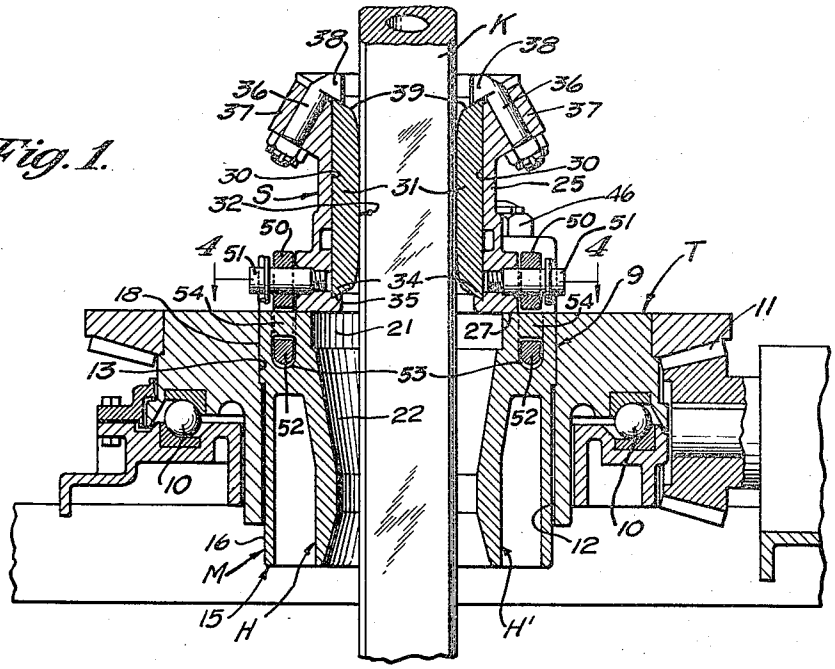
June 16, 1942. W. A. ABEGG 2,286,593

KELLY DRIVING MEANS

Filed Oct. 3, 1939 5 Sheets-Sheet 1

Fig. 1.



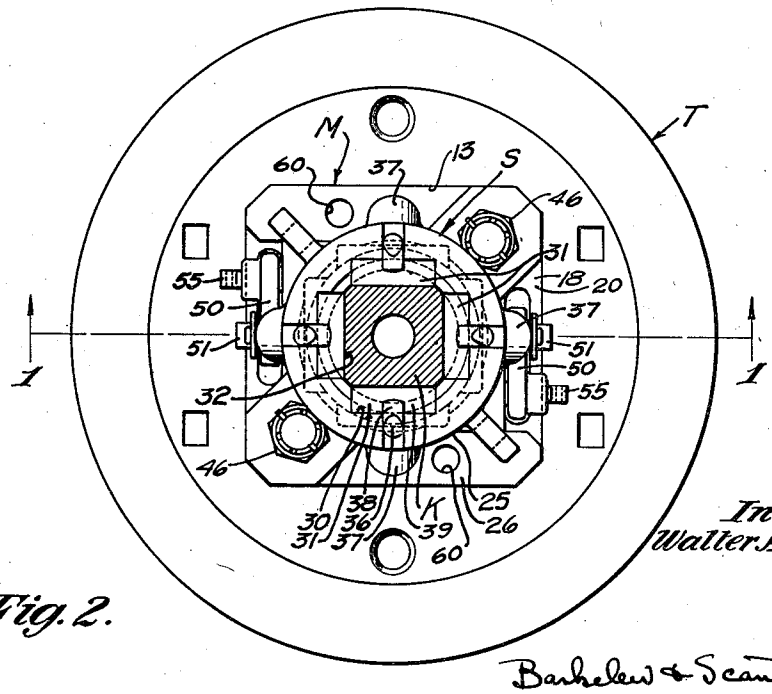


Fig. 2.

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June 16, 1942. W. A. ABEGG 2,286,593

KELLY DRIVING MEANS

Filed Oct. 3, 1939 5 Sheets-Sheet 2

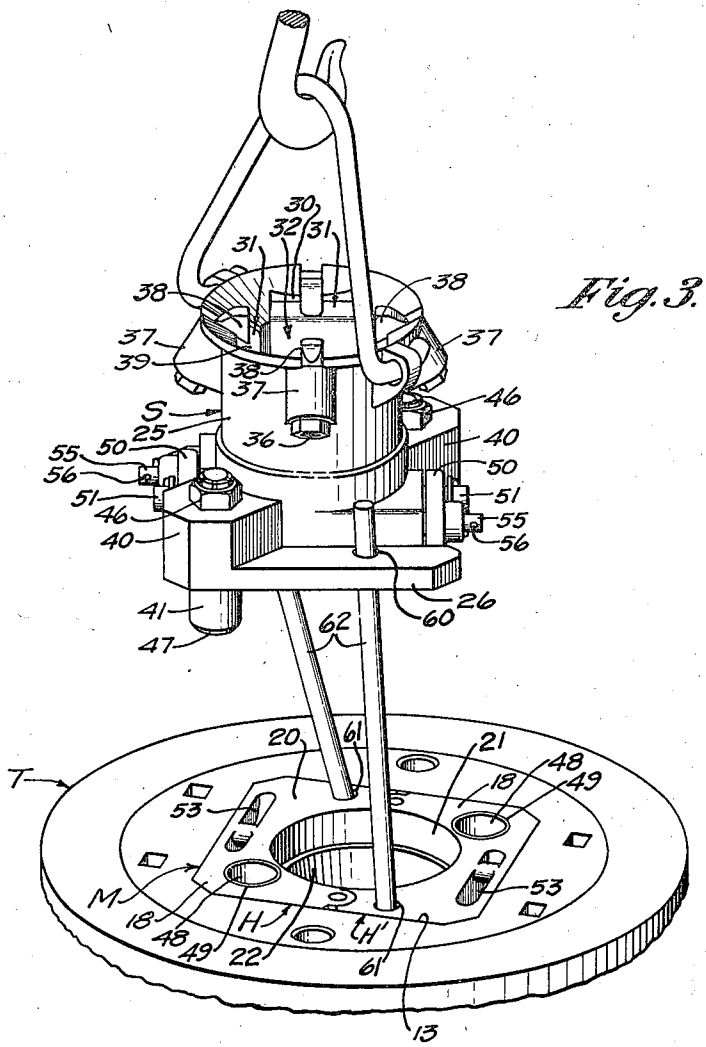


Fig. 3.

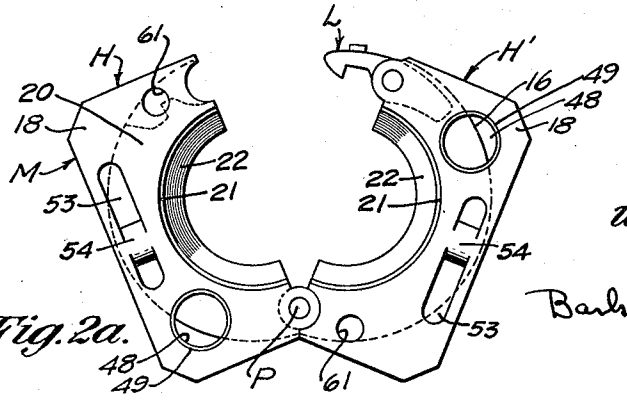


Fig. 2a.

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June 16, 1942. W. A. ABEGG 2,286,593

KELLY DRIVING MEANS

Filed Oct. 3, 1939 5 Sheets-Sheet 3

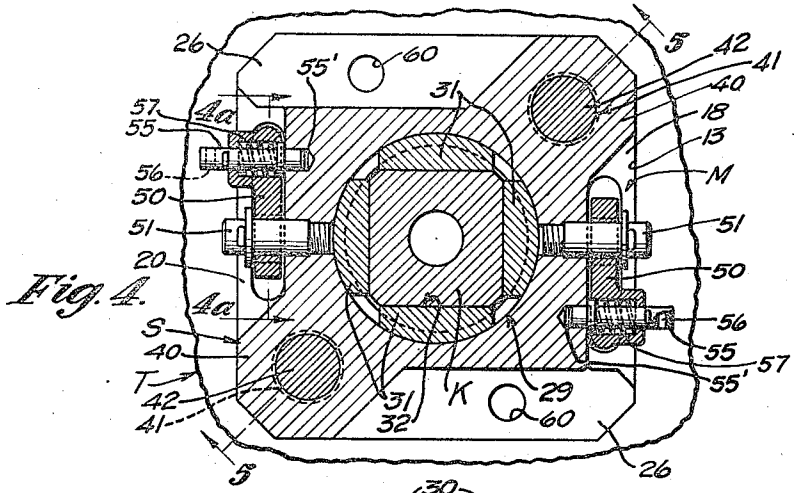


Fig. 4.

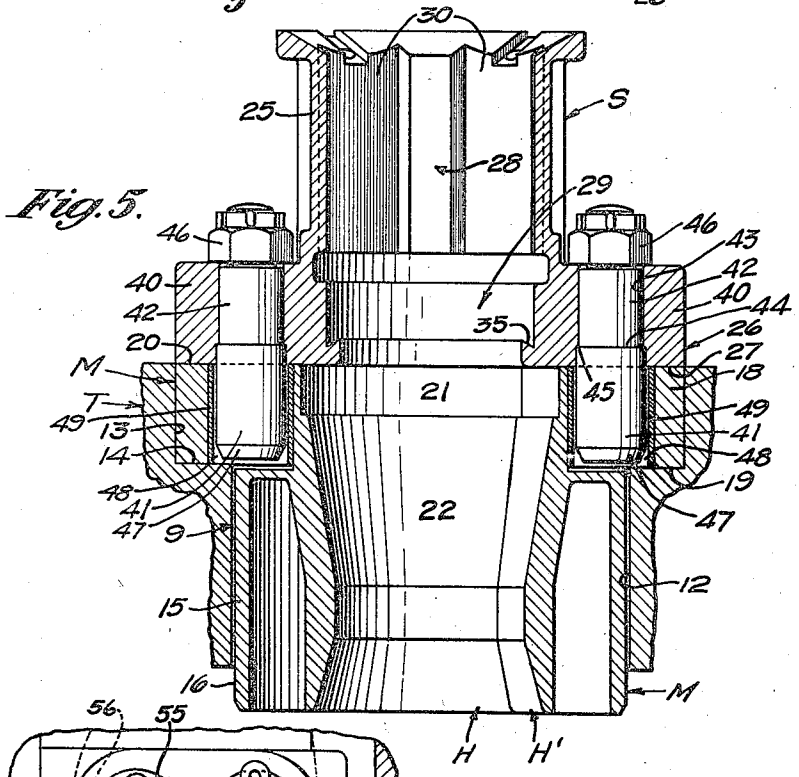


Fig. 5.

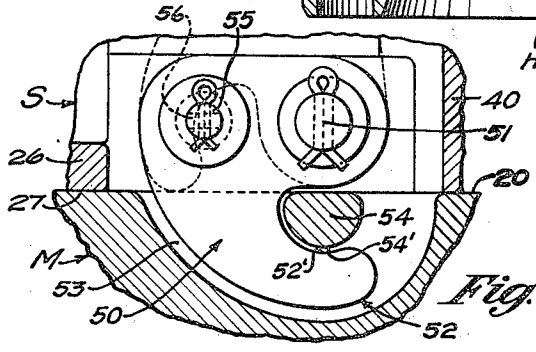


Fig. 4a.

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June 16, 1942. W. A. ABEGG 2,286,593

KELLY DRIVING MEANS

Filed Oct. 3, 1939 5 Sheets-Sheet 4

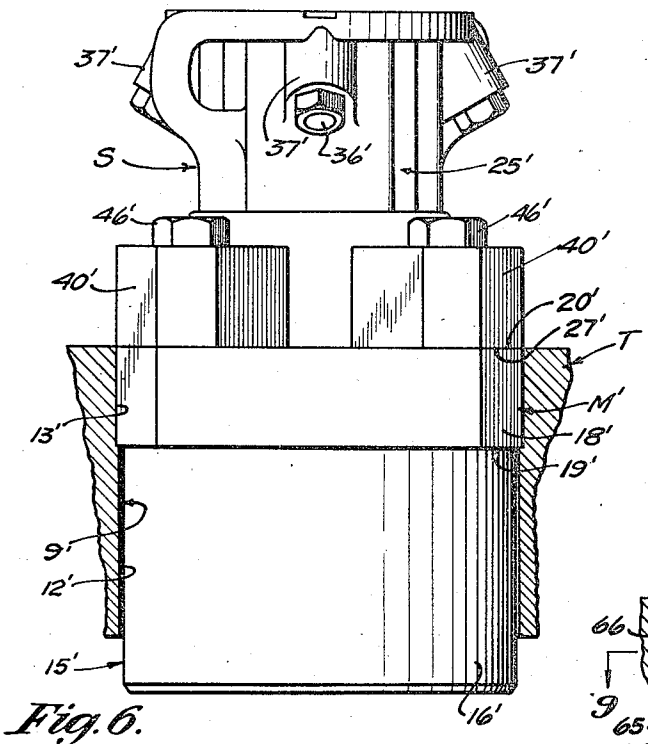


Fig. 6.

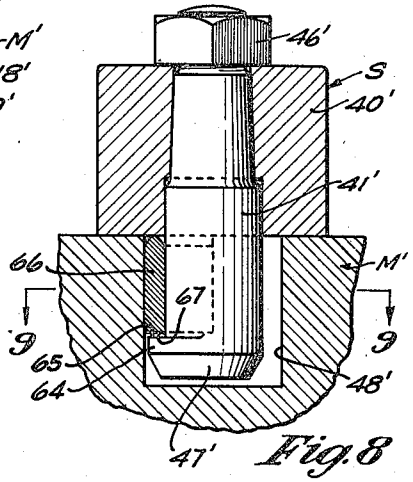


Fig. 8

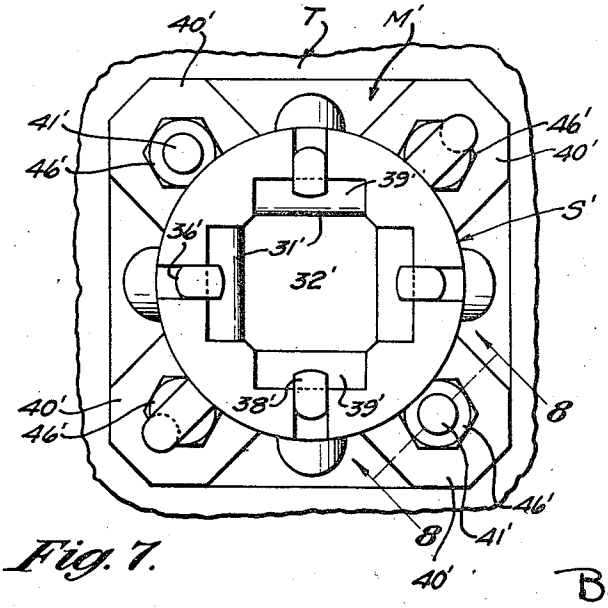


Fig. 7.

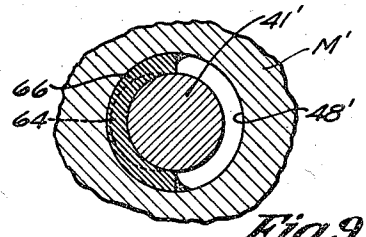


Fig. 9.

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June 16, 1942. W. A. ABEGG 2,286,593

KELLY DRIVING MEANS

Filed Oct. 3, 1939 5 Sheets-Sheet 5

Fig. 10.

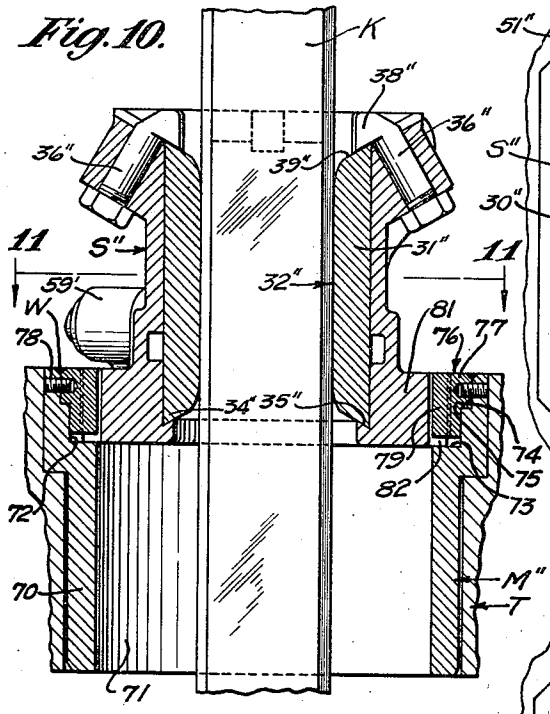
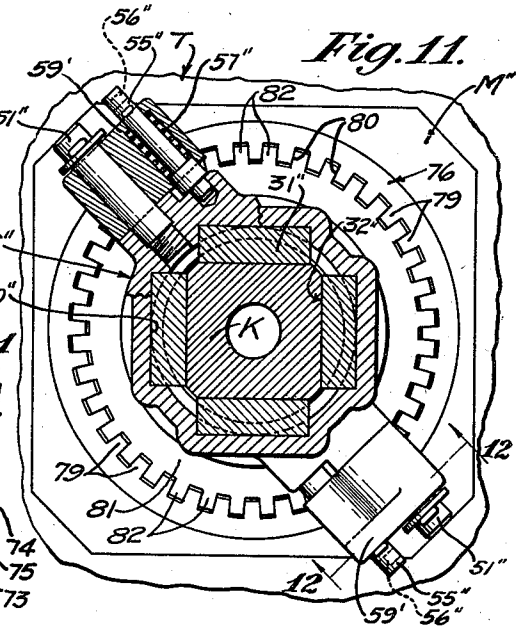
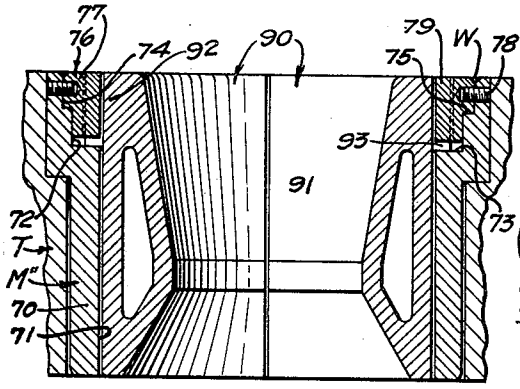


Fig. 11.





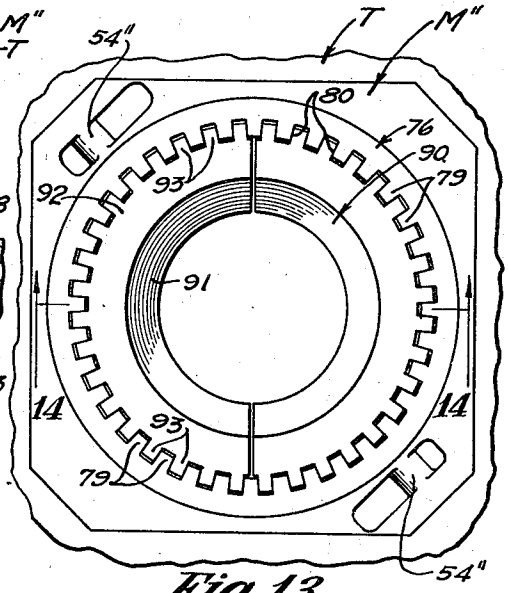


Fig. 14.

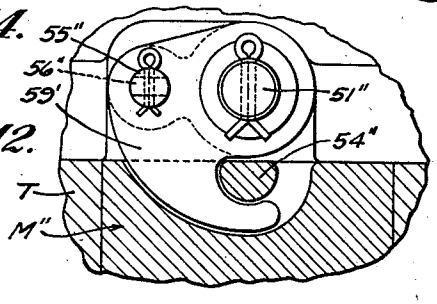


Fig. 12.

Fig. 13.

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Patented June 16, 1942 2,286,593

UNITED STATES PATENT OFFICE

2,286,593

KELLY DRIVING MEANS

Walter A. Abegg, Los Angeles, Calif., assignor to Abegg & Reinhold Co., Ltd., Los Angeles, Calif., a corporation of California

Application October 3, 1939, Serial No. 297,709

8 Claims. (Cl. 255—23)

This invention has to do generally with Kelly driving means, and is more particularly concerned with an improved Kelly bushing or driving sleeve and its novel association with the master bushing of the rotary table of a well-drilling rig.

In the usual Kelly driving mechanism, the Kelly bushing has a polygonal (usually square) head which seats in a complementary socket provided about the upper end of the master bushing bore, the rotary drive from the master bushing to the Kelly bushing being transmitted through the squares.

The severe service conditions to which such mechanisms are exposed soon wear the Kelly bushing head and/or master bushing socket out of square, and once such a condition starts, it becomes rapidly aggravated. Furthermore, master bushings are ordinarily sectional in character and the section-spreading force of the square head of the Kelly bushing, develops looseneses in the master bushing which ultimately result either in deformation of the well pipe engaging members carried by the master bushing or in putting uneven inward radially directed pressure thereon in a manner which ultimately results in radially deforming and weakening the engaged pipe.

It is among the objects of my invention to provide a drive interconnection between master bushing and Kelly bushing which eliminates the above described type of wear and, at the same time, puts little or no spreading force on the sections of the master bushing.

In the ordinary mechanism, it is often difficult to lower the Kelly bushing into the master bushing socket, particularly since the well-pipe passing through the master bushing bore is usually offset from the bore-axis, leaving insufficient room at one side for the entrance of the Kelly bushing. Another object of the present invention is to provide means for avoiding this difficulty so the Kelly bushing may be readily and easily drivingly interconnected with the table bushing.

It is also an object of the invention to provide a structure of such a nature as to enable maximum radial spacing of the bushing drive shoulders from the axis of rotation of the work, thus obviously giving added mechanical advantage.

I have also provided a releasable interconnection between master and Kelly bushings whereby they may be releasably held against vertical separation once they are in rotary driving interconnection. Thus, in effect, the weight of the master bushing is added to that of the Kelly bushing, and there is thus less likelihood of the Kelly bushing moving upwardly from the table when the well pipe is alternately elevated and lowered, as in certain phases of drilling and fishing operations.

How all the above objects are accomplished, may be better understood from consideration of the following detailed description, wherein further objects and features of novelty will be made apparent. Reference will be had to the accompanying drawings; wherein—

Fig. 1 is a vertical, medial section through a rotary table and Kelly driving means embodying my invention taken on line 1—1 of Fig. 2;

Fig. 2 is a top plan view of Fig. 1;

Fig. 2*a* is a plan view of a table bushing in spread condition;

Fig. 3 is a perspective view illustrating one method of guiding the Kelly bushing into operative position on the master bushing;

Fig. 4 is a section on line 4—4 of Fig. 1;

Fig. 4*a* is an enlarged fragmentary section on line 4*a*—4*a* of Fig. 4;

Fig. 5 is a section on line 5—5 of Fig. 4, but omitting the Kelly-bushing keys;

Fig. 6 is an elevation showing a variational embodiment of my invention;

Fig. 7 is a plan view of Fig. 6;

Fig. 8 is a fragmentary section on line 8—8 of Fig. 7;

Fig. 9 is a fragmentary section on line 9—9 of Fig. 8;

Fig. 10 is a section showing another variational embodiment of my invention;

Fig. 11 is a section on line 11—11 of Fig. 10;

Fig. 12 is a fragmentary section on line 12—12 of Fig. 11;

Fig. 13 is a plan view of the master bushing with a sectional slips-bowl in place; and

Fig. 14 is a section on line 14—14 of Fig. 13.

A typical rotary table, mounted on bearings 10 and driven by gear 11, is indicated at T, the table having a central opening or bore 9 whose lower part 12 is cylindric and whose upper part 13 is substantially square. The square, upper part 13 of the table opening is sufficiently large to present an upwardly facing shoulder 14 (Fig. 5) between parts 12 and 13, which shoulder is of sufficient extent to afford support for the master or table bushing generally indicated at M.

It lies within the broader scope of my invention to utilize a master bushing of any suitable type so long as it has certain structural characteristics which allow its proper coaction with my improved Kelly bushing, but I have chosen to illustrate the invention in connection with a sectional master bushing having the general characteristics fully described in my copending application, Serial No. 255,033, entitled "Rotary table bushing," filed February 7, 1939. However, this showing and the brief description thereof

is not in any way to be construed as limitative on the broader aspects of the invention.

Table bushing M is made up of a pair of segments or sections H and H' hingedly connected by a pin P at one set of their adjacent ends (Fig. 2a) while the opposite or distal ends are adapted to be disconnectibly joined by a latch generally indicated at L.

Each bushing section has a lower portion 15, the exterior surface of which is substantially cylindric, as indicated at 16, which, when the two halves are latched together, form a substantially cylindric lower bushing assembly adapted to fit freely and with slight annular clearance in the lower cylindric portion 12 of the table opening.

The upper portion of each bushing half is provided with a half-square flange 18 which presents a downwardly facing shoulder 19 adapted to seat on the upwardly facing shoulder 14 of the table, the composite square or head made up of these two half-square flanges fitting fairly closely but yet freely into the square opening 13 of the table and coacting with the defining wall of that square opening, there thus being provided drive shoulders whereby rotary motion of the table is transmitted to the master bushing and, in turn, to work-engaging members (to be described) carried by the bushing and thence to the work. On the other hand, shoulder 14 takes the bushing shoulder 19 in a manner to support the bushing against downward loads directed thereagainst.

The upper face 20 of the master bushing is substantially flush with the top of table M, and the bushing bore may have an upper portion 21 and lower, tapered conical portion 22, the latter being adapted to take usual wedge-slips (not shown) whereby work in the form of drill pipe may be suspended from the bushing and hence ultimately by the table.

The work is here shown in the form of a usual grief pipe or kelley K of polygonal cross section, it being to this member that rotative drive is transmitted from the table, and which Kelley, in turn, transmits rotative drive to the drill stem (not shown) attached thereto and suspended therebelow.

The Kelley bushing or sleeve S may be of any suitable type so long as it has certain novel structural characteristics to be described, and therefore the fact that I have here shown and will describe the sleeve as a soiled, "one piece" member with detachable driving keys, is not to be considered as limitative on the broader aspects of the invention.

The body portion 25 of the sleeve is substantially cylindric, having a lower, external flange 26 whose under face 27 is adapted to rest on upper face 20 of bushing M. The upper part of the peripheral wall 28 which defines sleeve bore 29 is vertically channeled at 30 to take drive keys 31, these keys being four in number and being arranged to define, in effect, a sleeve bore 32 (Fig. 3) which is of polygonal cross section and adapted to take kelly K with sliding fit. The keys are removably held in ways 30 by the entrance of their lower, tapered ends 34 (Fig. 1) in complementary, upwardly facing grooves 35 (Fig. 5) formed in the body portion of the bushing, and by the hold-down bolts 36 which are supported in body lugs 37 and have hooks 38 overhanging the upper, tapered ends 39 of keys 31, all as clearly shown in Fig. 1.

Vertical bosses 40 extend diametrically oppositely from body portion 25, being integral with flange 26. Drive pins 41 extend downwardly from bosses 40, their upper ends being rigidly secured thereto in any suitable manner. For instance, their upper, reduced-diameter portions 42 (Fig. 5) may have shrink-fit in boss-bores 43, with the shoulders 44, formed at the junction of the large and small diameter portions, drawn tightly against shoulders 45 by nuts 46. The lower ends 47 of the drive pins are preferably somewhat tapered in order to serve as guide noses for entering the pins in complementary sockets 48 provided in bushing M (there being one socket in each of the halves H and H') and opening upwardly to face 20. Pins 41 preferably fit sockets 48 with slight clearance, and, if desired, the sockets may be bushed as at 49 with material which is more wear-resistant than is the metal of the master-bushing, proper.

Sockets 48 are so located that, with pins 41 entered therein, they locate sleeve S so it is axially centered with master bushing M and hence with table T. Pins 41 serve not only as drive pins for transmitting rotary drive from bushing M to sleeve S and thence to kelly K, but also aid in holding the sections of the master bushing from spreading, since there is one pin in each section and the pins are rigidly connected through the one-piece sleeve S.

Also it will be noted that the pins are appreciably spaced from the sleeve axis and thus are obviously advantageously disposed for efficiently transmitting rotative drive. The peripheral faces of the pins and of the socket walls which contact during the transmission of rotative drive from bushing to sleeve, are, in effect, engaged driving faces which lie in planes substantially radial with respect to the axis of rotation, and hence the driving forces are circumferentially applied and do not have the spreading effect on the master bushing which is present when driving through the usual "square" Kelly bushing head and master bushing socket. The elimination of this spreading effect is not only extremely advantageous in preventing wear between Kelly sleeve or bushing and master bushing, but also in preventing wear between master bushing segments and the defining wall of the square portion of the table bore.

In order releasably to hold the sleeve S against vertical separation from bushing M when the drive pins are operatively entered in sockets 48, I provide diametrically opposite latches 50 pivoted at 51 to sleeve body 25 and pivotally movable from the inoperative position indicated in dotted lines in Fig. 4a, to the operative position shown in full lines in that figure. Each latch 50 has an arcuate hook 52 adapted to swing downwardly through passageway or socket 53, opening to the top of bushing M, and then beneath keeper bar 54 which is integral with said bushing. The lower face 54' of bar 54 and the upper face 52' of latch hook 52 may be considered as oppositely disposed latching shoulders.

A spring-pressed detent 55 (Fig. 4) is carried by each latch 50 and enters sleeve-socket 55' to releasably hold the latch in operative or holding position. When the latch is to be released, the detent is withdrawn from socket 55' by applying a pull-tool through detent eye 56, and the latch swung upwardly from beneath keeper bar 54 (dotted lines—Fig. 4a). When detent 55 is then released, its spring 57 forces it into sufficiently tight pressural engagement with the sleeve body to prevent the latch from dropping in a manner

to interfere with subsequent lowering of the sleeve onto the master bushing.

In order to guide sleeve S into a position insuring registration of pins 41 with sockets 48, both by rotating the sleeve to proper position and also by shifting the sleeve bodily to one side or the other if the kelly is axially offset from the master bushing axis, I have provided sleeve flange 26 with diametrically opposite initial-alinement bores 60, and bushing M with complementary sockets 61. Bore 60 and sockets 61 are so located that they will be in register when pins 41 and sockets 48 are in register. In Fig. 3 I have shown somewhat schematically how I proceed to secure drive-pin and socket alinement. Relatively long alinement rods 62 are dropped through bores 60 and into sockets 61 when the sleeve is an appreciable distance above bushing M. Bore 60 and sockets 61 are of sufficiently greater diameter than the rods to allow the described and illustrated rod-entry even though the sleeve be considerably out of line with bushing M, and even though pins 41 are considerably angularly out of line with sockets 48.

As sleeve S is now lowered, rods 62 bodily swing and rotate the sleeve so, by the time pins 41 are close to bushing M, said pins will be very nearly in registration with sockets 46—preferably at least close enough for tapered pin-noses 47 to enter the sockets and force complete registration.

In Figs. 6 to 9, inclusive, I have shown a variational embodiment of my invention wherein all parts are generally similar to those previously described except that four drive pins, equally spaced about the sleeve body, are provided, and these pins are utilized for releasably preventing vertical separative movement between bushing and sleeve once they are operatively engaged. Parts which are similar in character and operation to corresponding parts of the previously described embodiment, will be given the same, but primed, reference numerals.

Extending from body 25' of Kelly bushing or sleeve S', are four lugs 49', each of which carries a downwardly pointing drive pin 41'. In this case, however, each pin not only has a tapered guide nose 47' but it is also extended at one side to form a hook 64 having an upwardly facing shoulder 65.

Drive sockets 48' in bushing M' have welded therein arcuate keepers 66 which stop short of the socket bottoms and present downwardly facing shoulders 67. When sleeve S' is lowered onto bushing M', pins 41' will be in position to pass into sockets 48' alongside of keepers 66. The sleeve is then rotated to carry hooks 64 beneath keepers 66, the opposed shoulders 65 and 67 thereafter preventing the sleeve from being lifted from the bushing until said sleeve is rotated back to clear hooks 64 from keepers 66.

In Figs. 10 to 14, inclusive, I have shown another variational embodiment of my invention. Here, the table bushing M'' is made up of a one-piece ring 70 having a large cylindrical bore 71, of sufficient diameter to pass relatively large drill stem collars and tools, an intermediate counterbore 72 presenting an upwardly facing shoulder 73, and an uppermost counterbore 74 presenting an upwardly facing shoulder 75.

A ring 76 is fitted into counterbore 72 and has a flange 77 taken in counterbore 74 and resting on shoulder 75. Ring 76 may be detachably held in position by set screws 78, but preferably it is welded to the bushing, as at W. Teeth 79 are cut in ring 76, the spaces between teeth opening to the upper face of the bushing, and the inside diameter of the ring being not less than that of bore 71. Preferably, the side faces of teeth 79 extend substantially radially with respect to the bushing axis, said side faces 80 being, in effect, rotary drive faces, as will be seen later.

Kelly bushing or sleeve S'' is generally the same as sleeve S, except that instead of drive pins, the lower end of the sleeve has a circular head 81 which is provided with teeth 82. Said teeth are substantially complementary to teeth 79 and are adapted to be engaged therewith when the sleeve is lowered onto bushing M''. The lower ends of teeth 82 come to rest on shoulder 73 to limit the downward movement of the sleeve with respect to the bushing, while latches 59' coact with keeper bars 54'' in a manner and for a purpose similar to that described in connection with latch 59 and bar 54.

It will be seen that there are presented a great number of drive-faces between bushing and sleeve, said faces being represented by engaged teeth-faces, thus distributing the driving stresses and strains in the best manner possible. Also, since the engaged drive faces are in planes substantially radial with respect to the axis of rotation, there is no spreading effect exerted on the bushing, all as described in connection with the drive-pin embodiment.

When occasion arises for bushing down the bore 71 at a point below the counterbores, as, for instance, when a slips-bowl is to be installed, sleeve S'' is lifted bodily from bushing M'' and is replaced by a sectional bowl 90 which fits bushing bore 71 with some annular clearance, the bore of the bowl being formed conically as at 91 to take usual wedge slips (not shown). The upper end of the bowl has an external flange or head 92 formed with peripheral teeth 93 which are similar to sleeve-teeth 82 and are adapted to be engaged with bushing teeth 79 by lowering the bowl into the bushing. The lower ends of teeth 93 rest on bushing shoulder 73 to transmit down-bearing loads from the bowl to the bushing.

While I have shown and described preferred embodiments of my invention, it will be understood various changes in design, structure and arrangement may be made without departing from the spirit and scope of the appended claims.

I claim:

1. In combination with a rotary table having a central bore, a master bushing in said bore and having rotational drive-connection therewith, a detachable, tubular, rotary drive sleeve held against downward movement with respect to the bushing and with its bore axially alined with the bushing bore, means on the sleeve adapted to drivingly engage work extending vertically through the sleeve bore, rotary drive elements interconnecting the bushing and sleeve, and releasable means interconnecting the bushing and sleeve against vertical separation, said means embodying a latch pivotally mounted on the sleeve and a keeper on the bushing, said latch being pivotally movable to and from engagement with the keeper; and a detent acting between the sleeve and latch to releasably hold the latch in engaged position.

2. In combination with a rotary table having a central bore, a master bushing in said bore and having rotational drive-connection therewith, a detachable, tubular, rotary drive sleeve held against downward movement with respect to the bushing and with its bore axially alined with the bushing bore, means on the sleeve adapted to

drivingly engage work extending vertically through the sleeve bore, rotary drive elements interconnecting the bushing and sleeve, and releasable means interconnecting the bushing and sleeve against vertical separation, said means embodying a member adapted to project downwardly from the sleeve and having an upwardly facing shoulder, and a downwardly facing keeper shoulder on the bushing below the upper face thereof, there being a passage opening downwardly from the upper face of the bushing and leading to said shoulder, said member being enterable through said passage and movable to bring said shoulders into engagement one with the other.

3. In combination with a rotary table having a central bore, a master bushing in said bore and having rotational drive-connection therewith, a detachable, tubular, rotary drive sleeve held against downward movement with respect to the bushing and with its bore axially alined with the bushing bore, means on the sleeve adapted to drivingly engage work extending vertically through the sleeve bore, rotary drive elements interconnecting the bushing and sleeve, and releasable means interconnecting the bushing and sleeve against vertical separation, said means embodying a member adapted to project downwardly from the sleeve and having an upwardly facing shoulder, and a downwardly facing keeper shoulder on the bushing below the upper face thereof, there being a passage opening downwardly from the upper face of the bushing and leading to said shoulder, said member being enterable vertically through said passage and thereafter being movable to bring said shoulders into engagement one with the other by relative rotation of sleeve and bushing.

4. In combination with a rotary table having a central bore, a master bushing in said bore and having rotational drive-connection therewith, a detachable, tubular, rotary drive sleeve positioned with its bore axially alined with the bushing bore, means on the sleeve adapted to drivingly engage work extending vertically through the sleeve bore, a flange about the lower end of the sleeve and with its under face resting on the bushing, and a plurality of rotary drive elements rigidly carried by the flange and angularly spaced about and individually extending longitudinally of the sleeve, there being a plurality of substantially complementary sockets in the bushing and opening to the upper face thereof, said elements and the defining walls of the sockets having their effective portions representing engaged driving faces which lie in planes substantially radial with respect to the bushing and sleeve axes.

5. In combination with a rotary table having a central bore, a master bushing in said bore and having rotational drive-connection therewith, a detachable, tubular, rotary drive sleeve held against downward movement with respect to the bushing and with its bore axially alined with the bushing bore, means on the sleeve adapted to drivingly engage work extending vertically through the sleeve bore, and a plurality of downwardly pointing drive pins angularly spaced about the sleeve, there being a plurality of substantially complementary sockets in the bushing and opening to the upper face thereof, said pins being enterable in said sockets to effect a rotary drive connection between the bushing and sleeve.

6. In combination with a rotary table having a central bore, a master bushing in said bore and having rotational drive-connection therewith, a detachable, tubular, rotary drive sleeve held against downward movement with respect to the bushing and with its bore axially alined with the bushing bore, means on the sleeve adapted to drivingly engage work extending vertically through the sleeve bore, a plurality of downwardly pointing drive pins angularly spaced about the sleeve, there being a plurality of substantially complementary sockets in the bushing and opening to the upper face thereof, said pins being enterable in said sockets to effect a rotary drive connection between the bushing and sleeve; there being a pair of angularly spaced initial-alinement sockets opening to the upper face of the bushing and a pair of vertically extending, initial-alinement bores through the sleeve, which alinement sockets and bores are adapted to register one with the other when the drive pins and sockets are in register, and a pair of removable initial-alinement rods of appreciably greater length than the drive pins and adapted to fit relatively loosely in said alinement bores and sockets, said rods being adapted to be entered in the alinement sockets and bores when the bushing and sleeve are relatively widely vertically separated and serving to guide the sleeve as it is being lowered toward the bushing to bring said drive pins into vertical alinement with the complementary sockets.

7. In combination with a rotary table having a central bore, a master bushing in said bore and having rotational drive-connection therewith, a detachable, tubular, rotary drive sleeve held against downward movement with respect to the bushing and with its bore axially alined with the bushing bore, means on the sleeve adapted to drivingly engage work extending vertically through the sleeve bore, a plurality of circumferentially arranged teeth extending inwardly from the defining wall of the bushing bore with the spaces between teeth opening upwardly, and a plurality of substantially complementary teeth on the sleeve and adapted to be engaged with the bushing teeth by lowering the sleeve onto the bushing, said bushing and sleeve teeth in their engagement forming a rotary drive connection between bushing and sleeve, and releasable means interconnecting the bushing and sleeve against vertical separation when said teeth are operatively engaged.

8. In combination with a rotary table having a central bore, a master bushing in said bore and having rotational drive-connection therewith, said bushing comprising a plurality of hingedly connected sections, a detachable, tubular, rotary drive sleeve held against downward movement with respect to the bushing and with its bore axially alined with the bushing bore, means on the sleeve adapted to drivingly engage work extending vertically through the sleeve bore, there being a plurality of angularly spaced sockets in the bushing and opening to the upper face thereof, there being a socket in each of at least two bushing-sections, and a plurality of drive pins angularly spaced about and extending downwardly from the sleeve, said pins being enterable, one each, in said sockets.

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