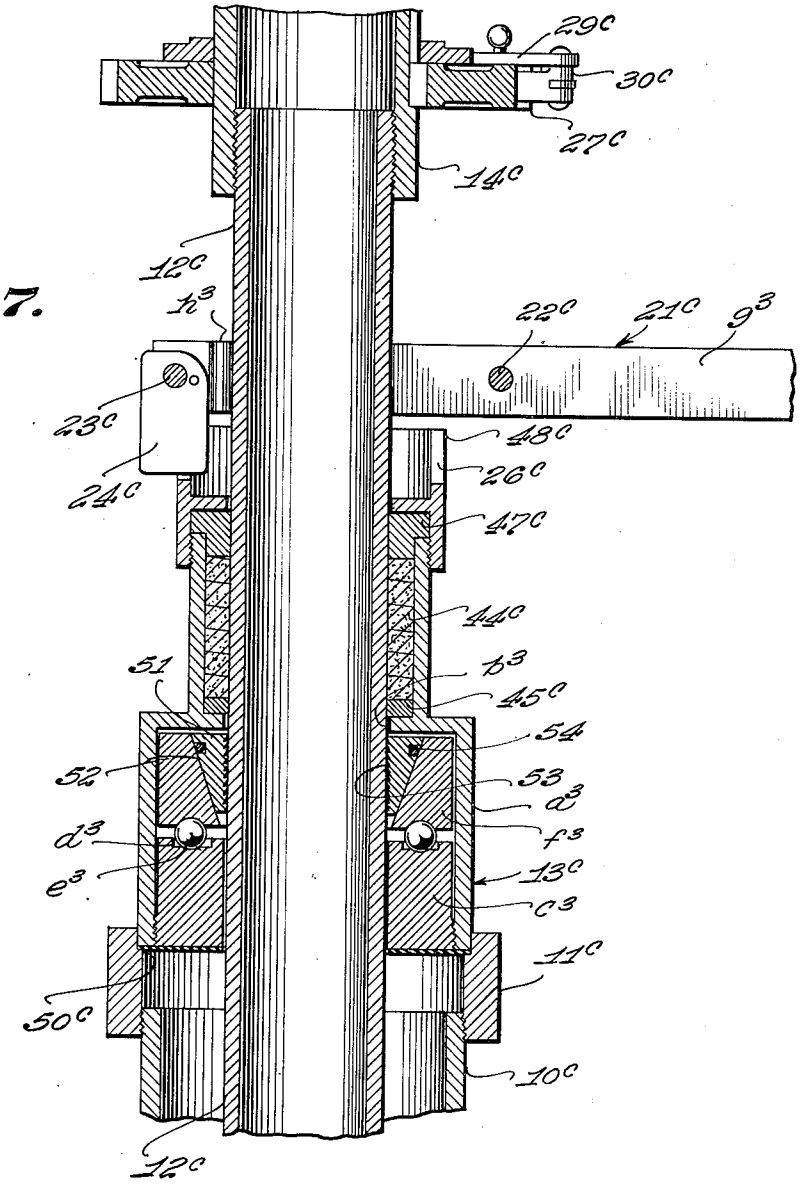
Fig. 7.



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UNITED STATES PATENT OFFICE

2,294,061

ROTATABLE PUMP-TUBING HANGER

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Application October 11, 1940, Serial No. 360,847

9 Claims. (Cl. 166—14)

The present invention relates to oil well apparatus and more particularly to means for rotating the string of tubing of oil well pumps, which tubing is disposed within a stationary outer casing of the well.

In connection with certain oil wells, it is necessary to pump the oil therefrom; and, to this end, a string of coupled tubing is lowered into the well through the well casing and suitably supported by the casing head, and a string of sucker rods extend through the tubing to a lower portion of the well, the upper end of said rods being connected to a suitable operating means for reciprocating the rods and the piston head on the lower end of them for raising the oil through the tubing to the surface of the ground where it is suitably discharged.

It has long been known that, due to various conditions, the sucker rods frictionally contact with different points of the tubing resulting in great wear on the tubing as well as the rods at these points of contact and frequently necessitate replacement of the tubing which, in many instances, is very costly.

It has been proposed, heretofore, to rotate the tubing and in some instances to rotate the rods during the pumping operation so as to better distribute the frictional point of contact between the tubing and the rods over a wider area, thus limiting the proportion of the operating time on any given point of contact which causes wear on the tubing.

The object and purpose of the present invention is to provide an improved and very simple means for rotating the tubing as there are many wells that have almost reached their economic limits which prohibits the installation of expensive equipment. The improved means of this invention employs a reduced number of parts heretofore employed and arranges them in a novel organization, the simplicity of which permits the present invention to be manufactured and marketed at a price between the reach of operators of small wells and other wells that have almost reached their economic limits, thus extending the economic limit of such wells by giving longer life to the most essential and costlier parts of pumping equipment, namely, tubing.

With the above and other objects in view, as will appear from the following specification, the invention consists of the organization, combination and arrangement of parts shown and described and particularly pointed out in the appended claims.

In the drawings, which show the preferred embodiments of the invention as at present devised:

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

Figure 2 is an enlarged vertical section of that portion of the well tubing and casing that normally extends above the surface of the ground;

Figure 3 is a transverse sectional view of Figure 2 taken substantially on line 3—3 of Figure 2;

Figure 4 is a transverse sectional view of Figure 2 taken substantially on line 4—4 of Figure 2;

Figure 5 is a fragmentary vertical sectional view illustrating a modified form of the invention which enables the tubing to be sealed off with respect to the casing when it is desired to employ a pulling vacuum on the casing;

Figure 6 is a further modified view of an improved means for sealing off the tubing when it is desired to employ a pulling vacuum on the casing; and

Figure 7 is a modification of the form shown in Figure 6, wherein a gripping means is employed to support the weight of the tubing instead of allowing the tubing to be supported by coupling shown resting on rotatable bearing member in Figures 2, 5 and 6.

Throughout the specification and drawings like characters of reference denote similar parts throughout the several views.

The usual well is lined with a casing 10 from the surface of the ground to the oil bearing sand, the casing usually being cemented in place so as to be stationary. The upper end of the casing 10 is provided in the present instance with a casing-head 11, known in the art as the "Berry pattern," which is in the form of a sleeve threaded at one end upon the upper end of the casing 10 and its other end portion provided with an internal annular rabbet, forming a shoulder 50, upon which rests various instrumentalities which may be employed in well operations. When pumping equipment is employed, a string of tubing 12 is passed down through the casing 10 to the oil bearing sands, the upper end of the tubing being supported above the surface of the ground in any suitable manner and is usually connected with a discharge pipe for delivering the oil to a suitable receptacle; and a string of sucker rods 51 extend through the tubing 12 to reciprocate the pump piston 52. Of course, the casing-head 11 may be provided with the discharge openings for permitting the egress of casing-head gas which rises from the well, which openings may be closed by threaded plugs.

The present invention is concerned particularly with the provision of a very simple means for rotatably supporting a string of tubing 12 from the casing-head and for permitting either manual or automatic rotation of the tubing and, further, in a very simple means for connecting the upper end of the rotatable tubing with a relatively stationary discharge pipe which delivers the oil to a receptacle, all of these parts being arranged in a very practical organization permitting convenient access to them for removal, adjustment and repair.

The mounting of the present invention for the tubing 12, as shown particularly in Figures 1 to 4, inclusive, comprises a support or hanger 13, the lower end of which is of such diameter that its perimetal edge will rest upon the shoulder 50 of the casing head, there being a packing washer interposed between said shoulder 50 and the lower end of the support 13. The support 13 provides a housing for a ball thrust bearing which directly supports the weight of the tubing and permits of its rotation. In the present form herein shown and described, the support 13 comprises the tubular sleeve member *a* having an internal annular flange *b* spaced from its upper end and through which extends a tubular coupling member 14 to threadedly engage the upper end of the tubing 12 and which coupling member rests upon the thrust bearing within the sleeve or housing member *a*. The thrust bearing may consist of an annular cap or plug *c* internally threaded into the sleeve *a* and having on its upper surface, and within the sleeve, a ball race *d* in which is disposed ball bearings *e* and upon which rests a rotatable collar *f*. It will thus be seen that the flange *b* and the cap *c* retain the collar *f* and the ball bearings *e* in operative position within the support 13 and that the tubing 12 extends upwardly through the cap *c*, collar *f*, and flange *b* where it is threadedly coupled with the coupling member 14 whose lower end rests upon the collar *f*. The flange *b* further serves the function of centering the coupling member 14. This construction provides for an effective rotatable supporting means for the tubing 12 and comprises few relatively inexpensive parts, all of which may be readily disassembled and replaced.

According to the present invention the tubing 12 may be rotated either manually or automatically from the sucker rod operating mechanism. To accomplish manual rotation of the string of tubing 12 I provide on the coupling 14 a laterally extending handle bar 21. This bar may be provided in any suitable manner but is preferably provided by providing two strips of metal *g* and *h*, each having corresponding intermediate portions, adjacent one of their ends, offset semi-circularly to form complemental portions of a clamping ring adapted to embrace the coupling 14. These strips *g* and *h* are clamped in position about the coupling 14 by bolts 22 and 23. The straight end portions of the bars *g* and *h* lie substantially parallel and the longer extending ends are in juxtaposition providing the handle bar 21. The extremities of the other ends of these strips are spaced apart for a distance and receive therebetween a locking detent 24 loosely pivoted on a bolt 25. This detent will normally depend by gravity from the bolt 25 and will engage into one of a plurality of notches 26 on the upper edge of the sleeve *a* of the support 13 to prevent rotation of the tube after it has been rotated once manually by means of the handle bar 21. Openings *i* and *j* are provided, respectively, in the detent 24 and in the adjacent ends of the bars *g* and *h* through which a pin (not shown) may be inserted to maintain the detent in inoperative position (as shown in dotted lines Figure 2) while the tubing is being rotated either manually or automatically.

To rotate the tubing automatically, a ratchet wheel 27 is keyed concentrically on the upper end portion with a coupling member 14 and a bearing ring 28 is disposed above the ratchet wheel 27 and rotatably mounted on the coupling 14, from which ring extends an arm 29 having pivoted to its extremity a spring pressed pawl 30 arranged in cooperative relation with the ratchet wheel 27. The arm 29 is oscillated by a rod 31 connected therewith at one of its ends and having its other end eccentrically connected to a ratchet wheel 32 rotatably mounted in a bracket 33 supported on the platform 34. The ratchet wheel 32 is rotated by a pawl 34 pivotally mounted on an arm 35 rotatably mounted on the axis of the ratchet wheel 32. Motion is transmitted from a walking beam 20 through a pitman rod 36 to a quadrant 37 pivotally mounted at 38 in a bracket 39 on the platform 34. A connecting rod 40 connects the quadrant 37 to the arm 35. Thus it will be seen that through this double ratchet operating means, the string of tubing 12 may be rotated on the ball bearing support 13 and that the degree of rotation may be nicely controlled by measuring the exact amount of eccentricity needed to revolve the ratchet 27 one tooth for each complete revolution of the ratchet 32.

From the above arrangement and organization it will be obvious that my invention contemplates the employment of either manual or mechanical forms of rotation, or both, in given installation and that either one may be readily applied or removed, as desired. In such instances as where both forms of rotation are employed in any one installation and it is desired to discontinue the automatic or mechanical rotation, the pawl or dog 34 can be lifted out of engagement with its ratchet 32 to dotted line position shown in Figure 1, in which event a manual form of rotation may be employed. And, of course, when the automatic form of rotation is utilized, the detent 25 will be raised to its inoperative position, shown in full lines in Figure 1 and in dotted line position in Figure 2, and held in that position by the insertion of a pin through the aligned openings *i* and *j*.

While the thrust bearing shown and described herein is employed, it is obvious that any type of thrust bearing may be used which will be contained within the support 13 and be provided with means upon which the coupling member 14 may rest.

It is essential, of course, that the oil passing upwardly through the tubing string 12 shall be collected for storage and, to this end, there is provided a vertical pipe extension 15 connected with the upper end of the coupling 14 and connected at its upper end with a stationary nipple 16 through means of a rotatable gland 17, the nipple 16 being connected with the discharge pipe 18 and capped by a stuffing box 19 through which the sucker rods 51 extend to an operating means, such as a walking-beam 20.

In Figure 5 there is disclosed a means for sealing off the tubing support 13 when it is desired to utilize a "vacuum pull" or to hold pressure on the casing. In this figure like reference char-

acters will be used to denote similar parts previously described but the numerals will be raised by the exponent "a" and the letters will be raised by the exponent " ' ". This modification for accomplishing this sealing off consists in turning down a portion of the upper exterior surface or circumference of the collar or block *f'* as well as its upper interior circumference to provide rabbets *x* and *y*, respectively, in which are disposed packing material **42** and **43**, respectively. The packing **42** will engage the interior surface of the sleeve *a'* of the tubing support **13a** as well as against the under-surface of the flange *b'*; whereas the packing material **43** will provide a seat upon which the coupling member **14a** with the weight of the tubing **12**, will rest, thus sealing the support at points where leakage may occur.

In Figure 6 another form of "sealing off" the tubing support is shown and in this figure like characters will be used to indicate similar and like parts shown and described in connection with Figures 1 to 4 inclusive but the numerals will be raised by the exponent "b" and the letters will be raised by the exponent "2". The "sealing off" means in this modification comprises filling the space between the flange b^2 of the sleeve a^2 of the tubing support **13b** with a packing **44** and interposing between the flange b^2 and the packing **44** a junk ring **45**. The upper edge of the sleeve a^2 is externally threaded to receive an annular cap nut **46** between which and the packing **44** an annular packing follower **47** is disposed. An upstanding flange **48** is provided on the cap nut **46** and provided with notches **26b** into which the detent **24b** engages.

In connection with deep wells it is often desirable to support the pump-tubing by releasable gripping means and, to this end, there is illustrated in Figure 7 a further modification of the invention as shown in Figures 1 to 4, inclusive, and Figure 6. However, like characters of reference are employed in Figure 7 to indicate similar and like parts as appear in Figures 1, 2, 3, 4, and 6, but the numerals are raised by the exponent "c" and the letters by the exponent "3" to avoid complete duplication of description. In this form of the invention, the rotatable bearing, comprising the parts c^3, d^3, e^3 and f^3 housed in the support or hanger **13c** on the casing head **11c**, is the same as previously described and the "sealing off" means is the same as described in connection with Figure 6 but may be varied as indicated. The coupling member **14c**, however, is disposed above and beyond the hanger **13c** and its "sealing off" means (comprising parts **44c**, **45c**, **46c**, **47c** and **48c**), instead of resting directly upon the rotatable bearing f^3, and connects with the pump-tubing **12c** at said point of disposition, it being observed that the tubing extends upwardly from the well casing **10c** through the support or hanger **13c** and its rotatable bearing and its "sealing off" parts. In order to releasably and rotatably support the weight of the pump-tubing **12c**, the bearing is provided with a means which will grip the tubing to hold it against downward movement relatively to the hanger **13c** but which will release it upon relatively upward movement. This gripping means may comprise an inverted frusto-conical annular sleeve-like gripping member **51** composed of a plurality of segments disposed in a complemental recess **52** of the inner circumferential face of the rotatable bearing member f^3, the gripping member and the recess being proportioned so that the gripping member will have an axially reciprocal sliding movement in said recess, in order to grip and bind the tubing **12c** against relatively downward movement and to spread and release the tubing when moved upwardly. The inner diameter of the annular gripping member **51** is preferably the same throughout its length, but may be provided with a toothed or roughened surface, as at **53**, to assist in the gripping action. The segments of the sleeve may be held together by a resilient member, such as a spring or split ring **54**, which will allow spreading of the segments. Furthermore, in this form of the invention the bars g^3 and h^3, forming the handle **21c** and support for the detent **24c**, are clamped directly upon the upwardly extending end of the pump-tubing **12c**, but the ratchet **27c** and its operating parts are applied to the coupling **14c** or the corresponding part of the gland **17**, should the coupling **14c** be dispensed with or found unnecessary.

Among the advantages for the construction above described is that the wear incident to contact between the sucker rods and the tubing is distributed around the inner circumference of the tubing, thus prolonging the time required to allow a hole through the side wall of the tubing; the lessening of the tendency of the sand to bridge around the tubing and lessening the tendency of the tubing sections from backing off their couplings because the rotation of the tubing, by either the manual or automatic means, will be to the right or clockwise.

Having thus described the invention and the manner in which the same is to be performed, it is to be understood that certain changes and variations may be made within the same, which fall within the scope of the appended claims.

What is claimed is:

1. A rotatable supporting means for well pump-tubing, comprising a tubing hanger adapted to be removably seated in a casing-head, said hanger including a housing containing an annular rotatable anti-frictional bearing through which bearing the upper end of said pump-tubing slidably extends, and means disposed above said housing for rotatably and detachably connecting the upper end of said pump-tubing and forming a continuation of said tubing for piping material passing through the pump-tubing, and means for supporting said pump-tubing directly from said rotatable bearing.

2. A rotatable supporting means for well pump-tubing, comprising a tubing hanger adapted to be removably seated in a casing-head, said hanger being a sleeve-like housing containing an annular anti-frictional bearing through which the upper end of said pump-tubing slidably extends, said bearing including at least two relatively movable members, one of which is removably threaded in the lower end portion of said housing and the other freely rotatable in said housing and means disposed above said housing for rotatably and detachably connecting the upper end of said pump-tubing and forming a continuation of said tubing for piping material passing through the pump-tubing, means for supporting said pump-tubing directly from said rotatable bearing member, and means for applying a rotative force to impart rotation to said pump-tubing.

3. A rotatable supporting means for well pump-tubing, comprising a tubing hanger adapted to be removably seated in a casing-head, said hanger including a housing containing an an-

nular rotatable anti-frictional bearing through which the upper end of said pump-tubing slidably extends, and means disposed above said housing for rotatably and detachably connecting the upper end of said pump-tubing and forming a continuation of said tubing for piping material passing through the pump-tubing, means for supporting said pump-tubing directly from said rotatable bearing, and manually and mechanically operable means on said rotatable piping for optionally rotating the pump-tubing and including a locking detent operable to maintain the tubing against rotation when said operable means is inoperative, said mechanical means including an operative connection to a source of power.

4. A rotatable supporting means for well pump-tubing, comprising a tubing hanger adapted to be removably seated in a casing-head, said hanger including a housing containing an annular rotatable anti-frictional bearing through which the upper end of said pump-tubing extends, and means disposed above said housing for rotatably and detachably connecting the upper end of said pump-tubing and forming a continuation of said tubing for piping material passing through the pump-tubing, means for supporting said pump-tubing directly from said rotatable bearing, a ring clamped about said rotatable piping and carrying a handle whereby said coupling may be rotated, and a detent carried by said clamping ring to engage a portion of said housing for locking said coupling against rotation, when the detent is in one of its positions.

5. A rotatable supporting means for well pump-tubing, comprising a tubing hanger adapted to be removably seated in a casing-head, said hanger including a housing containing an annular rotatable anti-frictional bearing through which the upper end of said pump-tubing slidably extends, and means disposed above said housing for rotatably and detachably connecting the upper end of said pump-tubing and forming a continuation of said tubing for piping material passing through the pump-tubing, means for supporting said pump-tubing directly from said rotatable bearing, including a gripping member carried by said rotatable bearing for contact with the pump-tubing passing therethrough and to be moved by it to grip and hold said pump-tubing against relative downward movement and to release it upon relative upward movement.

6. A rotatable supporting means for well pump-tubing, comprising a tubing hanger adapted to be removably seated in a casing-head, said hanger including a housing containing an annular rotatable anti-frictional bearing through which the upper end of said pump-tubing extends, and means disposed above said housing for rotatably and detachably connecting the upper end of said pump-tubing and forming a continuation of said tubing for piping material passing through the pump-tubing, means for supporting said pump-tubing directly from said rotatable bearing, including an inverted frustro-conical annular gripping member disposed in a complemental recess on the inner circumferential face of said rotatable bearing for contact with the pump-tubing passing through said bearing member and to be moved by it to grip and hold the pumping tubing against relative downward movement and to release it upon relative upward movement.

7. A rotatable supporting means for well pump-tubing, comprising a tubing hanger adapted to be removably seated in a casing-head, said hanger being a tubular housing containing an annular anti-frictional bearing through which the upper end of said pump-tubing slidably extends and including a rotatable bearing member, and a coupling member disposed above said housing and having its lower end internally threaded to receive the upper end of said pump-tubing and resting upon said rotatable bearing member.

8. A rotatable hanger support for pump-tubing of wells adapted to rest upon a casing-head and comprising a vertically disposed sleeve having an interior annular flange spaced from its upper end, an annular bearing removably disposed in the lower portion of the sleeve and below said flange, and a pump-tubing coupling having its lower end internally threaded and extending through said flange by which it is centered and resting on said annular bearing, whereby the upper end of the pump tubing may extend through said bearing and threadedly engage the lower end of said coupling and be rotatably suspended thereby, a relatively stationary discharge pipe connected with the upper end of said coupling, and a rotatable gland connection in said pipe.

9. A rotatable supporting means for well pump-tubing, comprising a tubing hanger adapted to be removably seated in a casing-head, said hanger including a housing containing an annular rotatable bearing through which the upper end of said pump-tubing extends, a coupling member disposed above said housing and having its lower end internally threaded to receive the upper end of said pump-tubing and resting upon said rotatable bearing member, and manually and mechanically operable means on said coupling and to be optionally employed for rotating the same and including a locking detent operable to maintain the coupling against rotation when said operable means is inoperative, said mechanical means including an operative connection to a source of power.

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