Dec. 29, 1942. D. M. SMITH 2,306,647

KELLY DRIVER ASSEMBLY

Filed Feb. 9, 1942

Fig. 1

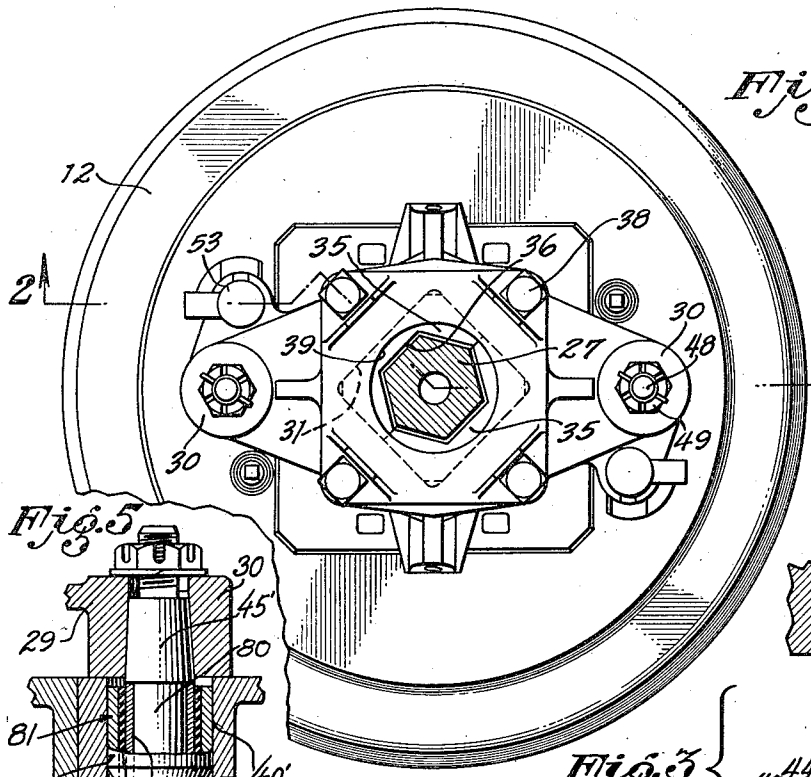


Fig. 5

Fig. 3

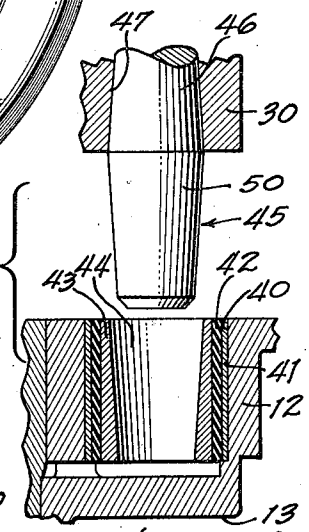


Fig. 2

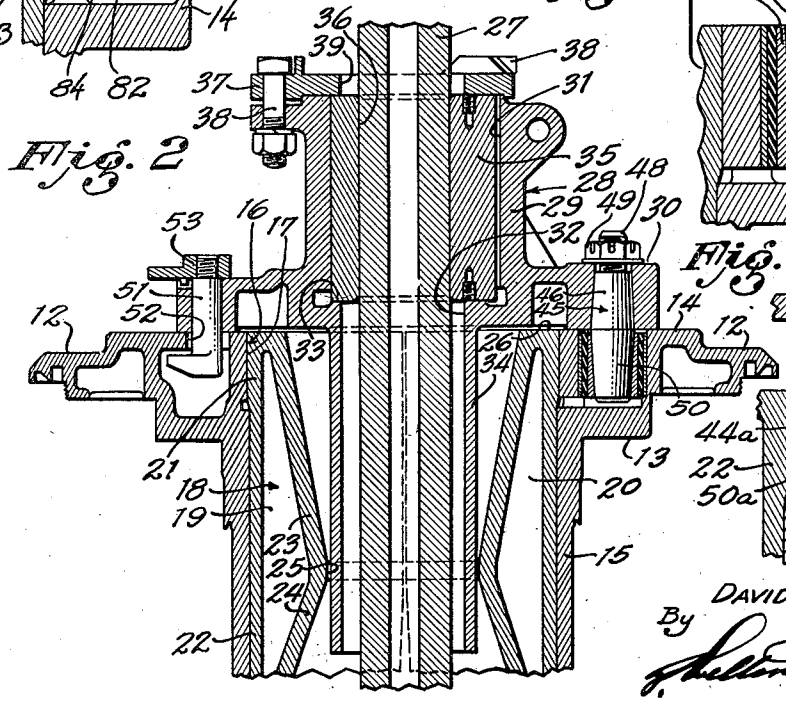
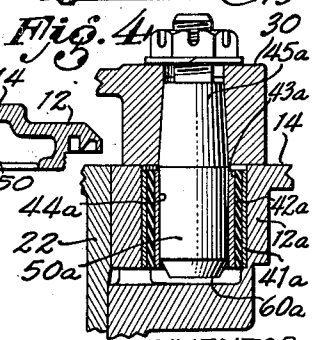


Fig. 4



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KELLY DRIVER ASSEMBLY

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Application February 9, 1942, Serial No. 430,006

3 Claims. (Cl. 255—23)

This invention relates to rotary well drilling equipment, and relates in particular to an attachment for a rotary machine through which rotation may be transmitted to a string of drill pipe used in a drilling operation.

The now standard method of rotating a string of drill pipe in a well uses a Kelly bar at the upper end of the string of drill pipe of polygonal cross-section extending through a similar polygonal opening in a part carried by the table of the rotary machine. The rotation of the table is accordingly carried directly to the Kelly bar, with the result that the pipe string, of which the Kelly bar forms a part, is rotated. In the rotary table there is normally a master bushing providing a vertical opening through which a string of pipe may be extended. This master bushing has a tapered seat arranged to receive slips by which to grip and support a pipe which extends through the master bushing.

An object of the present invention is to provide a Kelly driver which may be connected to the table of the rotary machine without necessity of removing the master bushing from the opening of the table, and which has no part engaging the master bushing so as to wear the master bushing, and cause wear between the master bushing and the walls of the table opening in which the master bushing rests.

A further object of the invention is to provide a Kelly driver for use with the table of a rotary machine which Kelly driver permits use of a master bushing in the opening of the table, which master bushing has its upper surface flush with the top surface of the table. The master bushing remains in place in the opening of the table during the driving of the string of drill pipe, and in event that holding of the drill pipe in raised position becomes necessary, this may be accomplished merely by raising the kelly which will in turn lift the Kelly driver from the upper face of the table, and bring the upper section of the drill pipe into a position projecting through the opening of the master bushing, whereupon the slips may be immediately placed in the resident master bushing. There is, accordingly, no delay occasioned by the necessity of placing a master bushing in the opening of the table, and the upper end of the opening formed by the seat of the master bushing is exposed at the upper surface of the table, facilitating the ready placing of the slips in the master bushing, since the shoulder defining the upper extremity of the opening in the master bushing is plainly visible in the plane of the upper surface of the table and is not offset downwardly within the opening of the table.

A further object of the invention is to provide a Kelly driver cooperating with the table of a rotary machine in such manner that wear on the gears and bearings of the rotary table and shock applied through the rotary table to the drill stem are minimized. During the drilling operation the rotary table is driven through a pinion gear which drives a ring gear secured to the table. Very often heavy vibration is transmitted from the cutting zone at the bottom of the hole through the drill pipe to the rotary table. Also the play existing between the Kelly drive bushing and the Kelly bar results in severe jolts being applied to the drill stem by the rotary table. The present invention provides between the Kelly driver and the rotary table a shock absorbing means which will minimize the transmission of shocks and vibration to and from the table and drill pipe, thereby reducing the severity of operating conditions which tend to cause crystallization of drill pipe, tool parts, and gear and bearing parts in the rotary machine.

A further object of the invention is to provide a Kelly driver having means for driving interengagement between the body of the driver and the table, and also having means for automatically bringing the interengaging parts into alignment. This is an important element of the invention. In many instances there may be four to seven thousand feet of drill pipe hanging from the kelly, making it difficult to bring the cooperating parts of an ordinary Kelly driver into engagement with the table.

An additional object is to provide in a Kelly driver, a drive pin and bushing construction that is self-conpensating for wear, and always maintains a tight fit, and furthermore, has readily replaceable parts.

Other objects and advantages will appear and be brought out more fully in the course of the following detailed description of the invention chosen for illustrative purposes. It will be understood that the invention is not limited to the details of construction hereinafter described, but should be construed to cover all the modifications and changes thereof which come within the spirit and scope of the appended claims.

In the drawing,

Fig. 1 is a plan view of the table portion of a rotary machine incorporating the Kelly driver of my invention.

Fig. 2 is a vertical, sectional view of the same taken along the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary view in sectional ele-

vation showing the drive pin connection between the drill stem bushing and the table, the parts being in separated position.

Fig. 4 is a fragmentary sectional view showing a second form of drive pin connection between the drill stem bushings and the table, the parts being shown in driving relation to each other.

Fig. 5 is a fragmentary sectional view similar to Fig. 4, but showing the cushioned drive means on the drive pin which projects downwardly from the Kelly driver.

Referring to the drawing in detail, the numeral 12 represents the rotary table of a rotary machine and has a shouldered portion 13 for engagement with a suitable supporting bearing member, the table having a top 14 and a downwardly depending skirt 15.

The table 12 has a table opening 16 concentric to the axes of rotation of the table, and the opening has a shouldered portion 17 in which a table bushing 18 is suitably supported. The bushing 18 preferably comprises two halves, 19 and 20, so that it may be installed in the table opening while a drill pipe or stem is extending through the table opening.

The bushing 18 has an upper shouldered portion 21 for engagement with the upper shouldered portion 17, and has a lower cylindrical portion 22 which extends downwardly in opening 16 and bears against the skirt 15. The bushing 18 has an upper tapered or conical wall portion 23 for supporting the slips, and a lower tapered or conical wall portion 24 forming a guide ring surface 25. The bushing 18 has an upper surface portion 26 substantially level with the top 14 of the table 12, whereby the slips may be positioned in the bushing with facility, since the top of the bushing 18 is within view at the top of the table at all times. A Kelly drive pipe 27 is shown extending through the table opening 16 and the bushing 18.

A Kelly driver or drill stem bushing 28 is mounted on the table 12 and has a vertical shouldered portion 29, and a pair of base extensions 30 supported on the top 14, the bushing having a square shaped enlarged opening 31, and a reduced cylindrical opening 32 through which the kelly 27 extends. Openings 31 and 32 form a shouldered seat 33, and a cylindrical skirt 34 extends downwardly through the bushing 18 and the guide ring 25, there being a small clearance therebetween. A liner bushing 35 is positioned in the opening 31 and is supported on the shouldered seat 33. The liner 35 is preferably composite, that is, comprises two or more parts which form a shouldered polygonal opening 36, the shoulders of which engage and drive the kelly 27, which will have a polygonal, external shape corresponding to the opening 36. A liner locking plate 37 is suitably secured to the top of the bushing 28, such as by plurality of bolts 38, and has a drill pipe opening 39, the edge portion of which is above the bushing 35.

The table 12 is provided with drive holes or cylindrical bores 40 in which is positioned a metallic sleeve 41, a rubber sleeve 42 being positioned in the sleeve 41. A pin bushing 43 is positioned with the rubber sleeve 42 and has a downwardly tapering bore 44. A drive pin 45 is secured to each base extension 30, such as by a tapered shank portion 46 positioned in a tapered bore 47 in the base extension 30, pin 45 having a threaded end 48 for a lock nut 49. The pin 45 has a tapered end portion 50 corresponding to the taper of the bore 44, it being understood that the axes of the bore 44 and the pin 45 are equidistant from the axis of rotation of the table 12.

Extensions 30 are each provided with a locking pin 51, adapted to be inserted through an aperture 52 in the table 12, and provided with a suitable tightening nut member 53, whereby the bushing 28 is secured against removal from the table.

In operation the Kelly drive bushing 28 is lowered onto the table 12, pins 45 being centered for entrance into the sleeves 43 by the skirt 34 as it passes into the table bushing 18, being guided by the tapered wall 23 and the guide ring 25 which substantially centers the Kelly bushing, and the engagement of the pins 45 with the sleeves 43 is facilitated, which operation is otherwise often very difficult, particularly when there is a long string of pipe such as five or six thousand feet, which is not an uncommon length. When the Kelly bushing is in driving position, as shown in Fig. 2, any shocks or impacts arising from the drill pipe are absorbed by the rubber or other resilient sleeve 42, and are not imparted to the table 12 and its associated bearings or driving gears, thus minimizing undue wear tending to cause crystallization of those parts. Also, shocks originating in the rotary machine are cushioned in their application to the drilling string.

The tapered drive pins and resiliently mounted bushing are automatically self-compensating for wear, and possible and occasional misalignment of the drive bushing and the rotary table, and insure a tight fit due to the upward pressure of the resilient sleeve on the tapered bushing. The drive pin and sleeves are readily removable and replaceable after excess wear or damage from any cause, and involve a minimum of time and cost therefor.

In Fig. 4 I have shown a form of my invention in which the pin 45*a* instead of being tapered at its lower end, has a cylindrical portion 50*a* which fits into a cylindrical bore 44*a* of the pin bushing 43*a*. This bushing 43*a* is supported within a rubber sleeve 42*a* which is in turn carried in the metallic sleeve 41*a*. These various parts are related to each other in the same manner as illustrated in Figs. 1 to 3 inclusive. The lower end of the pin 45*a* is provided with a taper 60*a* which in the event of disalignment of the cylindrical portion 50*a* with the bore 44*a* will guide the parts into alignment so that the pin may be moved downwardly into the bore 44*a*.

This form of my invention includes all of the features and advantages of the form of the invention disclosed in Figs. 1 to 3 inclusive with the exception that there are no tapered parts whereby the bushing which receives the pin may be depressed downwardly. However, in this form of the invention the guide sleeve on the drill stem drive bushing acts as a means for substantially centering the parts, but should there be a minor misalignment, the tapered end 60*a* will cause alignment between the pin and bushing.

In Fig. 5 I show the manner in which the shock absorbing connection of my invention may be carried on the extensions 30 of the Kelley driver 28, so as to project into openings 40' in the top 14 of the rotary table. The extension 30 carries a pin 45' having a downwardly projecting portion 80, which is substantially cylindric and is preferably of reduced diameter, as shown. A shock absorbing connection 81 is carried on the downwardly projecting portion 80 of the pin 45', such shock absorbing connection comprising an

inner metal sleeve 82, which is a pressed fit on the downwardly projecting portion 80, an outer sleeve 83 of hard metal and having its lower end chamfered, and an intervening cylindric body of rubber 84 occupying the space between the inner and outer sleeves 82 and 83. The opening 49' in the table top is cylindric and is of such diameter that the outer sleeve 84 is a close sliding fit therein. In this form of the invention, the worn shock absorbing drive member 81 may be readily replaced by removing the same from the pin 45' and substituting a replacement drive member 81 therefor.

I claim as my invention:

1. In a rotary machine of the class described having a base, the combination of: a table rotatably supported by said base, said table having a top and a table opening, a table bushing mounted in said opening and having the upper portion thereof substantially level with the top of said table, said bushing having an internal tapered portion forming a guide ring; a drill stem drive bushing for a kelly supported by said table and having a guide skirt portion extending into said table bushing within said guide ring; and a shock absorbing drive connection between said table and said drill stem bushing, including a drive pin and a resilient sleeve.

2. In a rotary machine of the class described having a base, the combination of: a table rotatably supported by said base, said table having a top and a table opening, a table bushing mounted in said opening and having the upper portion thereof substantially level with the top of said table, said bushing having an internal tapered portion forming a guide ring; a drill stem drive bushing for a kelly supported by said table and having a guide skirt portion extending into said table bushing within said guide ring; and a shock absorbing drive connection between said table and said drill stem bushing, including a drive pin and a resiliently supported sleeve.

3. In a rotary machine of the class described having a base, the combination of: a table rotatably supported by said base, said table having a top and a table opening, a table bushing mounted in said opening and having the upper portion thereof substantailly level with the top of said table, said bushing having an internal tapered portion forming a guide ring; a drill stem drive bushing for a kelly supported by said table and having a guide skirt portion extending into said table bushing within said guide ring; and a shock absorbing separable drive connection between said table and said drill stem bushing, including a tapered drive pin extending from said drill stem bushing and a tapered sleeve resiliently mounted in a bore in said table.

4. In a rotary machine of the class described having a base, the combination of: a table rotatably supported by said base, said table having a top and a table opening, a table bushing mounted in said opening and having the upper portion thereof substantially level with the top of said table, said bushing having an internal tapered portion forming a guide ring; a drill stem drive bushing for a kelly supported by said table and having a guide skirt portion extending into said table bushing within said guide ring; and a separable drive connection between said table and said drill stem bushing, including a drive pin and a resilient sleeve, said guide skirt and the tapered portion of said table bushing adapted to guie said pin into said sleeve.

5. In a rotary machine of the class described having a base, the combination of: a table rotatably supported by said base, said table having a top and a table opening, a table bushing mounted in said opening and having the upper portion thereof substantially level with the top of said table, said bushing having an internal tapered portion forming a guide ring; a drill stem drive bushing for a kelly supported by said table and having a guide skirt portion extending into said table bushing within said guide ring; and a drive connection between said table and said drill stem bushing, including a drive pin on said drill stem drive bushing and a sleeve removably supported in said table and into which said pin is extended, there being clearance between said guide skirt and said guide ring and said drive bushing transmitting no driving forces or weight to said table bushing.

6. In a rotary machine of the class described having a base, the combination of: a table rotatably supported by said base, said table having a top and a table opening, a table bushing mounted in said opening and having the upper portion thereof substantially level with the top of said table, said bushing having an internal tapered portion forming a guide ring; a drill stem drive bushing for a kelly supported by said table and having a guide skirt portion extending into said table bushing within said guide ring; and a shock absorbing drive connection between said table and said drill stem bushing, comprising a bore in said table, a resiliently compressable sleeve in said bore, a metallic sleeve in said compressable sleeve having a tapered bore, and a tapered pin extending from said drill stem bushing.

7. In a rotary machine of the class described having a base, the combination of: a table rotatably supported by said base, said table having a top and a table opening, a drill stem drive bushing for a kelly supported by said table; and a shock absorbing drive connection between said table and said drill stem bushing, including an interfitting drive pin and a resiliently mounted sleeve.

8. In a rotary machine of the class described having a base, the combination of: a table rotatably supported by said base, said table having a top and a table opening, a resilient, separable drive connection between said table and said drill stem bushing, including a detachable tapered pin extending downwardly from said bushing, a removable drive pin tapered bore bushing resiliently mounted in a bore in the top of said table, adapted to resist downward pressure of said pin therein.

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