May 22, 1956 W. W. PAGET 2,746,329

SPINNING DEVICE FOR DRILL PIPE

Filed Feb. 6, 1953 2 Sheets-Sheet 1

FIG. 1.

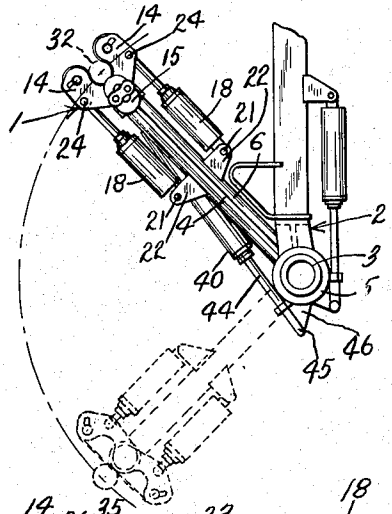


FIG. 2.

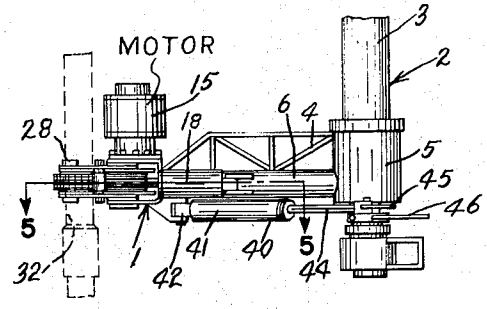


FIG. 3.

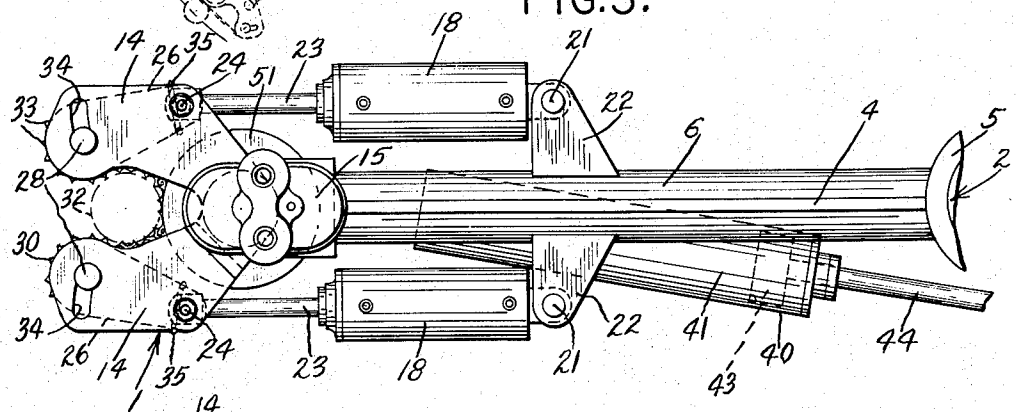
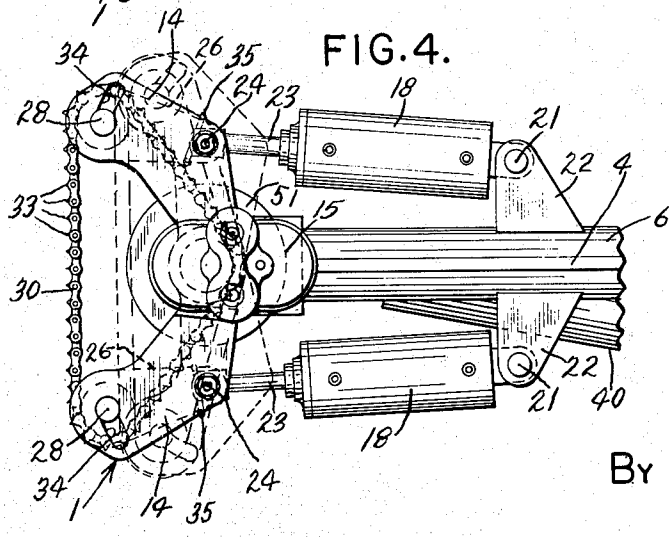


FIG. 4.



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SPINNING DEVICE FOR DRILL PIPE

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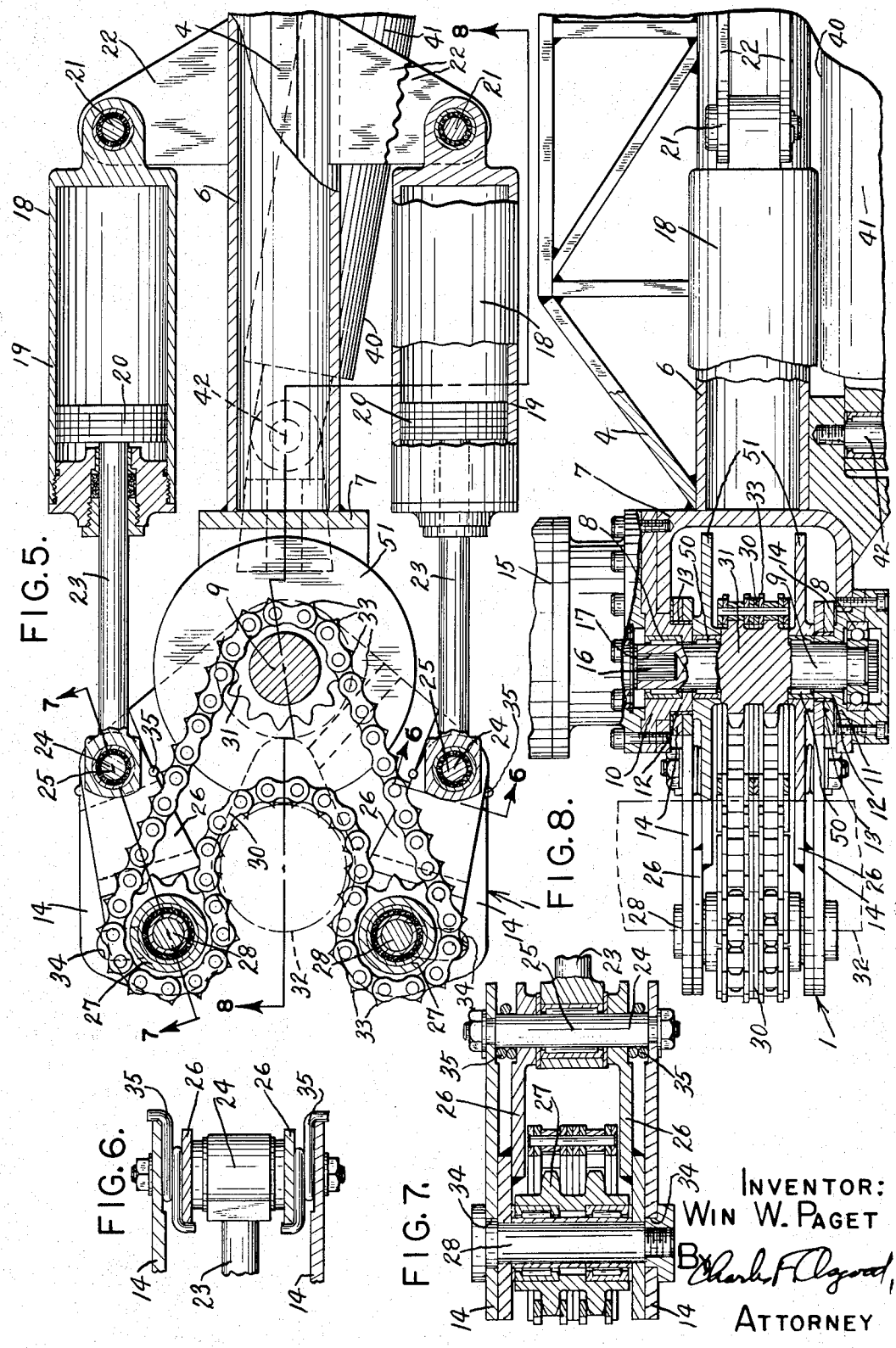


FIG. 5.

FIG. 8.

FIG. 6.

FIG. 7.

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SPINNING DEVICE FOR DRILL PIPE

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Application February 6, 1953, Serial No. 335,477

23 Claims. (Cl. 81—53)

This invention relates to spinning devices and more particularly to spinning devices for rapidly rotating sections or stands of drill pipe during the coupling and uncoupling of drill pipe joints.

In oil well drilling apparatus the drill pipe joints are usually made and broken by make and break tongs such as disclosed in my copending application, Serial No. 291,156, filed June 2, 1952, now matured into Patent No. 2,737,839, granted March 13, 1956, owned by the same assignee as the present invention, and during the making up and breaking out of the drill pipe joints it is desirable to rapidly rotate the upper pipe section or sections to expedite the coupling and uncoupling of the joints. Various known devices have been provided to effect such a spinning function and the present invention contemplates improvements over such known devices.

An object of the present invention is to provide an improved drill pipe spinning device. Another object is to provide an improved spinning device which may be quickly positioned and adjusted with respect to the work. Still another object is to provide an improved spinning device having improved and reliable means for rotating the drill pipe. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings:

Fig. 1 is a plain view illustrating a preferred embodiment of the spinning device and the associated supporting structure.

Fig. 2 is a side elevational view of the device shown in Fig. 1.

Fig. 3 is an enlarged plan view of the spinning device per se in pipe engaging position.

Fig. 4 is a fragmentary plan view of the spinning device shown in Fig. 3, with the operating levers for the pipe engaging and rotating means swung apart into open position.

Fig. 5 is an enlarged horizontal section taken on line 5—5 of Fig. 2.

Fig. 6 is an enlarged detail vertical section taken on line 6—6 of Fig. 5, showing the torsion springs for one of the idler sprocket levers.

Fig. 7 is an enlarged detail vertical section taken on line 7—7 of Fig. 5.

Fig. 8 is a longitudinal vertical section taken in the planes of line 8—8 of Fig. 5, and with parts shown in full.

In this illustrative construction, as shown in the drawings, the improved spinning device generally designated 1 is shown mounted on a supporting structure generally designated 2. The supporting structure comprises a vertical support 3 and the spinning device is mounted at its inner end on this vertical support to swing in horizontal planes. Evidently, the spinning device may be mounted in various other manners.

The spinning device comprises a horizontal frame 4, desirably of a fabricated welded construction, having a cylindrical inner bearing engaging portion 5 surrounding and mounted on the vertical support 3. The frame 4 has a tubular central body 6 which carries at its outer portion a housing or casing 7 (see Fig. 8) secured to the outer end of the tubular frame body 6 and journaled within bearings 8 supported within this housing is a vertical drive shaft 9. The housing has top and bottom caps or plates 10 and 11 secured, as by screws, to the housing and the bearings 8 are supported within these caps or plates in the manner shown in Fig. 8. These caps or plates provide aligned trunnions 12 supporting bearings 13 on which horizontally swingable arms or levers 14 are pivotally mounted. Mounted at the top of the housing is a motor 15, herein desirably a conventional reversible fluid motor, provided with a built in speed reducer having its terminal driven element 16 coupled at 17 to the upper end of the vertical shaft 9.

In this improved construction a pair of fluid jacks 18 are arranged longitudinally on the frame 4 at opposite sides of the tubular central body 6 (see Figs. 3 and 5), and these jacks comprise fluid cylinders 19 containing reciprocable pistons 20. The cylinders are pivotally mounted at their rearward ends at 21 on lateral lugs 22 secured to the opposite sides of the tubular frame body 6 to swing in horizontal planes about their pivots. The pistons have piston rods 23 projecting outwardly from the cylinders and they are pivotally connected at 24 to vertical pivot shafts 25, herein desirably in the form of studs, secured to the lever arms 14. Also as shown in Fig. 7 pivotally mounted on the shafts 25 are relatively short lever arms or levers 26 which carry multiple chain idler sprockets 27 journaled on vertical shafts 28 secured to the lever arms 26.

A relatively wide, multiple, endless drive chain or belt 30 engages and is driven by a drive sprocket 31 secured to the vertical drive shaft 9 and this chain is looped about the idler sprockets 27 with its outer portion which extends between the idler sprockets adapted to embrace a drill pipe designated 32. This endless chain has outer serrations 33 so that when the intermediate outer portion of the chain is brought into contact with or wrapped partially about the drill pipe to be rotated, by swinging the lever arms 14 inwardly about their pivots into the position shown in Fig. 5, the pipe is firmly gripped. Fluid may be trapped in the cylinders 19 to hold the lever arms 14 firmly in adjusted position. The shafts 28 on which the idler sprockets are journaled extend axially through arcuate slots 34 (Figs. 3, 4 and 5) formed in the lever arms 14 and these slots permit swinging movement of the levers 26 relative to the levers 14, and torsion springs 35 encircle the pivot shafts 25 (Figs. 6 and 7) and are connected between the levers 14 and 26 for constantly urging the latter inwardly about their pivots yieldingly to hold the idler sprockets 27 in the position shown in Fig. 5. These torsion springs serve to control the slack in the drive chain and are adapted to yield to permit limited swinging movement of the levers 26. These arcuate slots limit the extent of swinging movement of the lever arms 26 in either direction about their pivots relative to the levers 14.

A horizontal fluid jack 40 has its cylinder 41 pivotally connected at 42 to the lower portion of the swinging frame 4 of the spinning device, and reciprocable in this cylinder is a piston 43 having its piston rod 44 projecting outwardly from the cylinder and pivotally connected at 45 to a lateral lug 46 integral with the frame bearing portion 5. By properly supplying fluid under pressure to the jack cylinder 41 the frame 4 of the spinning device may be swung horizontally on its pivotal mounting, and fluid may be trapped in the cylinder 41 to hold the frame 4 firmly in adjusted position.

Journaled on bearings 50 supported by the vertical

shaft 9 above and below the chain sprocket 31 are axially spaced idler rollers 51 which are adapted to bear against the exterior periphery of the drill pipe whenever the drive chain is brought into driving contact with the drill pipe as shown in Fig. 5.

The general mode of use of the improved spinning device is as follows: The spinning device is adapted for association with the make and break tongs of my copending application above referred to and after the pipe joint is broken or prior to final tightening of the pipe joints, the upper pipe section or sections may be rapidly rotated in the proper direction by the spinning device of the present invention. Fluid under pressure may be supplied to the swing jack 40 and the spinning device may be swung horizontally about its pivotal mounting until the rollers 51 engage the outer periphery of the drill pipe, with the spinning device positioned as shown in Figs. 1 and 2. Fluid under pressure may then be supplied to the jacks 18 to swing the lever arms 14 inwardly about their pivots to bring the outer run of the drive chain 30 into firm gripping contact with the upper pipe section as shown in Fig. 5, and the motor 15 may then be operated to drive the chain to cause rapid orbital circulation thereof about the sprockets thereby rapidly to rotate the drill pipe section. The spring controlled levers 26 on which the idler sprockets 27 are journaled, serve to hold the drive chain in driving contact with the drill pipe section with the chain at the desired tension and these levers may swing slightly outwardly about their pivots against the action of the torsion springs as the pipe section is rotated. The spinning device may be readily released from the drill pipe simply by operating the jacks 18 to swing the lever arms 14 wide apart as shown in Fig. 4 and thereafter the fluid jack 40 may be operated to swing the spinning device horizontally into the out-of-the-way lateral position indicated in dotted lines in Fig. 1.

As a result of this invention, an improved drill pipe spinning device is provided which is relatively rugged and simple in design yet extremely efficient in operation. By the provision of the improved mounting for the spinning device and the levers for adjusting the pipe gripping means, the device may be quickly positioned with respect to the drill pipe and moved into pipe gripping position. The improved spring mountings for the idler sprocket levers which are carried by the swinging arms of the spinning device not only remove any slack in the endless drive chain during engagement with the drill pipe but also provide for some yielding during rotation of the pipe section. These and other uses and advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. A spinning device for drill pipe comprising a casing, a pair of levers pivotally mounted on said casing and projecting therefrom in positions to straddle a drill pipe, means for swinging said levers about their pivots, an endless drive chain engageable with the drill pipe for rotating the latter, idler sprockets about which said chain passes, driving means carried by said casing for circulating said chain about said idler sprockets, lever arms pivotally mounted on said levers respectively to swing relative thereto and by which said sprockets are respectively carried, and yieldable means acting on said lever arms for urging the latter inwardly toward their innermost positions with respect to said levers.

2. A spinning device as set forth in claim 1 wherein said driving means includes a drive sprocket journaled on said frame and engaging the inner intermediate portion of said endless chain for circulating the latter relative to said idler sprockets.

3. A spinning device as set forth in claim 2 wherein said levers have their pivots arranged coaxially with and in the same straight line as the axis of said drive sprocket.

4. A spinning device for drill pipe comprising a casing, a pair of levers pivotally mounted on said casing and projecting therefrom in positions to straddle a drill pipe, pipe engaging and rotating means carried by said casing and operatively associated with said levers, motor operated means for swinging said levers to move said pipe engaging and rotating means into and to hold the same in pipe engaging and rotating position with respect to the pipe, and a roller journaled on said casing and projecting therefrom intermediate the inner portions of said levers, said roller engaging the pipe periphery to provide a bearing for the device upon the drill pipe for receiving the thrust imparted by said pipe engaging and rotating means when the latter is in operative pipe engaging and rotating position.

5. A spinning device as set forth in claim 4 wherein said pipe engaging and rotating means comprises an endless flexible drive element adapted to embrace the exterior periphery of the drill pipe and having outer pipe engaging serrations whereby said flexible element may grip the drill pipe.

6. A spinning device for drill pipe comprising a casing, a pair of levers pivotally mounted on said casing and projecting therefrom in positions to straddle a drill pipe, pipe engaging and rotating means carried by said casing and associated with said levers, means for swinging said levers inwardly toward one another to move said pipe engaging and rotating means into pipe engaging and rotating position with respect to the pipe, and a roller journaled on said casing and projecting therefrom intermediate the inner portions of said levers, said roller engaging the pipe periphery to provide a bearing for the device upon the drill pipe when said pipe engaging and rotating means is in operative pipe engaging and rotating position, said pipe engaging and rotating means comprising an endless flexible drive element adapted to embrace the drill pipe when said levers are swung inwardly as aforesaid and a rotatable driving element journaled on said casing and engaging said endless flexible element for driving the latter, said roller having its axis of rotation aligned with the axis of rotation of said rotatable driving element.

7. A spinning device for drill pipe comprising a casing, a pair of levers pivotally mounted on said casing to swing in common planes, said levers projecting from said casing in positions to straddle a drill pipe, an endless flexible element for engaging and rotating the drill pipe, motor operated means on said casing for driving said flexible element comprising a rotatable drive member, rotary guides mounted on said levers and about which said flexible element passes, means for mounting said rotary guides for limited movement inwardly relative to said levers, and yieldable means for urging said rotary guides inwardly toward one another relative to said levers to take up slack in said flexible element during engagement of the latter with the drill pipe.

8. A spinning device as set forth in claim 7 wherein said mounting means comprises lever arms pivotally mounted on said levers respectively and by which said rotary guides are carried and said yielding means comprises springs for urging said lever arms inwardly about their pivots relative to said levers.

9. A spinning device as set forth in claim 8 wherein said rotary guides are journaled on shafts carried by said lever arms respectively, and said levers have arcuate slots through which said shafts extend and said slots limit the swinging movement of said lever arms in opposite directions relative to said levers.

10. A spinning device for drill pipe comprising a casing, a drive shaft journaled on said casing, a pair

of oppositely extending levers pivotally mounted on said casing to swing relative thereto and projecting from said casing in positions to straddle a drill pipe, axially spaced rollers journaled in coaxial relation with said shaft and projecting from said casing intermediate the inner portions of said levers, said rollers engaging the drill pipe periphery during spinning of the pipe, an endless flexible driving element guided for orbital movement and engageable with a pipe to be rotated, means carried by said levers for guiding said flexible driving element, and a driving element secured to said shaft between said rollers and engaging said flexible driving element for circulating the latter relative to said guiding means.

11. A spinning device as set forth in claim 10 wherein said guiding means comprises rotary idlers carried by said levers and about which said flexible driving element passes, the inner portion of said flexible element between said idlers passing around said driving element.

12. A spinning device for drill pipe comprising a support, a pair of levers pivotally mounted on said support and projecting therefrom in positions to straddle a drill pipe, an endless flexible drive element adapted to embrace the exterior periphery of a drill pipe for rotating the latter, means for effecting orbital circulation of said flexible element, rotary guides on said levers respectively and about which said flexible element passes as it is circulated, and movable yieldable mountings for said rotary guides on said levers respectively for maintaining said flexible drive element under the proper tension during engagement of said flexible element with the drill pipe.

13. A spinning device as set forth in claim 12 wherein said movable yieldable mountings comprise lever arms pivotally mounted on said levers respectively, and springs act on said lever arms for urging the latter inwardly about their pivots relative to said levers.

14. A spinning device as set forth in claim 12 wherein said levers are pivoted on said support to swing about aligned axes.

15. A spinning device for drill pipe comprising a support, a pair of levers pivotally mounted on said support to swing in common planes relative thereto and projecting therefrom in positions to straddle a drill pipe, pipe rotating means carried at the outer portion of said support including a rotating element having an orbitally moving pipe engaging portion adapted to embrace the pipe, yieldable mounting means for said orbitally moving pipe engaging portion on said levers, means for mounting said support at its inner end remote from said pipe rotating means, and a motor carried in fixed relation at the outer end portion of said support for driving said pipe rotating means.

16. A spinning device for drill pipe comprising a support, adjustable pipe embracing and gripping means carried by said support, roller means journaled on said support at the inner side of said pipe embracing and gripping means and engageable with the exterior periphery of the drill pipe, and means for adjusting said pipe embracing and gripping means into pipe embracing and gripping position, said last mentioned means when adjusted into pipe embracing and gripping position causing said roller means to be held firmly in rolling contact with the drill pipe to provide a bearing for the device upon the pipe at the adjacent side of the latter.

17. A spinning device as set forth in claim 16 wherein said pipe embracing and gripping means includes a flexible pipe embracing and gripping element guided for circulation in an orbital path, and said adjusting means is effective to change the shape of the orbit of said element as the latter is adjusted into and out of pipe embracing and gripping position.

18. A spinning device for drill pipe comprising a casing, a pair of cooperating, oppositely moving levers pivotally mounted on said casing and projecting therefrom in positions to straddle the drill pipe, pipe engaging and rotating means carried by said casing and operatively associated with said levers, means on said casing for swinging said levers inwardly toward one another about their pivots on said casing to move said pipe engaging and rotating means into pipe engaging and rotating position with respect to the drill pipe, and roller means journaled on said casing at the inner pivoted ends of said levers and having a peripheral portion projecting from said casing into engagement with the pipe periphery to provide a bearing for the device upon the pipe for receiving the thrust imparted by said pipe engaging and rotating means when the latter is in operative position with respect to the pipe.

19. A device as set forth in claim 18 wherein said roller means and the pivots of said levers are in coaxial relation.

20. A device as set forth in claim 19 wherein said roller means comprises axially spaced rollers journaled on said casing and said pipe engaging and rotating means includes a driven element arranged coaxial with and between said spaced rollers.

21. A spinning device for drill pipe comprising an elongated support, a pair of cooperating lever arms pivotally mounted at their inner ends on said support and disposed symmetrically with respect to the longitudinal median line of said support at the opposite sides of said line, rotary guides journaled on vertical axes at the outer end portions of said lever arms, a rotary drive member journaled on said support with its vertical axis of rotation lying in a longitudinal vertical plane in which said median line also lies, an endless driving element engaging said rotary drive member and passing around said rotary guides, extensible power jacks extending generally longitudinally of said support at the opposite sides thereof and pivotally mounted at the rear ends on said support to swing horizontally, means for pivotally connecting the outer ends of said jacks to the outer sides of said lever arms at points intermediate the ends of the latter, and means for operating said jacks to swing said lever arms about their pivots, said lever arms swingable inwardly to move said endless driving element into embracing engagement with a drill pipe to be rotated.

22. A spinning device as set forth in claim 21 wherein said pivotal axes of said lever arms are coaxial and are aligned with the axis of rotation of said rotary drive member.

23. A spinning device for drill pipe comprising an elongated support, a pair of cooperating lever arms pivotally mounted at their inner ends on said support to swing toward and from one another, a motor driven rotary drive member journaled on said support, guides carried at the outer portions of said lever arms, an endless driving element engaging said rotary drive member and passing around said guides, extensible power jacks extending generally longitudinally of said support along the opposite sides thereof, means for operatively connecting said power jacks to said lever arms at the intermediate portions of the latter, and means for operating said jacks to swing said lever arms about their pivots, said lever arms swingable about their pivots inwardly toward one another to bring said endless driving element into embracing driving contact with the exterior periphery of a drill pipe to be rotated.

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