

Dec. 2, 1958

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2,862,690

TUBULAR MEMBER ROTATING DEVICE

Filed March 26, 1956

2 Sheets-Sheet 2

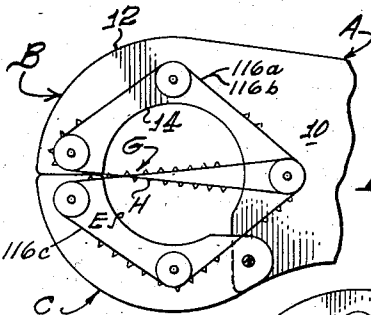
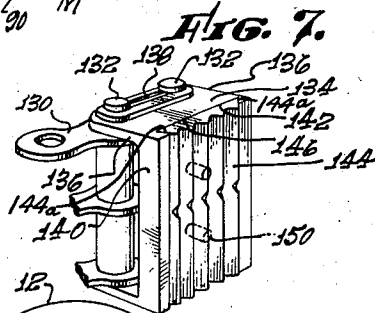
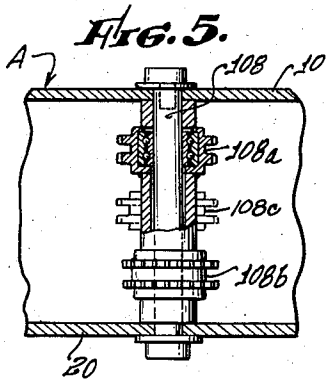
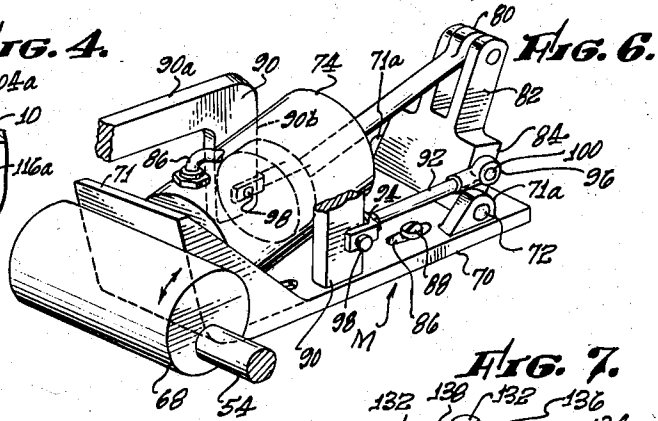
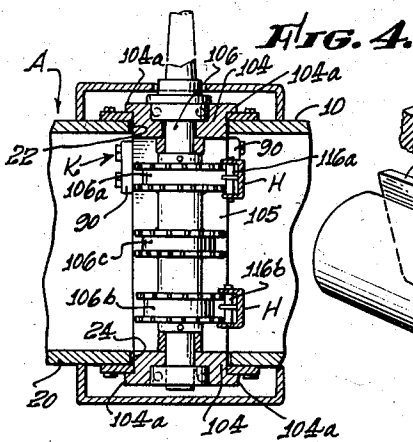


FIG. 8a.

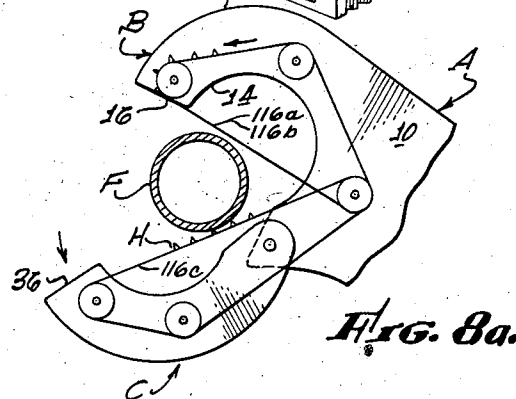


FIG. 8b.

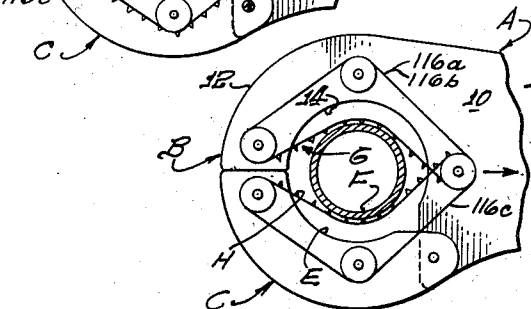


FIG. 8c.

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2,862,690

TUBULAR MEMBER ROTATING DEVICE

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Application March 26, 1956, Serial No. 573,726

11 Claims. (Cl. 255—35)

The present invention relates generally to the field of oil well equipment, and more particularly to a portable power-driven device for rotating or spinning tubular members.

A major object of the invention is to provide a portable, compact, power-driven device of relatively simple structure that is adapted to rotate tubing, casing, drill stem, or special tubular tools, as the case may be, as a string thereof is made up and lowered into the bore of a well.

Another object of the invention is to supply a tubular member rotating device that requires a minimum of maintenance attention, and which, due to its simplified structure, can be retailed at a sufficiently low price as to encourage its widespread use.

A further object of the invention is to furnish a power-driven rotating device by means of which the time required in making up a string of tubing or casing and lowering same into a hole will be considerably shortened, with this make-up operation requiring a minimum of physical exertion on the part of the working crew.

Yet another object of the invention is to provide a power-driven rotating device that tends to diminish the hazard of personal injury to one or more of the crew members during make-up of a string of tubing or casing.

A still further object of the invention is to provide a power-driven rotating device that is adapted to handle both tubing and casing of various diameters.

These and other objects and advantages of the present invention will become apparent from the following description of a preferred form thereof, when taken in conjunction with the accompanying drawings illustrating that form in which:

Figure 1 is a perspective view of the invention shown engaging either tubing or casing outlined in phantom line;

Figure 2 is a plan view of the device;

Figure 3 is a longitudinal cross-sectional view of the device taken on line 3—3 of Figure 2;

Figure 4 is a vertical cross-sectional view of the transmission used in conjunction with the device taken on line 4—4 of Figure 3;

Figure 5 is a vertical cross-sectional view of one of the idling sprockets, taken on line 5—5 of Figure 2;

Figure 6 is a perspective view of the hydraulic cylinder holding carriage utilized in the device;

Figure 7 is a perspective view of one of the chain-supported, tubing or casing engaging dies;

Figure 8a is a diagrammatic view of the tubing or casing engaging chains, just before the chains assume an engaging position;

Figure 8b is a diagrammatic view of tubing or casing when engaged by the chains and are rotated thereby;

Figure 8c is a diagrammatic view of the chains when the invention is in the closed position.

Referring now to the drawings for the general arrangement of the invention, it will be seen that an elongate

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housing A is provided that develops at one end into a first arcuate jaw B. A second arcuate jaw C is pivotally supported from housing A that by means of a latch D can be removably held in a locked position with jaw B to define a circular opening E which encircles a portion of tubing or casing F.

A number of sprocket-supported endless chains G, best seen in Figures 2, 3, 8a, 8b, and 8c, are so disposed in housing A that dies H mounted on the chains can be caused to engage tubing or casing F. Tubing or casing F is rotated when the chains are actuated by a prime mover J through a transmission K. The force exerted by dies H on the exterior surface of tubing or casing F is controlled by the use of fluid under pressure (preferably air), which pressure is in turn regulated by a valve L shown in Figure 2. Control of portions of the chains G to the extent that they engage tubing or casing F of different diametrical size is achieved by means of a carriage M (see Figure 6).

Carriage M is positioned within the confines of housing A, and is longitudinally adjustable therein by manually pivoting an arm O mounted on the housing as shown in Figure 1. A yoke P or other supporting structure is affixed to housing A, which yoke projects upwardly therefrom and is connected to a suitable flexible support R such as a rope or cable. An anchor cable S affixed to one end of housing A prevents same from rotating with the tubing or casing F.

In detail, housing A comprises an upwardly disposed, normally horizontal plate 10 as can best be seen in Figure 2, that includes an elongate portion having two side edges 10a and 10b and a rearwardly situated end edge 10c preferably of curved configuration. The forward end portion of plate 10 develops into jaw B that is defined by an outer curved edge 12, an inner curved edge 14, and a straight end edge 16. A continuous side wall 18 extends downwardly from edges 10a, 10b, 10c, and 12. The lower edge of side wall 18 develops into a plate 20 of the same shape as plate 10 and parallel thereto. Plates 10 and 20 have openings 22 and 24 respectively, formed therein in which transmission K is disposed. A second opening 26 is also provided in plate 10 for access to the interior of housing A, which opening is normally closed by a cover plate 28.

Jaw C as best seen in Figure 1, is defined by an upwardly disposed arcuate plate 30 having an outer curved edge 32, an inner curved edge 34, and a straight outer end edge 36 that is adapted to abut against edge 16 of jaw B. Jaw C has a side wall 38 extending downwardly from a portion of outer edge 32. The lower edge of side wall 38 develops into a plate 40 identical in shape to plate 30 and parallel thereto.

Plates 30 and 40 have two rearwardly extending lug portions 30a and 40a respectively, in which vertically aligned bores 30b and 40b are formed. Plates 10 and 20 are also provided with vertically aligned bores 42 and 44 respectively. A pair of heavy bolts 46 extends through bores 42, 44, 30b and 40b, and pivotally supports jaw C from housing A. A U-shaped handle 48 is mounted on jaw C, and a similar handle 50 is mounted on the rearward portion of housing A, as may best be seen in Figure 1. A third U-shaped handle 49 is provided and mounted on jaw B as shown in Figures 1 and 2.

Longitudinal adjustment of the endless chains G for the particular diameter of the tubing or casing F to be engaged thereby is accomplished by use of the handle O. Handle O includes a rod 52 that is mounted at substantially a right angle on the outer end portion of a transversely disposed shaft 54. Rod 52 preferably terminates in a ball 55 for easy manipulation of the rod. A pin 56 extends inwardly from rod 52 and is adapted to engage

any one of a plurality of semi-circularly spaced bores 57 formed in side wall 18, as shown in Figure 1.

A journal block 58 is supported on plate 20 within the confines of housing A and rotatably supports one end portion of shaft 54. The other end portion of shaft 54, adjacent rod 52, is rotatably supported in a bore 60 formed in side wall 18. A collar 62 is mounted on the end of shaft 54 opposite that which supports rod 52. A compressed helical spring 64 encircles that portion of shaft 54 between the inner face of collar 62 and the outer face of the journal block 58. Spring 64 at all times tends to urge pin 56 into one of the bores 57.

A cylindrical member 68 is eccentrically mounted on shaft 54, which member rotatably engages one end of carriage M, as can best be seen in Figures 3 and 6. Rotation of shaft 54 causes member 68 to move carriage M longitudinally relative to housing A. Carriage M includes a rectangular base 70, on one end of which an upwardly and forwardly extending plate 71 is affixed that is in contact with the eccentric member 68. Two laterally spaced, upwardly projecting ears 71a are formed or mounted on the rear end portion of base 70, which ears support a shaft 72 therebetween.

A cylinder 74 is provided in which a piston 76 is slidably disposed, and from which piston a piston rod 78 extends rearwardly. Piston rod 78 terminates in an eye 80 that is positioned in a clevis 82 formed in a member 84 which is pivotally supported by its lower end portion on shaft 72. Fluid (preferably air) is supplied to the forward confines of cylinder 74 through a conduit 86.

Base 70 has several elongate, longitudinally extending slots 86 formed therein in which screws 88 affixed to base 70 are slidably mounted. Screws 88 serve as guides for the slidable movement of base 70 on plate 20, and prevent inadvertent separation of the base therefrom.

Transmission K has two laterally spaced, parallel, L-shaped arms 90 extending rearwardly therefrom. Each arm includes a horizontal leg 90a and a vertical leg 90b. Two rigid links 92 are provided, each of which links has a clevis 94 formed on one end and an eye 96 formed in the opposite end thereof. Clevises 94 permit links 92 to be pivotally connected by pins 98 to arms 90, as shown in Figure 6. The lower ends of legs 90b slidably engage the upper surface of base 70 to maintain legs 90a in parallel relationship to the base at all times. Eyes 96 are pivotally connected to a pin 100 that is mounted on member 84 in a position intermediate between shaft 72 and clevis 82. It will be apparent that the closer pin 100 is to the pin 72, the greater will be the force exerted by the arms 90 on transmission I as member 84 is pivoted by actuation of cylinder 74. The forward end of cylinder 74 at all times abuts against the forward face of plate 71.

Transmission K also includes two parallel, vertically spaced plates 104 that are longitudinally movable in the openings 22 (Figure 3). Flanges 104a are affixed to plates 104, with the flanges slidably engaging the plates 10 and 20 to prevent vertical movement of plates 104 relative thereto. One or more members 105 may be connected to plates 104 by conventional means such as welding, or by screws, bolts, or other suitable fastening means, to the forward end portions of arms 90.

A shaft 106 is rotatably supported in a vertical position in plates 104, which shaft is driven by the prime mover J that is preferably of the air motor type. Shaft 106 has three driving sprockets 106a, 106b and 106c mounted thereon.

Plates 10 and 20 rotatably support a vertical shaft 110 adjacent the edge 16 thereof, which shaft has two vertically spaced sprockets 110a and 110b mounted thereon. Another shaft 108 is rotatably supported in a vertical position by the plates 10 and 20 in a position intermediate the shafts 110 and 106. Shaft 108 has two vertically spaced sprockets 108a and 108b mounted thereon that

are in vertical alignment with sprockets 110a, 110b, and 106a, and 106b.

Plates 30 and 40 of jaw C rotatably support two shafts 112 and 114 that are oppositely disposed to shafts 110 and 108 respectively. Sprockets 112a and 114a respectively are mounted on shafts 112 and 114, and are in vertical alignment with sprocket 106a. Three endless roller chain belts G are provided, which for the sake of clarity are further identified as belts 116a, 116b and 116c. Belt 116a is rotatably supported on sprockets 106a, 108a, 110a, and belt 116b on sprockets 106b, 108b and 110b. The third belt 116c is rotatably supported on horizontally aligned sprockets 106c, 112a and 114a, and between belts 116a and 116b.

Each of the belts G is composed of a number of links 130 (Figure 7) that are pivotally connected by pins 132. Each link 130 supports a U-shaped die 134 having two laterally spaced side members 136 in which slots or holes 138 are formed that can be engaged by the pins 132. The outer edge portions of side members 136 are connected by a web 140 which has a hardened serrated face, or as shown in Figure 7, the web has a dovetailed recess 142 formed therein into which a hardened die 144 having downwardly and outwardly sloping end portions 144a can be slid transversely. Die 144 and web 140 are formed with bores 146 that are in alignment when the die is fully disposed in recess 142, with the bores being engaged by a suitable elongate fastening member 150 such as a small screw, rivet or the like, to prevent inadvertent displacement of a die from the supporting web by moving outwardly therefrom and parallel thereto.

The valve L is connected to a source of fluid (preferably air) under pressure by means of a conduit 152. Valve L is normally closed, but when it is opened by manipulation of handle 154, the structure of the valve is such that fluid is concurrently supplied through conduit 86 to cylinder 74, and by conduit 156 to motor J. This concurrent application of fluid under pressure causes the chain belts G to be tightened around the tubing or casing F due to rearward movement of carriage M, and practically simultaneous rotation of the chain belts due to actuation of the prime mover J.

In use, the operation of the invention is extremely simple. The device is supported at a convenient position in the derrick by means of the flexible cable or a rope R, and the rearward end of the invention is restrained as to rotational movement beyond a predetermined point by the anchor cable S.

Prior to operation, the diameter of the tubing or casing F on which the tongs of the present invention are to be used is determined, whereupon the handle O is pulled outwardly and rotated until the positioning of the belts G is substantially as shown in Figure 8b. The belts shown in this figure are sufficiently slack to permit them to snugly engage the tubing or casing F when the invention is disposed in the closed position shown in Figure 1. After this adjustment is made the handle O is released, with the pin 56 engaging one of the openings 57 due to the action of spring 64. Rotation of handle O in turn causes rotation of eccentric member 68 to move the carriage M rearwardly as previously explained in detail. The greater the pivotal movement of the handle O toward the rearwardmost opening 57, the more carriage M is moved rearwardly relative to housing A. Such rearward movement of the carriage results in concurrent rearward movement of transmission K and a lengthening of the distance between the shafts 106 and 108. The greater the adjusted distance between shafts 106 and 108, the less the slack in chain belts G to wrap around the tubing or casing F. Once the handle O has been used to adjust the chain belts G to a tubular member of a particular diameter, no further belt adjustments have to be made until a tubular member of a different diameter is to be engaged.

Latch D, as can best be seen in Figures 1 and 2, in-

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cludes an elongate bar 170, from the sides of which a pin 172 projects in a position intermediate the ends 174 and 176 of the bar. Pin 172 is pivotally supported in two laterally spaced journals 175 affixed to jaw B. A compressed helical spring 173 is situated between the end portions 174 of bar 170 and the exterior surface of jaw B. A hollow rectangular handle 180 is affixed to end portion 176, which handle has two sections 180a and 180b that extend outwardly from bar 170. When jaws B and C are in the closed position, bar 170 is disposed between two laterally separated lugs 182 and 184 affixed to jaw C (Figure 1), with the spring 173 at all times urging the bar to so remain. The laterally extending handle sections 180a and 180b abut against the exterior faces of lugs 182 and 184 when jaws B and C are in the closed position, and prevent the separation thereof. An outward pull on handle 180 brings it out of abutting contact with lugs 182 and 184 to permit jaw C to be swung into an open position by means of handle 160.

The invention is now ready for use, and by means of handle 160 which extends outwardly from jaw C, the latch D is unlocked to place jaw C in the open position. With jaw C open, the invention is swung to a position where the jaw can be placed in the closed position and encircle a portion of tubing or casing F within the confines of jaw portions B and C. Jaw C is then locked to jaw B by latch D. The latch can be any one of the commercially available types desired.

Valve L is next placed in the open position, which causes prime mover J to start rotating chains G, and piston rod 73 concurrently moves rearwardly to exert force on the chains and hold the dies H mounted thereon in tight frictional engagement with the tubing or casing F. Rotation of chains G, of course, causes rotation of the tubing or casing F, yet rotation of the entire apparatus is prevented by the anchor cable S. After the tubing or casing F has been rotated the desired amount, the valve L is closed, and the latch D actuated to permit the apparatus to be separated from the tubing or casing F. This operation is then repeated to spin the next succeeding length of pipe in the manner described.

When the dies 144 become worn after prolonged use, the rivet 150 or other fastening means is simply removed, the die slid transversely from the cavity 142, and a new die substituted therefor.

If desired, it is possible to have valve L of the invention simply control the flow of fluid to cylinder 74 and the conduit 156 separately supply fluid to the motor J. When this variation of the invention is utilized, flow of fluid through conduit 156 is controlled by an elongate spring-loaded, normally closed valve 156a (Figure 1). This form of the invention operates in precisely the same manner as previously described, other than the fact that the valve L must be opened manually to tighten the chain belts G, and the valve 156a then manually opened to actuate motor J. The advantage of this form of the invention resides in the fact that different fluid pressures can be employed in the actuation of cylinder 74 and motor J. Valve 156a is maintained in a fixed position relative to housing A by a Y-shaped support 186 extending upwardly therefrom.

Although the invention herein shown and described is fully capable of achieving the objects and providing the advantages heretofore mentioned, it is to be understood that it is merely illustrative of the presently preferred embodiment of the invention, and it is not intended to limit the device to the details of construction herein shown and described, other than as defined in the appended claims.

I claim:

1. A power driven device for rotating tubing or casing of various diameters, including: first and second opposing endless belts arranged in a generally triangular configuration, with first and second portions respectively of said belts being situated adjacent to one another; first

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rotatable means that rotatably support forwardly disposed portions of said first belt; second rotatable means that rotatably support forwardly disposed portions of said second belt; third rotatable means that rotatably support rearwardly disposed portions of both said first and second belts; a movable carriage that supports said third rotatable means, which carriage when moved toward said first and second rotatable means places sufficient slack in said first and second belt portions to permit them to engage opposite and separate surface areas of said tubing or casing; first power means for moving said carriage in a direction away from said first and second rotatable means to place sufficient tension on said belts that said first and second portions thereof are in non-slipping contact with said surface areas; and second power means that rotates said third rotatable means to drive said belts and rotate tubing or casing that is engaged thereby when said belts are under tension.

2. A power driven device as defined in claim 1 wherein an elongate housing is provided having a first arcuate jaw formed on the forward portion thereof adapted to encircle a portion of said tubing or casing, and a second arcuate jaw is pivotally supported from said housing opposite said first jaw, which second jaw is adapted to encircle the balance of said tubing or casing, said jaws being formed with edge portions that are in abutting contact when said jaws are closed, said first rotatable means is supported in said first jaw, and said second rotatable means is mounted on said second jaw.

3. A power driven device as defined in claim 2 wherein said first and second jaws are formed with curved inner edges that define a circular opening in which said tubing or casing can be disposed when said jaws are closed.

4. A power driven device as defined in claim 3 wherein locking means are mounted on said first and second jaws that automatically hold said jaws in a closed position.

5. A power driven device as defined in claim 4 wherein at least sections of said first and second belt portions are disposed in said opening to engage said casing or tubing.

6. A power driven device as defined in claim 5 wherein said carriage is mounted in said housing rearwardly of said jaw, and said first power means is a fluid-actuated piston and cylinder positioned in said housing.

7. A power driven device as defined in claim 6 wherein said second power means is a fluid-actuated motor.

8. A power driven device as defined in claim 6 wherein said cylinder and piston are movably mounted in said housing and an eccentric member is provided that is pivotally and adjustably supported in said housing forwardly of said cylinder, with the position of said member so limiting the forward movement of said cylinder and carriage as to provide sufficient slack in said first and second belt portions to engage tubing or casing of a particular external diameter.

9. A power driven device as defined in claim 8 in which valve means are provided which admit fluid under pressure into said first and second power means as desired by the operator.

10. A power driven device as defined in claim 9 wherein said valve means when actuated concurrently delivers fluid to said first and second power means.

11. A power driven device as defined in claim 10 wherein said valve means when actuated delivers fluid first to said first power means and thereafter to said second power means.

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