

March 24, 1931.

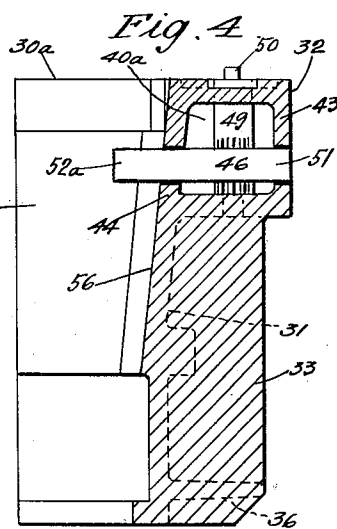
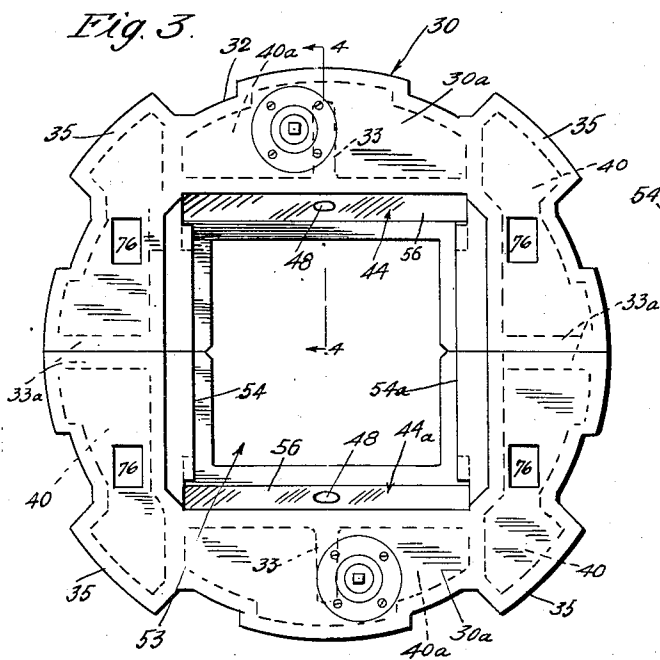
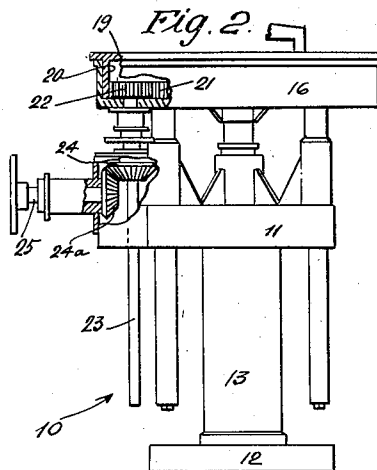
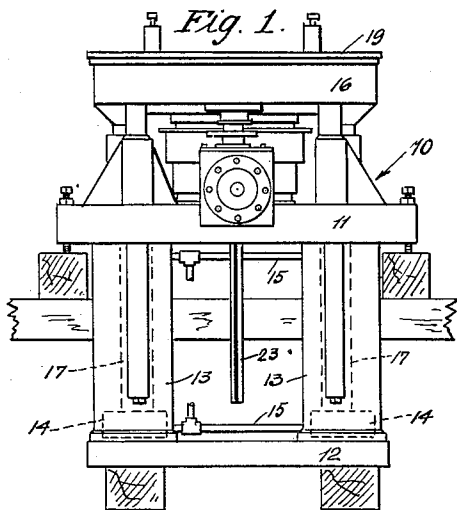
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1,797,486

WORK GRIPPING MEANS FOR ROTARY TABLES AND THE LIKE

Filed March 3, 1928

3 Sheets-Sheet 1



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WORK GRIPPING MEANS FOR ROTARY TABLES AND THE LIKE

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3 Sheets-Sheet 2

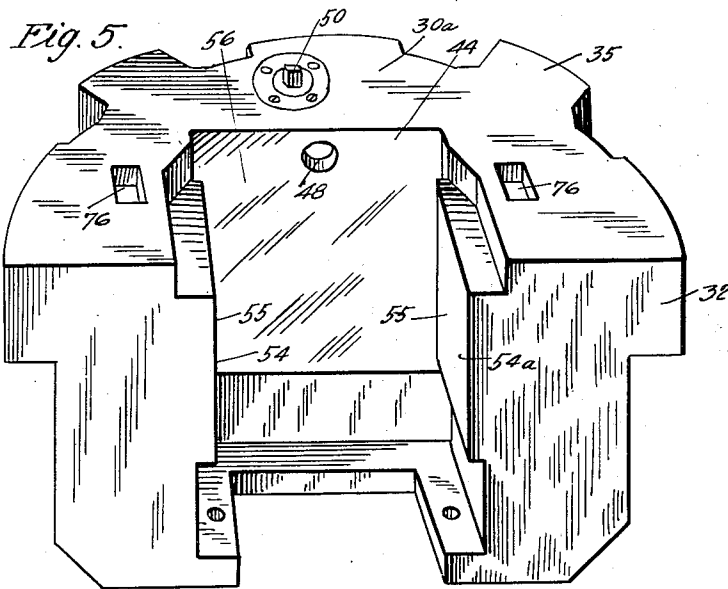
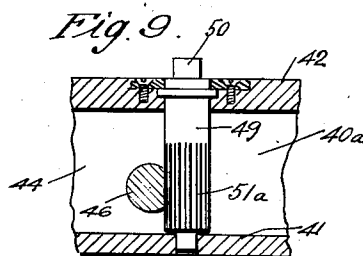
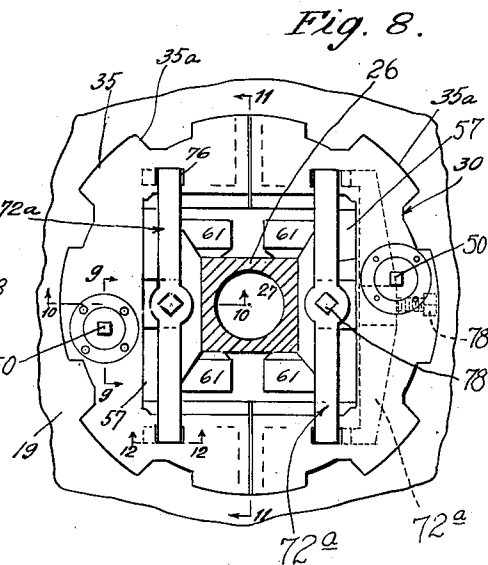
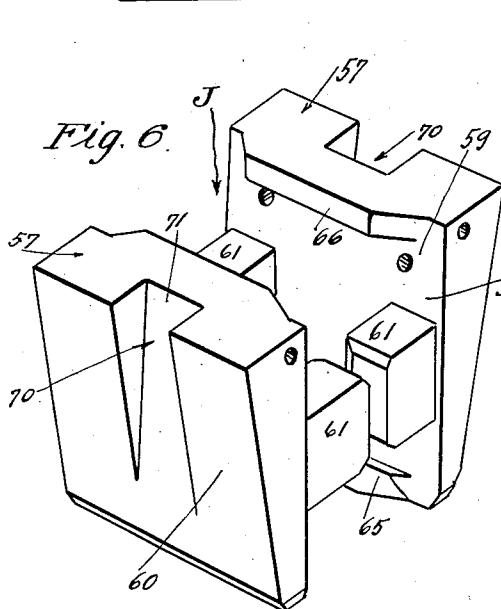
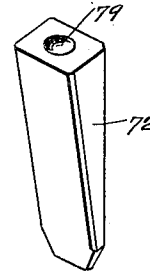


Fig. 7.



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WORK GRIPPING MEANS FOR ROTARY TABLES AND THE LIKE

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3 Sheets-Sheet 3

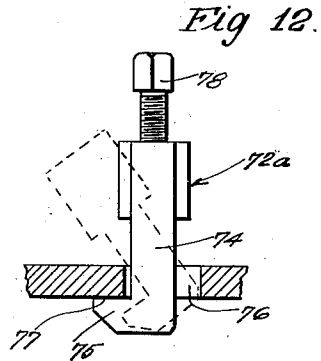
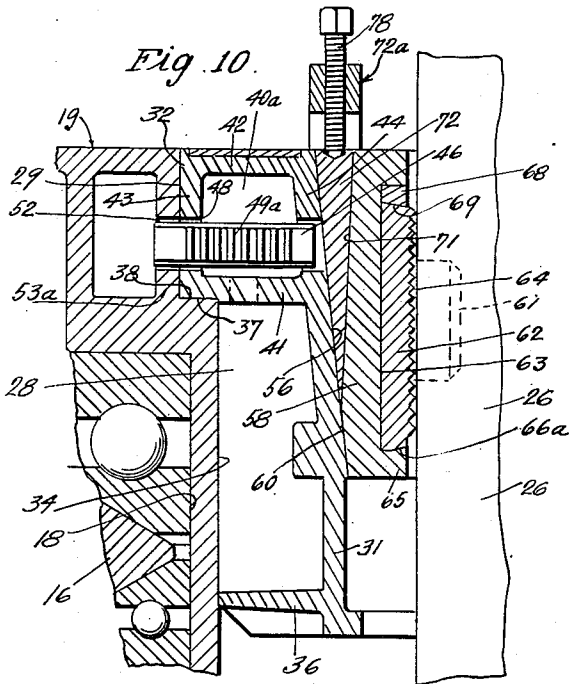
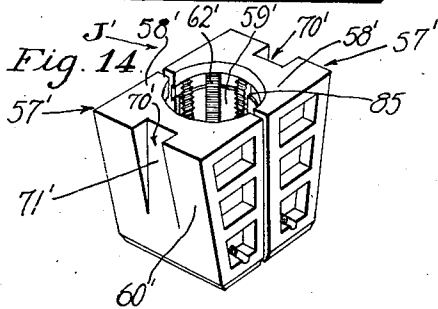
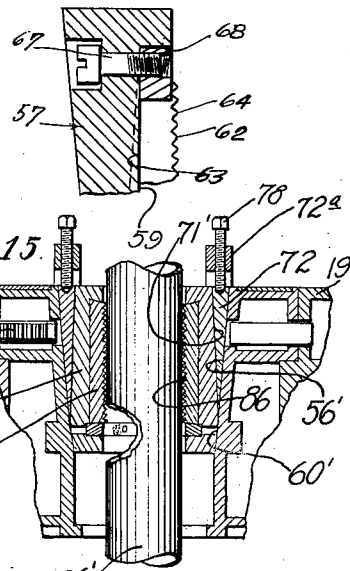
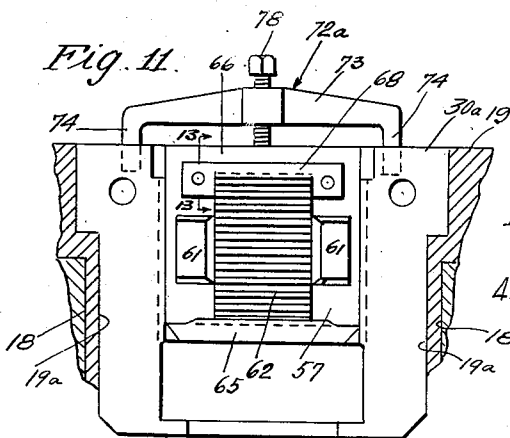


Fig. 13.



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WORK-GRIPPING MEANS FOR ROTARY TABLES AND THE LIKE

Application filed March 3, 1928. Serial No. 258,813.

This invention has to do generally with well-drilling apparatus, and is more particularly concerned with improved means for taking drill stems adapted to be driven through the rotary tables of such apparatus.

the table but is movable freely vertically therethrough, the vertical movement of the stem being controlled from usual hoisting tackle.

We have provided means whereby this clamping may be effected positively and without danger of accidental release (it will be readily understood that such accidental release would be most apt to result disastrously) and yet the clamping means is such that it may be assembled with the table or removed therefrom with ease and dispatch, factors of great importance in well drilling operations, as is well understood.

How the above is accomplished may be pointed out to better advantage in the following detailed specification, wherein further objects and novel features of the invention will be made apparent. Reference will be had to the accompanying drawings, in which:

Fig. 1 is a side elevation of an apparatus equipped with our invention;

Fig. 2 is an elevation of Fig. 1 as viewed from the right thereof, parts being shown in broken away section;

Fig. 3 is a detached, plan view of a table bushing which may be used in connection with the device;

Fig. 4 is a section on line 4—4 of Fig. 3;

Fig. 5 is a detached, perspective view of one-half of the table bushing;

Fig. 6 is a perspective of kelly slips used in carrying out our invention;

Fig. 7 is a perspective view of a wedge element of the assembly;

Fig. 8 is a fragmentary top plan view of the rotary table showing the slips applied thereto;

Fig. 9 is an enlarged detail section on line 9—9 of Fig. 8;

Fig. 10 is an enlarged detail section on line 10—10 of Fig. 8;

Fig. 11 is a section on line 11—11 of Fig. 8;

Fig. 12 is an enlarged, fragmentary section on line 12—12 of Fig. 8;

Fig. 13 is an enlarged detail section on line 13—13 of Fig. 11;

Fig. 14 is a perspective view of a varia-

While there are certain features of the invention which may be used to advantage irrespective of the type of drill stem handled or the type of rotary table, the invention may be used with particular advantage in connection with the operation of drill stems or grip pipes of square cross section (commonly known as "kellys") driven through the medium of a rotary table which is adapted to be reciprocated vertically (or controlled in such reciprocation) whereby vertical table movement in either direction may be imparted to the drill stem. Such rotary tables have many features of advantage over standard tables, and while it is needless to discuss such advantages exhaustively, it may be well to point out a few of them here.

With a capacity for vertical movement and means for causing such movement or controlling it in either direction, it will be seen that the table may be utilized for taking from the bit some of the load of the drill stem above it when such load is excessive; that added down-bearing force may be applied to the bit when the weight of the stem is insufficient to give the bit sufficient penetrating force; that the bit may be "picked up off bottom"; and, in situations where inclined earth strata have slipped after the bit has penetrated them, thus bringing the high side of the strata into engagement with the drill stem above the bit, that the bit may be utilized to drill upwardly through said strata by rotating the table and simultaneously elevating it.

To make the above operations possible, it will be seen that means must be provided between the table and the drill stem which not only imparts rotational drive from one to the other, but also releasably clamps the stem to the table to prevent relative vertical movement therebetween, this in contradistinction to the usual apparatus wherein the stem is held against rotation with respect to

tional type of slips which may be used in connection with the assembly; and

Fig. 15 is a view generally similar to Fig. 10 but showing the slips of Fig. 14 substituted for those of Fig. 6.

As mentioned above, while the present invention is particularly well adapted for use in connection with a particular type of rotary table and with a particular type of drill stem (which types will be here described) certain features of the invention are as well adapted for embodiment in other types of tables and for use with grief pipes or drill stems of a nature other than that shown. Accordingly, though we will describe the illustrated embodiment of the invention in connection with a particular type of apparatus and fashioned to take a particular type of work, it will be understood this is merely done for the purpose of clearly pointing out a typical application of the invention and is in no way to be considered as controlling or limiting the appended claims, except those which specifically call for these particularities.

The well drilling apparatus shown in Figs. 1 and 2 may be described briefly as including a main frame 10 made up of upper and lower heads 11, 12, respectively, which are spaced apart by cylinders 13 through which pistons 14 are adapted to be reciprocated or controlled in their reciprocation by fluid admitted under pressure to the cylinders as conventionally indicated at 15. A circular, non-rotatable cross-head 16 (of upwardly-opening cup formation) is carried at the upper ends of piston rods 17, and mounted for rotation within the axial bore 18 (Fig. 10) of this head is rotary table 19. The table has a depending annular flange 20 which fits within the upstanding flange of head 16, the flange 20 having internal gear teeth 21 formed thereon. The table is rotated through the medium of a pinion 22 which is in mesh with gear 21 and is slidingly keyed to a vertical drive spindle 23, said spindle being driven, in turn, through gear couple 24, 24a receiving its drive from power shaft 25. Due to the sliding spline connection between spindle 23 and bevel pinion 24, the table may be rotated during vertical reciprocation of the cross head or when said cross head is held at any given level.

The drill stem is adapted to pass vertically through the axial bore 19a of the table, means being provided for clamping the drill stem to the table so said stem may be driven either vertically or rotatably from the table. The drill stem is here indicated as a grief pipe or kelly 26 which is of square cross-section, as shown in Fig. 8, having a vertically extending bore 27 therethrough to accommodate circulating fluid, in the usual manner. As stated above, however, it will be understood that all the features of the invention are not

confined in their advantageous use to work having these particular characteristics.

The kelly slips which surround the work within the table bore are, of course, adapted to be drivingly connected to the table in order that they may be utilized as drive-transmission elements. Now while this connection, considering the invention broadly, may be made directly between the kelly slips and the table, such connection is ordinarily made through a so-called "table bushing," the general purposes and functions of this table bushing (which bushes down the table bore and may be readily replaced by other bushings having variational internal characteristics or which itself may be adapted to take different types of slips) being well understood by those skilled in the art. However, for the purpose of the claims, it will be understood that where we designate broadly as a "body member" the element which takes the kelly slips, the term "body member" may be considered as referring broadly either to the table bushing or to the table, proper, for since the bushing is held within the table against rotation and relative vertical movement, a lock accomplished between the slips and the bushing is, in effect, the same as a lock between the slips and the table.

Since it is usual to employ a table bushing, we have illustrated the invention as applied to a drilling apparatus embodying such a bushing and will describe this illustrated form with some particularity in order that a clear understanding of the association of the kelly slips therewith may be understood, but this is in no way to be considered as limiting the invention in its application to this particular type of table bushing. Furthermore, we have shown and will illustrate a particular type of means for locking the table bushing to the table, but this is done for illustrative purposes only, the particular locking means shown being the subject-matter of a copending application entitled "Rotary table and pipe gripping means therefor," filed by use under even date herewith, Serial No. 258,814.

Table 19 has a vertically extending, axial bore or socket 28 and an upwardly opening counterbore 29. Dropped into this axial opening is the table bushing indicated generally at 30, the bushing preferably being made up of two similar parts 30a. Each part 30a includes a sleeve portion 31, angular, as viewed in plan, and an annular head portion 32. Preferably, though not necessarily, the sleeve portion has external, vertically extending ribs 33 which engage the faces of the bore defining walls 34 of the table to center the bushing sleeve in said bore, while head portion 32 is taken within counterbore 29. While the rotational drive connection between table and bushing may be accomplished in any suitable manner, we have here indicated that

the head portion has radially extending lugs 35 which enter complementary recesses 35a in the table and serve to hold the table and bushing against relative rotation. Ribs 33 extend downwardly from the head portion to an annular flange 36 provided about the sleeve portion near its lower end and adapted to fit within the table bore, and the opposed ribs 33a on the two parts preferably meet as indicated in Fig. 3.

The lower face 37 of head portion 32 engages the upwardly facing shoulder 38 presented by the table at the junction of its bore and counterbore, the limit of downward movement of the bushing with respect to the table thus being established.

The head portion 32 of each bushing part is cored out at intervals to provide segmental recesses or cavities 40, a particular recess 40a being utilized to contain a locking pin and its actuating mechanism. It will be seen that a given recess 40a (Figs. 9 and 10) is defined vertically by the head walls 41, 42, and defined horizontally by head walls 43 and 44, these several walls forming a housing for the locking mechanism, to be described, with obvious advantage.

A locking pin 46 is mounted for horizontal reciprocation through the recess 40a, walls 43 and 44 having horizontally aligned openings 48 therethrough to take the pin. One side of the pin is formed with teeth 49a (Fig. 10) and thus becomes, in effect, a rack bar. Extending vertically across recess 40a is a shaft 49 which has bearing in walls 41 and 42, preferably extending to the top of the wall 42 and having an extension 50 extending above the top of the table and adapted to take a tool whereby shaft 49 may be rotated. Shaft 49 is formed with gear teeth 51a which mesh with the rack bar, it following that when a suitable wrenching tool is applied to extension 50 and shaft 49 thereby rotated, locking pin 46 is reciprocated horizontally.

Before the bushing is introduced to the table the locking pin is moved inwardly until its outer end 51 is at least flush with the outer face of head wall 43 so the bushing may be dropped to place without interference. Thereupon shaft 49 is rotated in a manner to project the locking pin, the end 51 of said pin then entering a registering opening or socket 52 in the annular wall 53a which defines the counterbore of the table. It will be seen that the locking pin thereafter functions to hold the bushing and table releasably against relative vertical movement. The pin is projected far enough to bring its inner end 52a clear of the bushing bore defined by wall 44 so said pin may offer no interference to the insertion of other elements within said bore.

The angular bore 53 of the table bushing is defined by oppositely disposed walls 44, 44a and the adjacent, oppositely disposed walls 54 and 54a. While the inner faces 55

of walls 54, 54a extend substantially parallel to the axis of the bore, the inner faces 56 of walls 44 and 44a incline inwardly and downwardly towards the axis of work 26, for a purpose which will be made apparent hereinafter.

The driving elements or kelly slips 57, of which there are preferably two in number, are adapted to be dropped into bore 53 at diametrically opposite sides of stem 26. Each slip is made up of a body portion 58 whose inner face 59 is adapted to extend substantially in parallelism with the work axis, and whose outer face 60 is complementary to and adapted to engage the inclined faces 56 of bushing walls 44 or 44a. Taken together, the slips may be considered as a constrictable jaw J. The slips are of a width to be taken nicely between bushing walls 54, 54a. Extending transversely from faces 59 are the horizontally spaced lugs 61 which extend at opposite sides of work 26, forming, in effect, with the body portion of the slips a vertically extending, angular socket adapted to take the work. The square kelly thus being taken within the substantially complementary socket formed by the slips, it will be seen that rotation of the slips imparts like movement to the kelly, and due to the complementary angularity of the bushing and slips, that slip rotation is caused by rotation of the bushing through table rotation.

Furthermore, it will be seen that due to the inclined characteristics of faces 56 and 60, the slips tend to move downwardly and wedge themselves between the bushing and kelly to clamp the latter to the table. Preferably, however, a formation is applied to the interior faces 59 of the slips to give said slips superior gripping engagement with the kelly so the slips and kelly may be more positively held against relative vertical movement. As a preferred construction, though not a necessary one, this formation is in the nature of removable inserts which have serrated inner faces, it then being possible to remove these inserts for replacement or re-sharpening without having to discard the entire slip body when the prepared gripping faces become unsuited for the work in hand.

We have shown these gripping members or inserts in the form of plates 62 having flat faces 63 adapted to engage body faces 59 and opposite toothed or serrated faces 64 presented toward the work. These inserts lie between lugs 61 which thus act, in effect, as horizontally spaced shoulders for holding the inserts against movement horizontally over faces 59. The lower ends of the inserts rest upon horizontal flanges 65 which extend from the slip body or gripping member carriers, the flanges vertically overlapping said lower ends as at 66a to hold them against outward displacement. Beneath an upper horizontal flange 66 on a given body 58, is detachably

secured as by bolts 67 (Fig. 13) a strap or keeper 68 which vertically overlaps the upper ends of the inserts as at 69 (Fig. 10). The lugs 61 and overhangs 66a and 69 thus hold the inserts from accidental displacement from the slip bodies, but it will be evident that when occasion arises for exchanging or resharpener the slips, it is merely a matter of removing bolts 67 and keepers 68 to free said inserts entirely from the slip bodies.

The above method of mounting the inserts is the subject matter of certain claims in a copending application entitled "Work-gripping means for well drilling apparatus" filed by Frederick Stone, one of the present applicants, under date of January 4, 1928, Serial No. 244,423.

When the drilling operation calls for the table only to take a part of the down bearing load or to elevate the load, it is necessary to use only as much of the assembly as has so far been described. It will be seen that with the weight of the pipe applied, the slips are wedged down tightly, or the jaw J constricted, by reason of inclined faces 56, 60, the teeth of the inserts grippingly engaging the pipe with sufficient force to prevent said pipe from dropping through the table bore. Of course, the greater the weight of the drilling stem the greater the clamping action of the slips, this being a condition usual to ordinary segmental wedge slips, as will be understood.

Lugs 61 are of such length, that the ends of the lugs on one slip body are spaced horizontally from the ends of the lugs on the other body when the inserts engage the kelly, it following that said lugs do not interfere with proper clamping or wedge action of the slips. However, when the kelly is removed from the table, the lugs on one slip body will engage the lugs on the other before said bodies can slide downwardly and inwardly completely through the bushing. The horizontal spacing of the lugs when the slips are in operative position, however, is not sufficient to destroy the function of said lugs as rotational driving members.

Now when occasion arises for crowding the work down, that is, applying down-bearing force to the bit by forcing the rotary table downward, it will be seen that means must be provided to prevent movement of the table bushing and table downwardly with respect to the kelly slips, and we have provided particularly efficient means for accomplishing this. One of the features of the arrangement is that the greater the force tending to create this relative movement, the greater the effectiveness of the hold-down means to prevent it. In Fig. 6, we have shown central grooves or ways 70 cut in the slip bodies, said grooves opening at their sides to faces 60, and at their upper ends to the ends of the bodies. The bottom faces 71 of these grooves incline oppositely to faces

60, that is, they incline downwardly and outwardly with respect to the axis of the work. Inserted within grooves or ways 70 are wedges 72, the opposite wedge faces of these members engaging faces 71 and 56, movement downwardly of said wedge, causing, of course, horizontal or radial movement of the slips toward the work.

We provide for each slip part a hold-down bridge or jack generally indicated at 72a (Fig. 12) which is adapted to be readily attached to or detached from the bushing, and, when in operative position, to bridge both the slips and the wedges. Considering the invention broadly, this wedge depressor and hold-down means may be of any suitable nature, but we have shown and will now describe a preferred means, though this is not to be construed as limitative on our broader claims calling for hold-down means. Member 72a is made up of a horizontal bar or body portion 73 having depending terminals or legs 74 from the lower ends of which extend transverse hooks 75. In applying the bridge to the bushing, hooks 75 are first passed through the openings 76 provided in the top of the bushing at opposite sides of bore 53, and the member is then rotated from the dotted line position of Fig. 8 through the position indicated in dotted lines in Fig. 12 to the upright position shown in full lines in the last-named figure, hooks 75 moving beneath the downwardly facing shoulder 77 provided by the underside of the bushing top. It will be seen that the bridge may be considered as embodying a horizontal bar mounted for movement about a horizontal axis from a position at one side of the slips to a position overlying said slips and wedge. Means tending to spread the bridge and slips vertically apart are then actuated. For instance, central jack screw 78 is threaded downwardly through the bar of the bridge and against the upper end of the wedge, the latter preferably having a slight recess or socket 79 to take the end of the jack screw. Downward pressure of the screw thus forces the wedge downwardly between the bushing and slips, wedging said slips tightly against the kelly. Said wedges may be considered as being slip hold-down means positioned beneath the bar and, by reason of their inclination, horizontally overlapping the kelly slips.

Assuming that the bit be on bottom and that the rotary table be hydraulically forced downwardly, carrying with it, of course, the bushing and wedge, said wedge acts with increased force to contract the slips, or constrict the jaw J, about the kelly.

It will be thus seen that we have provided for a double wedge action whereby wedge action comes into play to force the slips tightly into engagement with the work whether the table be tending to drop or to

be elevated with respect to the work. The faces of the wedge presented to inclined faces 56 coact with said faces in the same manner as do faces 60 to tend to move the slips inwardly to the work when the table is being elevated or when the down bearing load of the drill stem is taken by the slips.

It will be seen that all the above advantageous ends are gained without complications of assembly or operation, the importance of these characteristics being self-evident.

In Figs. 14 and 15 we have illustrated a type of slips which may be substituted for the slips shown in Fig. 6 when the square kelly is dispensed with and the table is adapted to take directly round drill stem 26'. The elements of these slips which have the same general characteristics and functions as similar elements of the previously described slips, will be given the same number primed. With this numbering condition existing it will be unnecessary to repeat certain descriptions of structure and operation.

Driving elements or slips 57' are adapted to be taken within bore 53 at diametrically opposite sides of stem 26', each slip being made up of a body portion 58' whose inner, semi-cylindric face 59' is adapted to extend substantially in parallelism with the work axis and whose outer face 60' is complementary to and adapted to engage the inclined faces 56 of bushing walls 44, 44a. The slips are of a width to be taken nicely between bushing walls 54, 54a. Together, the slips may be considered as making up constrictable jaw J'.

While cylindrical faces 59' may be fashioned in any suitable manner to have proper gripping engagement with the work, we have here shown a preferred method of accomplishing this, the particular structure being the subject matter of certain claims in the aforementioned, copending application bearing Serial No. 244,423. Removable inserts 62' are set in vertically extending channels or ways 85 sunk in arcuate faces 59'. It will be unnecessary to specify here the particular characteristics of the inserts or the manner of retaining them, except to state their exposed faces are serrated or otherwise suitably formed at 86 for proper gripping engagement with stem 26'.

It will be seen that due to the inclination of faces 56' and 60' the jaw J' is constricted, or, in other words, the slips tend to move downwardly and wedge themselves between the bushing and drill stem to clamp the latter to the table, both as regards relative rotation and movement of the stem downwardly with respect to the table.

The slip bodies are provided with central grooves or ways 70' which open at their sides to faces 60' and at their upper ends to the ends of the bodies. The bottom faces 71' of

these grooves incline oppositely to faces 60', that is, they incline outwardly and downwardly with respect to the axis of the work. When occasion arises for crowding down the work, wedges 72 and hold-down devices 72a are employed in exactly the same manner and with the same effect as described in connection with the operation of the slips 57.

It will be understood the drawings and description are to be considered merely as illustrative of and not restrictive on the broader claims appended hereto, for various changes in design, structure and arrangement may be made without departing from the spirit and scope of said claims.

We claim:

1. In a device of the character described, a body member having a bore adapted to take vertically extending work, said bore having a wall inclining inwardly and downwardly, work-engaging and gripping means in the bore about the work and supported directly by the body member, said gripping means being movable downwardly along said wall into engagement with the work, and an element extending vertically between and in face to face engagement with both the body member and work-gripping means and movable vertically therebetween in one direction to urge said gripping means more tightly into engagement with the work.

2. In a device of the character described, a body member having a bore adapted to take vertically extending work, said bore having a wall inclining inwardly and downwardly, work-engaging and gripping means in the bore about the work and supported directly by the body member, said gripping means being movable downwardly along said wall into engagement with the work, an element extending vertically between and in face to face engagement with both the body member and work gripping means and movable vertically therebetween in one direction to urge said gripping means more tightly into engagement with the work, and releasable means adapted to hold said element against movement vertically in the opposite direction.

3. In a device of the character described, a body member having an opening extending vertically therethrough to take work, work engaging and gripping means within the opening about the work, said body member directly and slidably supporting the work engaging and gripping means, portions of the opposing walls of the body member and of the gripping means defining a downwardly converging space, and a downwardly pointing wedge removably received in said space.

4. In a device of the character described, a body member having a bore adapted to take vertically extending work, work-engaging and gripping means in the bore about the work and supported directly by the body

member, a downwardly pointing wedge introduced between the body member and work gripping means from above and having an effective inclined wedge face in engagement with said means, said wedge being adapted by its introduction to move said gripping means toward the work, and releasable means adapted to hold said wedge against movement upwardly from between said body and means.

5. In a device of the character described, a body member having a bore adapted to take vertically extending work, work-gripping means in the bore about the work, a wedge introduced between the body member and work-gripping means, releasable means holding the wedge therebetween, and inclined faces on said wedge, body member and gripping means coacting with one another in a manner whereby vertical movement, both up and down, of the member with relation to said means causes coincident movement of the gripping means into forcible engagement with the work.

6. In a device of the character described, a body member having a bore adapted to take vertically extending work, work-gripping means in the bore at one side of the work, said body member and gripping means having opposed faces, portions of which incline oppositely with respect to the work axis and converge downwardly, a wedge complementary to and entered in the space defined by said faces, and means releasably holding said wedge from movement upwardly out of said space.

7. In a device of the character described, a body member having a bore adapted to take vertically extending work, work-gripping means in the bore at one side of the work, said body member and gripping means having opposed faces, portions of which incline oppositely with respect to the work axis and converge downwardly, a wedge complementary to and entered in the space defined by said faces, and means carried by said body member for forcing said wedge downwardly into said space.

8. In a device of the character described, a body member having a bore adapted to take vertically extending work, a work-engaging member entered in said bore from above and releasable means for holding said work-engaging member against upward displacement from the body member, said means including a horizontal bar extending above the body member, means releasably connecting the bar to the body member, and a downwardly pointing wedge beneath the bar and extending downwardly between opposed faces of the work-engaging member and the body member.

9. A work driving member of the character described, embodying a body having opposite side faces, one side face of said body

being adapted to engage the work, and a portion of the opposite side face inclining downwardly and inwardly towards said one face, there being a way cut into said opposite side face, the bottom wall of said way inclining oppositely to said face portion.

10. A work driving member of the character described, embodying a body having opposite side faces, one side face of said body being adapted to engage the work, a pair of transverse lugs extending from said one face, said lugs being spaced from one another at opposite sides of the face center, and a portion of the opposite side face inclining downwardly and inwardly towards said one face, there being a way cut into said opposite side face, the bottom wall of said way inclining oppositely to said face portion.

11. In a device of the character described, a body member having a bore adapted to take vertically extending work, work-gripping means in the bore at one side of the work, and means engaging said work-gripping means to force said gripping means into forcible engagement with the work by virtue of upward movement of the work-gripping means with relation to the body member.

12. In a device of the character described, a body member having a bore adapted to take vertically extending work, work-gripping means in the bore at one side of the work, a downwardly pointing wedge introduced between the body member and means, said wedge having a face inclining downwardly and outwardly with respect to the bore axis, said face being in effective wedge-engagement with said means, and means adapted to hold said wedge from upward movement.

13. In a device of the character described, a body member having a bore adapted to take vertically extending work, work gripping means in the bore at one side of the work, said body member and means having opposed faces, portions, at least, of which define a downwardly converging space therebetween, the space-defining face on the gripping means inclining downwardly and outwardly with respect to the bore axis, a wedge substantially complementary to and entered in said space, and means releasably holding said wedge from movement upwardly out of said space.

14. A drive member of the character described, embodying a body, a work-gripping element on one side face of the body near the center thereof, transverse lugs extending from said face at opposite sides of said gripping element, a portion of the opposite side face inclining downwardly and inwardly towards said one face, there being a way cut into said opposite side, the bottom wall of said way inclining oppositely to said face portion.

15. In a device of the character described, a body member having a downwardly taper-

ing bore adapted to take vertically extending work, a pair of tapered slips in said bore and forming together a constrictable jaw about the work, said body member coacting with the slips to constrict said jaw about the work when the work is suspended from the body member through the slips, a pair of downwardly pointing wedges entered, one each, between the body member and the respective slips and coacting therewith to constrict further said jaw about the work when downward bearing pressure is transmitted to the work from the body member through the slips, and releasable means applied to the wedges to hold said wedges from moving from between said body member and slips.

16. In a device of the character described, a rotatable body member having a downwardly tapering bore adapted to take vertically extending work of polygonal cross-section, a work-engaging and rotary-driving element in the bore and held against rotation with respect to the body member, said element embodying a vertically extending body portion, one side face of said body portion inclining downwardly and inwardly toward the opposite side face and engaging a tapering face of said bore, and horizontally spaced, transverse lugs on said opposite side face, said lugs engaging the work on its opposite sides to transmit rotary drive from the element to the work.

17. In a device of the character described, a rotatable body member having a downwardly tapering bore adapted to take vertically extending work of polygonal cross-section, a work-engaging and rotary-driving element in the bore and held against rotation with respect to the body member, said element embodying a vertically extending body portion, one side face of said body portion inclining downwardly and inwardly toward the opposite side face and engaging a tapering face of said bore, and horizontally spaced, transverse lugs on said opposite side face, said lugs engaging the work on its opposite sides to transmit rotary drive from the element to the work, and a detachable work-gripping member on said opposite face of the body portion between the lugs, said lugs engaging opposite sides of the work-gripping member to position it horizontally on the element.

18. In a device of the character described, a rotatable body member having a downwardly tapering bore adapted to take vertically extending work of polygonal cross-section, a work-engaging and rotary-driving element in the bore and held against rotation with respect to the body member, said element embodying a vertically extending body portion, one side face of said body portion inclining downwardly and inwardly toward the opposite side face and engaging a tapering face of said bore, and horizontally spaced, transverse lugs on said opposite side face, said lugs en-

gaging the work on its opposite sides to transmit rotary drive from the element to the work, and a work-gripping member on said opposite face of the body portion between the lugs.

19. In a device of the character described, a body member having a bore adapted to take vertically extending work, a work-engaging member entered in said bore from above and releasable means for holding said work-taking member against upward displacement from the body member, said means including a horizontal bar extending above the body member, means releasably connecting the bar to the body member, a downwardly pointing wedge beneath the bar and extending downwardly between opposed faces of the work-engaging member and the body member, and a jack screw threaded through said bar into end contact with said wedge.

In witness that we claim the foregoing we have hereunto subscribed our names this 25th day of January, 1928.

FREDERICK STONE.
ALBERT L. STONE.