

June 18, 1935.

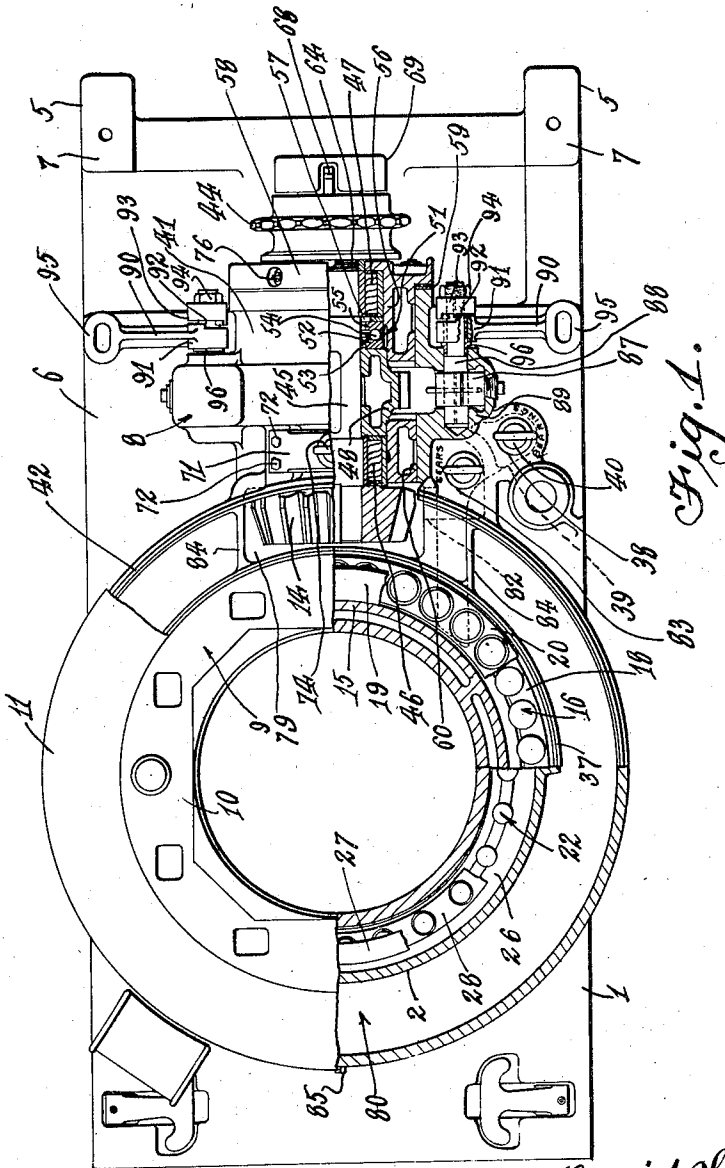
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2,005,137

ROTARY MACHINE

Filed Dec. 26, 1930

6 Sheets-Sheet 1



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ROTARY MACHINE

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6 Sheets-Sheet 2

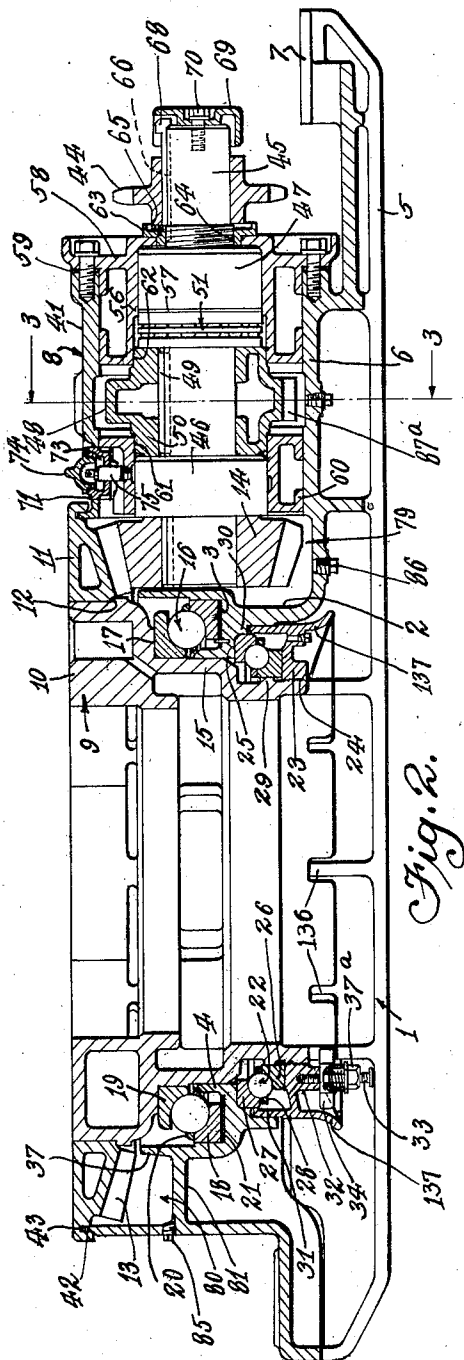


Fig. 2.

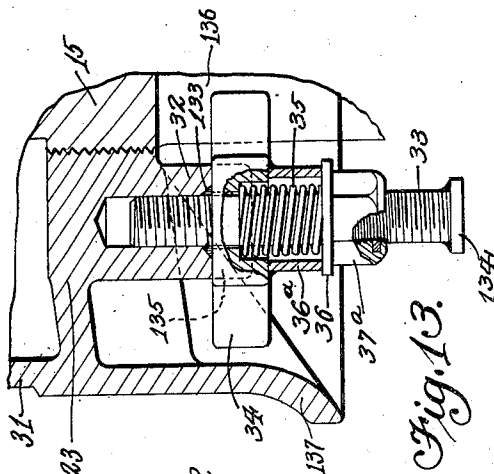


Fig. 13.

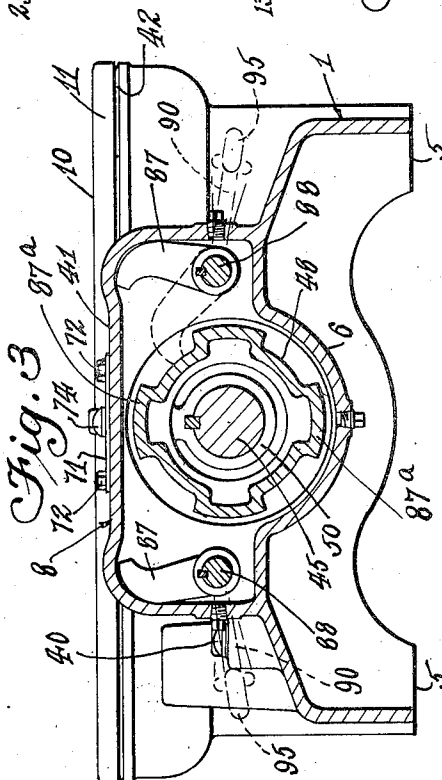


Fig. 3.

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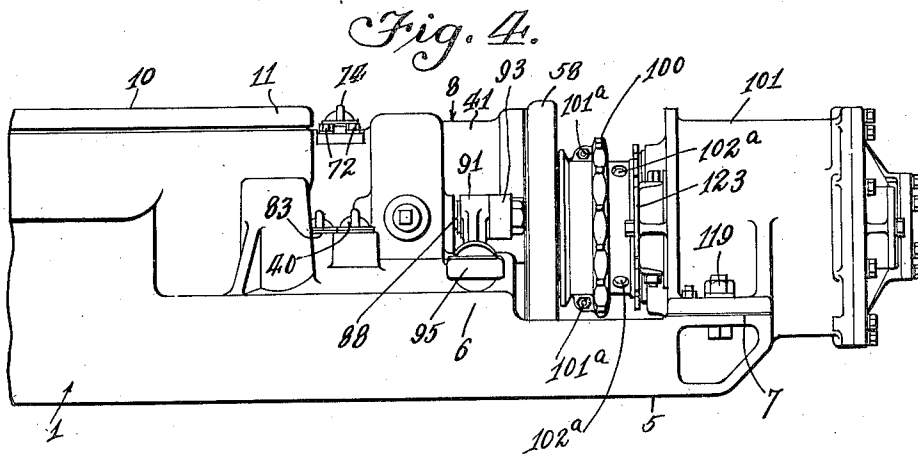
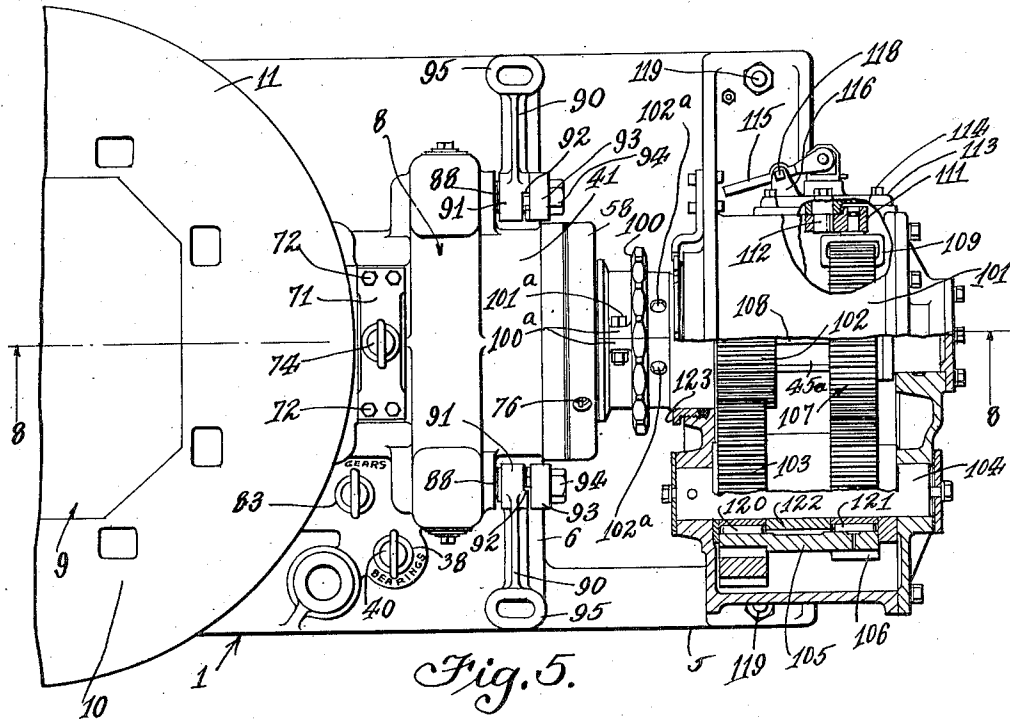
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6 Sheets-Sheet 3



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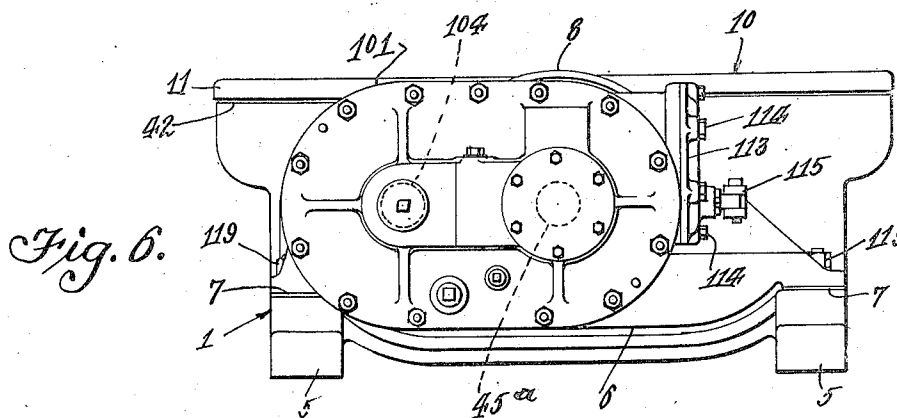
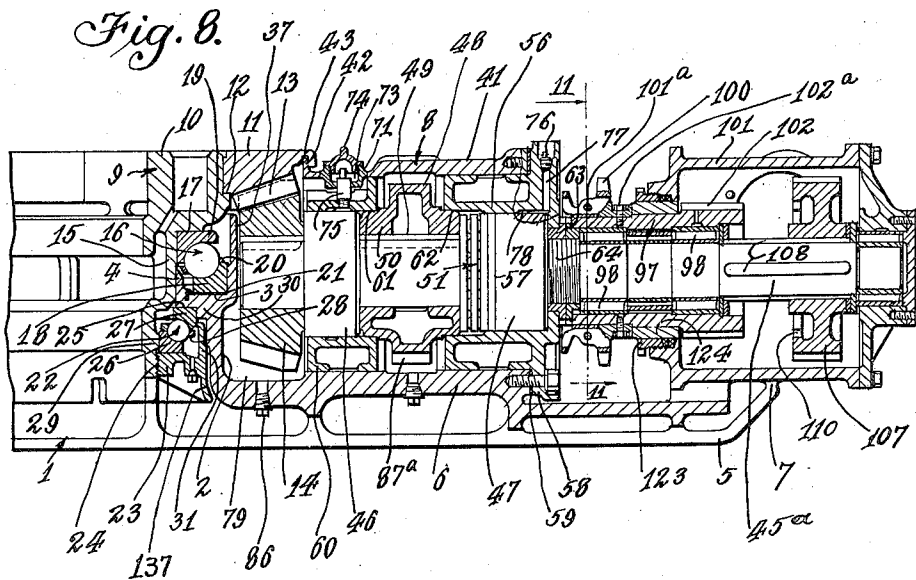
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ROTARY MACHINE.

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6 Sheets-Sheet 4



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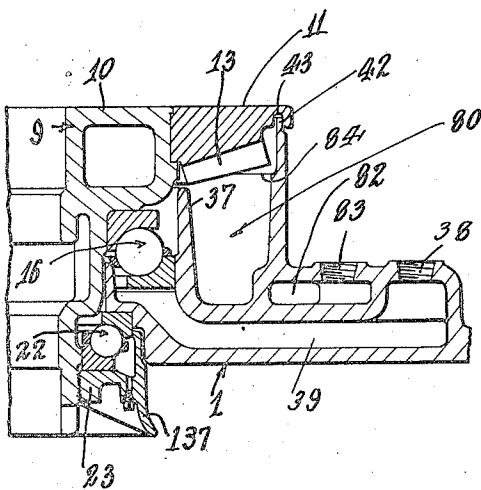
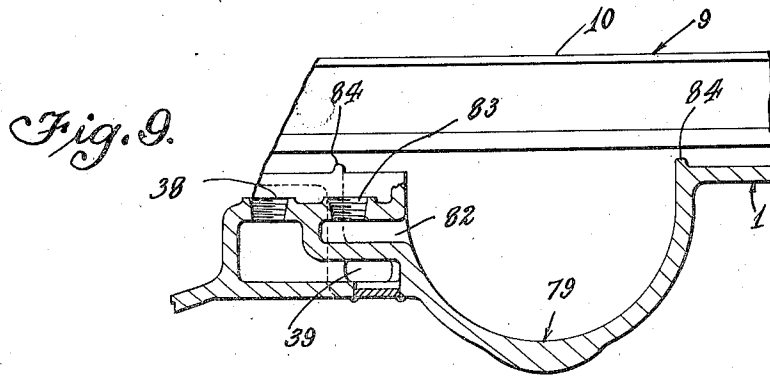
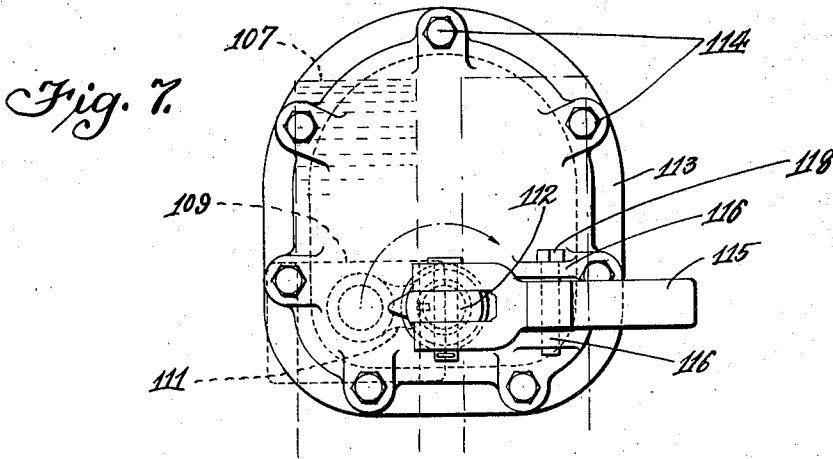
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ROTARY MACHINE

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6 Sheets-Sheet 5



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ROTARY MACHINE

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Fig. 11.

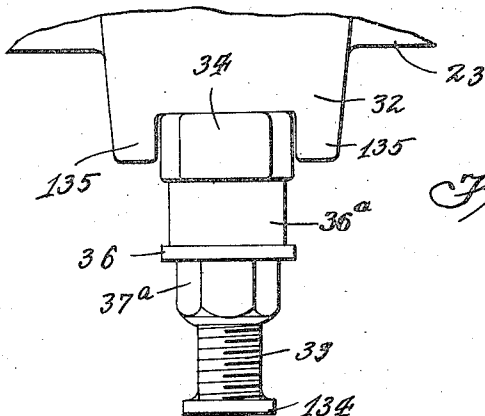
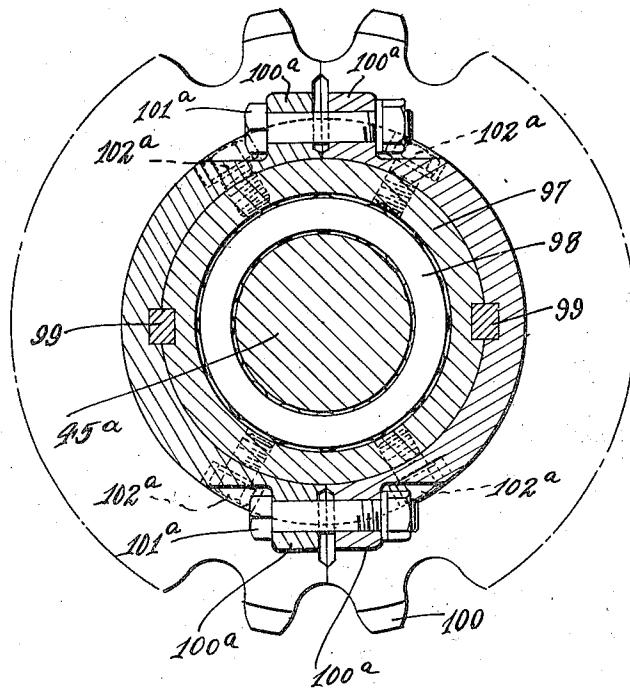


Fig. 12.

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UNITED STATES PATENT OFFICE

2,005,137

ROTARY MACHINE

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Application December 26, 1930, Serial No. 504,758

66 Claims. (Cl. 255—23)

This invention relates to rotary machines, and more particularly to a rotary machine which is fully enclosed and is so constructed as to withstand the severe shocks imposed upon present day well drilling apparatus.

An object of this invention is to provide a rotary machine having a one piece base which entirely encloses all working parts and protects such working parts from mud, water and other foreign matter.

Another object of this invention is to provide a rotary machine having a one piece base which supports a unitary pinion shaft assembly intact permitting the removal of the pinion shaft as a unit and which provides a means for positively maintaining the pinion shaft in alignment with the rotary table supported by the base.

Another object of this invention is to provide a rotary machine including a one piece base to which a unitary pinion shaft assembly is secured and in which rotary machine there is provided an enclosed pinion shaft lock which is enclosed to protect such pinion shaft lock from mud, water and other foreign matter, and which also prevents and makes impossible the injury of the operator of the rotary machine when actuating the pinion shaft lock.

Another object of this invention is to provide a smooth-running rotary table in which there is no side slap during the operation of such rotary machine and in which structure the supporting bearings are positively lubricated at all times.

Another object of this invention is to provide a rotary machine including a base and a rotary table and in which rotary machine the rotary table is held down by means of threading to the table skirt an adjustable ring which supports the bottom race of the hold-down bearings and forms an oil seal.

Another object of this invention is to provide a rotary machine having a one piece base and the provision in such a rotary machine of a detachable two-speed attachment which may be optionally connected with the pinion shaft assembly of the rotary machine or detached therefrom as desired.

Other objects and advantages of this invention it is believed will be apparent from the following detailed description of a preferred embodiment thereof as illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a top plan view partly in section of a rotary machine embodying our invention.

Figure 2 is a sectional side elevation thereof. Figure 3 is a sectional end view taken substantially on the line 3—3 of Figure 2.

Figure 4 is a fragmental side elevation illustrating the two-speed attachment mounted upon the base and connected with the pinion shaft.

Figure 5 is a plan view partly in section of the structure illustrated in Figure 4.

Figure 6 is an end elevation of the structure illustrated in Figure 4.

Figure 7 is a detached elevation of the shifter and control plate therefor of the two-speed attachment.

Figure 8 is a fragmental sectional view of the two-speed attachment illustrating the same as connected with the pinion shaft assembly.

Figure 9 is a fragmental sectional view of the base of a rotary machine illustrating the lubricant ducts and inlets.

Figure 10 is a fragmental sectional elevation of the structure illustrated in Figure 9.

Figure 11 is a sectional end elevation taken substantially on the line 11—11 of Figure 8.

Figure 12 is a fragmental elevation of the up-thrust bearing ring lock embodied in our invention.

Figure 13 is an enlarged fragmental sectional view illustrating locking means for the closure ring embodied in our invention.

In the preferred embodiment of our invention illustrated in the accompanying drawings, 1 indicates the base of a rotary machine which is of one-piece construction and includes an up-standing flange 2 formed integral with the base 1 and providing a bearing race way 3, the flange 2 being formed to define the vertical passage formed axially of the base 1. Formed integral with the base 1 at a point spaced from the flange 2 is an annular bearing retaining flange 4. Formed integral with the base 1 is a pair of spaced skids 5. The skids 5 extend outwardly from the annular portion of the base 1 and are formed integral with the outwardly extending unitary pinion shaft portion 6 of the base 1 and the supporting base 7 to which a two-speed attachment means is removably secured.

The outwardly extending portion 6 of the base 1 is also cast integral with a housing 8 for the unit pinion shaft assembly hereinafter to be described. The housing is formed integrally with the base as to insure at all times the perfect aligning of the unit pinion shaft assembly radially with the table 9 of the rotary machine

which is rotatably supported by the base 1 in the axial opening thereof.

The rotary table 9 includes a table ring portion 10 upon which a gear ring 11 is shrunk and supported on an annular shoulder 12. The gear ring 11 is formed on its under surface with bevel gear teeth 13 which are adapted to mesh with the teeth of the bevel pinion 14 of the pinion shaft assembly.

The rotary table 9 is formed integral with a downwardly depending skirt 15 which extends through the upwardly extending flange 2 of the base 1. Mounted in the bearing race way 3 is the main supporting bearing 16 which is interposed between the flange 2 and the shoulder formed as illustrated at 17 by the extension of the skirt 15 from the ring portion 10 of the table 9. The bearing 16 as herein illustrated includes upper and lower race rings 18 and 19 between which balls are mounted and retained by means of a retaining ring 20.

Mounted between the lower race ring 18 and the base are a plurality of shims 21 utilized for the purpose of adjusting the main supporting bearings 16.

In order to provide for the holding of the table 9 down relative to the base 1, and to provide for the closure of the space between the table 9 and the base 1 so as to prevent the introduction of rotary mud, sand or other foreign matter into the bearings 22, 16, or the gear teeth 13, or pinion 14, we provide a closure ring 23 which is threaded as indicated at 24 to the lower extremity of the skirt 15 of the table 9 and fits closely a portion of the periphery of the flange 2, thereby providing a means for preventing the flow of rotary mud under pressure, sand, or other foreign matter to within the working mechanism of the rotary machine. The closure ring 23 likewise provides a means for supporting an up-thrust or hold-down bearing 22 which is interposed between the closure ring 23 and the annular shoulder 25 of the upwardly extending flange 2 of the base 1. The bearing 22 is preferably of the ball type and includes upper and lower races 26 and 27 between which the balls are positioned and held by means of a retaining ring 28. Ball race 26 is supported by the ring 23 on its under surface and by the annular rib 29 on the skirt 15 on its inner surface. Its concave race receives the balls of the bearing 22. The ball race 27 is supported on its upper surface by the shoulder 25 and on its outer surface by the inner periphery of an annular wall 30 of the flange 2.

The closure ring 23 is formed to provide an upwardly extending closure flange 31 which on its inner periphery surrounds in part the upper ball race 27 and provides the closure for the retaining of lubricant within which the bearing 22 runs.

In order to adjust the up-thrust bearing 22 so as to prevent relative vertical movement of the table 9 in relation to the base 1, and still to provide for running clearance for the said bearings, the closure ring 23 is threaded to the skirt 15.

In order to lock the closure ring 23 in adjusted position, the ring is provided with a downwardly extending boss 32 into which is threaded a bolt 33. A lock bar 34 is slidably mounted on the bolt 33 and is yieldably held in position by means of a spring 35 mounted on the bolt 33 in a recess formed in the boss 32 at one end, and in position to engage a washer 36

mounted on the bolt 33. The washer 36 engages the end of the cylindrical stop sleeve 36a secured to the lock bar 34 at its opposite end. The washer 36 is adjustably held in position by means of a lock nut 37a threaded upon the bolt 33. In order to prevent accidental displacement of any of the parts of this lock, the bolt 33 is welded as indicated at 133 to the boss 32 and a cap 134 is welded to the outer end of the bolt 33.

The lock bar 34 is formed elongated so that its intermediate portions will fit between a pair of ears 135 which extend outwardly from the boss 32 when the lock bar 34 is in locking position. The lock bar 34 is moved from locking position by forcing the same downwardly against the tension of the spring 35 and rotating same through 90° so that its ends will rest upon the surface of the ears 135, holding the same from engagement from within the spaced locking detents 136 formed around the end of the skirt 15 of the table 9.

The closure ring 23 is at its outer periphery formed with a curved annular mud flange 137 formed to follow the curvature of the base 2 at this point to prevent mud, sand or other detritus splashing upward into the bearing 22.

The flange 2 is provided with an upwardly extending ring portion 37 which extends upwardly above the bearing 16 mounted within the race 3 providing an enclosure for the retaining of lubricant within which the bearing 16 runs. The overflow of the lubricant from the channel formed by the ring 37 and flange 4 runs down into the up-thrust bearing 22, filling the channel provided by the ring flange 31 of the ring 23, maintaining both the bearings 16 and 22 running continuously in a bath of oil. The overflow from the channel provided by the flange 31 runs over the top of the flange 31 and down out of the rotary machine through the space provided between the flange 31 and the inner surface of the flange 2 of the base 1.

Lubricant is supplied to the channel formed by the ring portion 37 and flange 4 from a lubricant inlet 38 communicating with this channel through a conduit 39 cast during the formation of the base 1. A cap 40 is threaded into the inlet 38 to prevent foreign matter finding its way to the bearings 16 and 22.

Cast integral with the base 1 is a pinion shaft housing 41 which, at its upper surface, is formed as a horizontal extension of a closure ring 42 of the base 1. The closure ring 42 extends annularly around the main portion of the base 1 in position to fit within a ring groove 43 formed from the under surface of the ring gear 11 secured to the table 9. The ring 42 fitting within the ring groove 43 continuously around the table 9 prevents the introduction of foreign matter such as mud, water and the like into the rotary machine or to the gear ring 11.

The pinion shaft assembly carrying pinion gear 14 which meshes with the gear teeth 13 is formed as a complete unit and is inserted into the housing 41. The pinion shaft assembly which is fitted within the housing 41 is of substantially the same construction for the rotary machine in either of the cases where the rotary machine is utilized with or without the two speed attachment, as hereafter described, except for the manner of connecting the drive sprocket to the pinion shaft so as to either utilize the two speed attachment or provide a di-

rect connection to the pinion shaft where no such two speed attachment is employed.

The pinion shaft assembly, being formed as a unit, is completely removed from the housing 41 when it is desired to convert the rotary machine from a single speed to a two speed machine. The pinion shaft assembly for the two speed attachment is carried directly by the two speed attachment and is insertable in the housing 41 as a unit. The pinion shaft unit which carries the overhanging drive sprocket as illustrated in Figure 2 is a separate removably mounted pinion shaft assembly which is insertable in or removable from the housing 41. Each of these assemblies is the same in so far as their construction within the housing 41, except for the pinion shaft 45 which is used for the single speed rotary and the pinion shaft 45a which is required for the rotary when equipped with a two-speed attachment.

The shaft 45 is supported on spaced bearings 46 and 47, preferably the roller type, between which bearings there is provided on the shaft 45 a locking ring 48. The locking ring 48 is keyed as indicated at 49 to the shaft 45. The bearing 46 is held from endwise movement along the shaft 45 at one end by engagement with the end face of the pinion 14, and at its opposite end by engagement with the inner hub 50 of the lock ring 48. Interposed between the bearing 47 and the lock ring 48 is an end-thrust bearing 51 which is preferably of the ball type and is constructed to include a race ring 52 which is supported on an outwardly extending annular flange 53 of the lock ring 48 and provides a race for the balls 54. The balls 54 are held by a suitable retaining ring and also ride within a race ring 55 which is supported within the bore of a bearing spider or retaining ring 56. Interposed between the race ring 55 and the end of the bearing 47 is a thrust washer 57. The bearing spider ring 56 is formed integral with the housing cap 58 which is fitted to the end of the housing 41 and is adjustably secured thereto by the interposing of shims 59 between the end face of the housing 41 and the inner face of the housing cap 58. The shaft 45 extends axially through the housing cap 58.

The outer end of the bearing 47 engages the inner face of the housing cap 58 and the bearing 47 is positioned within bearing spider ring 56 so that the bearing spider ring 56 forms a sub-housing for the bearing 47 within the main housing 41. A similar bearing spider or retaining ring 60 provides a sub-housing for the bearing 46 and is mounted around the bearing 46 and fits the cut-away portion 61 of the lock ring 48 in substantially the same manner as the spider 56 fits the cut-away portion 62 of the lock ring 48.

The bearing assembly thus provided, including the lock ring 48, is assembled as a unit before it is mounted in the housing 41.

In order to prevent pinion 14 from meshing too deeply with the ring gear 13, a collar 63 is threaded to the shaft 45 as indicated at 64. The collar 63 is locked in position in the case where the single speed rotary is employed by the use of a tongued key 65 which fits into an extension of the sprocket key-way 66 formed in the shaft 45. In the case of a single speed rotary machine, the overhanging sprocket 44 is mounted on the projecting end of the shaft 45 and is keyed thereto by means of a key 68 which fits within the key-way 66 and is held in position

by means of a cap 69 secured to the end of the shaft 45 by means of a cap screw 70.

The housing 41 is provided with a removable inspection plate 71 and is removably secured in position over an opening formed in the housing 41 by means of cap screws 72. The plate 71 is provided to enable inspection of the pinion 14 so as to enable the adjustment of the pinion 14 to be inspected. The inspection plate 71 is provided with an opening 73 which is normally capped by means of a cap 74 permitting a grease fitting 75 to be threaded into the spider 60 for the purpose of lubricating the bearing 46. Bearing 47 is lubricated from a grease fitting 76 which is threaded in a passage 77 formed in the plate 58, and which communicates at its lower end with a longitudinally extending grease passage 78 formed in the spider 56, providing a means for conducting lubricant to the bearing 47.

The pinion 14 is mounted in a sump 79 formed in the base 1 by the flange 2 on one side, and by the casting structure forming the housing 41 on its opposite side, which sump is enclosed by the casting forming the base 1, and communicates at its opposite ends with a trough 80 defined by the horizontal web 81 of the base 1 and the ring 42 and the ring 37. Means are provided for filling the sump 79 with lubricant in which the pinion 14 is maintained. This means includes a passage 82 formed in the base 1 communicating with the sump 79 on one end and with a cap opening 83 at its opposite end.

Lubricant picked up by the pinion 14 from the sump 79 is transferred to the gear ring 13 during the meshing of the pinion 14 with the gear ring 13 and as the lubricant drips from the gear ring 13, it falls into the trough 80 and is by the trough 80 returned to the sump 79. The trough 80 is at its ends where it communicates with the sump 79 provided with a pair of shallow dams 84 so that a depth of lubricant is maintained in the trough 80, permitting all foreign matter to settle from the lubricant in the trough 80 before the lubricant flows over the shallow dam 84 back into the sump 79.

An opening is formed in the ring 42 into the trough 80 which is normally plugged by means of a plug 85, the removal of which permits the withdrawal of the lubricant from the trough 80 and the cleansing of the trough 80 to remove foreign matter therefrom. The sump 79 is also formed with a plug opening 86, permitting draining of the lubricant therefrom when it is desired to renew the lubricant or cleanse the sump 79.

The lock ring 48 is enclosed within the housing 41 and, together with lock pawls 87, provides an enclosing means for locking pinion shaft 45 from rotation. The enclosing of this pinion shaft lock adds greatly to the safety of the operation of the rotary machine embodying our invention, eliminating the possibility of serious accidents heretofore caused by the open type of pinion shaft locks commonly used.

Two lock pawls 87 are provided mounted upon opposite sides of the pinion shaft 45 within the housing 41. Each of the locking pawls 87 is secured to a lock pawl shaft 88, which is journaled in bosses 89 cast integral with the housing 41. Lock pawls 87 are supported by the shafts 88 in position so that when they are rotated to non-engaging position, they engage the inner surface of the housing 41 in a position past dead center so that there is no danger of said pawls

falling into engagement with the locking lugs 87^a of the lock ring 48.

Journalled on lock pawl shafts 88 on the end of said shafts extending through the housing 41 are weighted actuating levers 90, the journal hubs 91 of which are provided with a clutching face 92 which is adapted to engage the clutch collar 93 keyed to the lock pawl shaft 88 and held in position thereon by means of a nut 94 threaded to the end of the lock pawl shaft 88. The opposite end of the lever 90 is provided with a weighted head 95. The lever 90 is journalled on the shaft 88 so that the said clutch faces of the hub 91 and the clutch collar 93 are engaged when the lever has been rotated to off center position to either hold the locking pawls 87 in engagement with the locking lugs 87^a of the lock ring 48 or to hold the locking pawls 87 out of engaging position against the inner surface of the housing 41.

The lost motion connection provided by this means permits the rotation of the lever 90 to the off center positions described, and also permits the ratcheting of the pawls when in the engaged position and the shaft is rotating in the direction counter thereto without causing movement of the operating levers.

A packing gland 96 is provided for packing the lock pawl shaft 88 where said shaft projects from the housing 41.

The construction so far described provides a single speed rotary machine. Our invention also contemplates the construction of a rotary machine so as to enable the use of an attachment providing a two-speed drive for the rotary machine which, as heretofore described, may be removably secured to the supporting base 7 which is formed integral with the base 1. The pinion shaft 45^a in this two-speed construction is of the same construction as in the single speed drive rotary machine where the said shaft projects from the housing 41.

In the case of the two-speed rotary machine attachment, the shaft 45^a is provided with a sleeve or quill shaft 97 which is journalled upon spaced bearings 98 mounted upon the shaft 45^a on the exterior of the housing 41. The shaft 45^a is rotatably supported at its outer end in a bearing carried within the cover portion of the housing 101.

The sleeve 97 is keyed as indicated at 99 to sprocket 100, which differs slightly in construction from the sprocket 44.

In order to permit replacement of the sprocket 100, as this part becomes worn more quickly than any other part of the rotary machine, without necessitating the disassembling of the unitary pinion shaft assembly and the two-speed attachment, the sprocket 100 is formed as a split, or two-piece, sprocket held together at flanges 100^a by means of bolts 101^a. The two half sections of the sprocket 100 are secured to the sleeve 97 by means of the two keys 99, one being provided for each half of the sprocket 100, and by means of spaced cap screws 102^a. This construction allows for the removal and replacement of the sprocket 100 without disturbing the adjustment or setting of the unitary pinion shaft assembly, or the two-speed attachment.

The sleeve 97 projects into the interior of the two-speed attachment housing 101 and is on its inner end provided with gear teeth 102.

The gear teeth 102 are adapted to mesh with a change speed pinion 103 which is journalled on

the countershaft 104 secured in position within the two speed attachment housing 101. The hub 105 of the gear 103 extends longitudinally of the shaft 104 and is at its outer end provided with gear teeth 106 which are adapted to mesh with a speed-shifting gear 107 which is splined to the shaft 45^a so as to move longitudinally of the shaft 45^a in a splined key 108.

With the gears in mesh, as thus described, the drive to the rotary machine pinion shaft 45^a is from the sprocket 100 through the gear teeth 102 to the gear 103 from the gear teeth 106 to the shifter gear 107, and from the shifter gear 107 to the shaft 45^a, thus providing a low speed drive for the rotary machine.

A shifter fork 109 engaging the edge faces of the gear 107 is provided for shifting the gear 107 along the shaft 45^a so that the gear 107 is moved out of mesh with the gear teeth 106 and is shifted to a position where the teeth 110 engages with the teeth 102 providing a direct drive from sprocket 100 to the shaft 45^a. The shifter fork 109 is pivotally mounted on an arm 111 which in turn is secured to a shifter fork shaft 112 which projects through the shifter plate 113 removably secured by means of bolts 114 to the housing 101.

Secured to the shifter fork shaft 112 on the face of the plate 113 is a shifter lever 115 by means of which the shifter fork 109 is actuated.

In order to lock the two-speed attachment in selected positions, a pair of lock lugs 116 is formed on the outer face of the shifter plate 113. The lever 115 fits between the pair of lugs 116 and is held in position by means of a pin 118 which is passed through eyes formed in the lugs 116.

In shifting from the direct drive to the lower speed drive, the shifter lever 115 is released from between the lugs 116 and is rotated through 180° in a plane substantially perpendicular to the axis of the shaft 112. The lever 115 is then rotated upon the pin which secures it to the shaft 112 back into position where it is and will again fall between the pair of lugs 116, and the pin 118 is replaced to lock the shifter lever in position again.

The housing 101 is removably secured to the supporting base 7 by means of bolts 119.

The gear 103 and its longitudinally extending lug 105 is journalled upon the shaft 104 on spaced bearings 120 and 121 held in spaced relation by means of a spacing ring 122. The bearings 120 and 121 are by this means located immediately within the gear 103 and the gear provided by the teeth 106 formed on the end of the hub 105.

The housing 101 is of fluid-tight construction, enabling a lubricant to be maintained within the housing in which the gears 102, 103, 106 and 107 run. The sleeve 124 is fixed on quill 97 between the teeth of gear 102 and the split sprocket 100 and the sleeve 124 projects into the housing 101 and is packed thereto by means of a packing gland 123.

Having fully described our invention, it is to be understood that we do not wish to be limited to the details herein set forth, but our invention is of the full scope of the appended claims.

We claim:

1. In a rotary machine, the combination of a base having a vertically extending opening therein and an annular recess surrounding said opening, a table mounted in said opening, table

supporting bearings carried by the base for rotatably supporting said table, up-thrust bearings between the table and the base for holding the table from upward movement relative to the base, and means secured to the table and confined in part within said annular recess for supporting and enclosing said up-thrust bearing and for enclosing the said supporting bearing to prevent introduction of foreign matter into said bearings.

2. In a rotary machine, the combination of a base having a vertically extending opening therein, bearings supported by said base, a rotary table mounted upon said bearing, the base being provided with an outwardly extending integral pinion shaft supporting portion, a gear ring secured to the table, a unitary pinion shaft assembly mounted on said pinion shaft supporting portion of said base in radial alignment with said table, and a two-speed attachment means removably secured to the outwardly extending portion of said base and adapted to be releasably secured to said pinion shaft assembly.

3. In a rotary machine, the combination of a base having a vertically extending opening therein, a rotary table rotatably supported by said base in said opening, the base being provided with an outwardly extending integral pinion shaft supporting portion terminating in an integral two-speed attachment base, a unitary pinion shaft assembly mounted on said outwardly extending portion and adapted to drive the rotary table, and a two-speed attachment removably secured to said two-speed attachment base portion and providing a multiple speed drive for the pinion shaft of the pinion shaft assembly.

4. In a rotary machine, the combination of a base having a vertically extending opening therein, a rotary table rotatably supported by said base in said opening, the base being provided with an outwardly extending integral pinion shaft supporting portion formed integral with a pinion shaft housing, a pinion shaft rotatably supported by spaced bearings within said housing, a lock ring mounted on said shaft within the housing between said spaced bearings, and pinion shaft lock pawls mounted within said housing and adapted to be releasably engaged with said lock ring.

5. In a rotary machine, the combination of a base having a vertically extending opening therein, a rotary table rotatably mounted on the base, the base being provided with an outwardly extending integral pinion shaft supporting portion, providing an integral pinion shaft housing, a pinion shaft mounted within said housing and provided at one end with means for driving the rotary table and projecting from said housing at its opposite end, a drive sprocket secured to the projecting end of said shaft, spaced bearings mounted within said housing for rotatably supporting said pinion shaft, and lock means mounted within said housing between said spaced bearings and adapted to engage said pinion shaft to hold said rotary table from rotation.

6. In a rotary machine, the combination of a base having a vertically extending opening therein, bearings supported by said base, a rotary table mounted upon said bearings within said opening, the base being provided with an outwardly extending integral pinion shaft supporting portion providing a pinion shaft hous-

ing, and a two-speed attachment provided with a pinion shaft assembly adapted to be removably secured to said outwardly extending portion of the base so that the said pinion shaft assembly thereof fits within said housing in position to drive said rotary table at selected speeds.

7. In a rotary machine for well drilling, the combination of a base, a rotary table mounted on the base, supporting bearing means between the base and the table, hold-down bearing means between the table and the base below the supporting bearing means, means for conducting lubricant to the supporting bearing means, retaining means for retaining a head of lubricant in which the supporting bearing means operate, retaining means for holding a head of lubricant within which the hold-down bearing means operate, and the hold-down bearing means being lubricated by lubricant passing the supporting bearing means lubricant retaining means.

8. In a rotary machine for well drilling, the combination of a base having a vertical opening therethrough, defined by an upstanding integral flange providing a bearing raceway, a bearing mounted in the bearing raceway, and an annular bearing retaining flange extending upwardly from the bearing raceway on the inner periphery of said raceway, providing a lubricant retaining wall for retaining a head of lubricant in the bearing raceway, a rotary table supported on said bearing and having a downwardly depending annular skirt, upthrust bearing means supported at the lower end of the skirt for holding the rotary table from being thrust upward relative to the base, means for retaining a head of lubricant around the upthrust bearing means, means for conducting lubricant to the first of said bearings, and the upthrust bearings being lubricated from lubricant passing the inner retaining flange for the first of said bearings.

9. In a rotary machine for well drilling, the combination of a base having an opening therethrough, a rotary table having a downwardly depending skirt extending through said opening, supporting bearing means carried by the base for rotatably supporting the table, means carried by the lower end of the skirt for supporting upthrust bearing means between the table and the base, the latter said supporting means including a curved flange around the outer periphery of the upthrust bearing means to retain a head of lubricant around the upthrust bearing means, and said flange being curved to the contour of the base to provide a mud barrier for holding mud from being thrust into said bearing means, and the surfaces between said curved flange and base being lubricated by the overflow of lubricant over the retaining means from the upthrust bearing means.

10. In a rotary machine, the combination of a base having a vertical opening therethrough, a rotary table, supporting bearing means interposed between the rotary table and the base, an annular flange completely surrounding the supporting bearing means on their outer periphery, and defining the outer periphery of a bearing lubricant chamber and the inner periphery of a gear ring lubricant chamber, said annular flange extending vertically upward substantially beyond the center line of said supporting bearing to form a barrier to hold lubricant within the bearing chamber formed and to hold the lubricant from mixing with the lubricant in the gear ring lubricant chamber, a gear ring secured to the rotary table above the annular

flange, a pinion adapted to mesh with the gear ring, a shaft for rotatably supporting the pinion, means for driving the shaft to drive the rotary table, and separate means for conducting lubricant to the bearing lubricant chamber and to the gear ring lubricant chamber.

11. In a rotary machine, the combination of a base having a vertically extending opening therein, a rotary table rotatably supported by said base in said opening, the base being provided with an outwardly extending pinion shaft supporting portion, a pinion shaft housing supported thereby, a pinion shaft rotatably supported within said housing, drive means carried by the shaft and adapted to drive the rotary table, a lock ring mounted on said shaft within the housing, means within the housing to engage the lock ring and hold the pinion shaft from rotation, and means extending through the housing for operating the lock means from the exterior of said housing.

12. In a rotary machine, the combination of a base having a vertically extending opening therethrough, a rotary table rotatably supported by said base in said opening, the base being provided with an outwardly extending pinion shaft supporting portion, a pinion shaft housing supported by said portion, a pinion shaft rotatably supported by spaced bearings within said housing, drive means carried by the shaft and adapted to drive the rotary table, locking means mounted on said shaft within the housing between said spaced bearings, means within the housing for engaging the lock means to hold the shaft from rotation, and means extending through said housing for operating the latter said means to and from engagement with said locking means.

13. In a rotary machine, the combination of a base having a vertically extending opening therein, a rotary table rotatably mounted on the base, an outwardly extending pinion shaft supporting means extended outwardly from the base, a pinion shaft housing supported by said portion, a pinion shaft mounted within said housing and providing at one end means for driving the rotary table and projecting from said housing at its opposite end, drive means secured to the projecting end of said shaft, bearings mounted within said housing for rotatably supporting the pinion shaft, lock means mounted within said housing on the shaft, and means within said housing adapted to engage said lock means to hold the shaft from rotation, and means extending through said housing for actuating the latter said means to and from locking position.

14. In a rotary machine, the combination of a base having a vertically extended opening therein, a rotary table including a gear rotatably mounted on the base, the base being provided with an outwardly extending integral pinion shaft housing, a unitary pinion shaft assembly mounted within the housing, the pinion shaft assembly including gear means on the shaft having rolling contact with the table gear to impart rotation thereto for driving the rotary table, means on the outer end for driving the shaft, axially spaced bearings for rotatably supporting the shaft within said housing, the said pinion shaft assembly being insertable into the housing as a unit from the outer end thereof in position to drive the rotary table, and means secured to the outer end of said

housing for retaining the pinion shaft assembly in driving position within the housing.

15. In a rotary machine for drilling wells, the combination of a base, a rotary table including a gear rotatably supported by the base, a pinion shaft, gear means on the shaft having rolling contact with the table gear to impart rotation thereto whereby said pinion shaft drives said rotary table, a housing supported by said base, a pair of bearings within said housing for rotatably supporting the pinion shaft, said pinion shaft, bearings and rotary table drive means being removable as a unit through the outer end of said housing.

16. In a rotary machine for drilling wells, the combination of a base, a rotary table including a gear rotatably supported by the base, a pinion shaft, gear means on the shaft having rolling contact with the table gear to impart rotation thereto whereby said pinion shaft drives said rotary table, a housing supported by said base, a pair of bearings within said housing for rotatably supporting the pinion shaft, said pinion shaft, bearings and rotary table drive means being removable as a unit through the outer end of said housing, and thrust bearing means adjacent the outer end of said housing for holding the pinion shaft assembly in driving position with relation to the rotary table.

17. In a rotary machine for drilling wells, the combination of a base, a rotary table including a gear rotatably supported by said base, a pinion shaft, gear means on the shaft having rolling contact with the table gear to impart rotation thereto whereby said pinion shaft drives said rotary table, a housing supported by said base, a pair of bearing means mounted on said shaft for rotatably supporting said pinion shaft within said housing, means between said bearings for maintaining the bearings in spaced relation, including end thrust bearing means, and means secured to the outer end of said housing for closing the outer end thereof, and for transposing the end thrust imposed upon said end thrust bearings to said housing.

18. In a rotary machine for drilling wells, the combination of a base, a rotary table including a gear rotatably supported by said base, a pinion shaft, gear means on the shaft having rolling contact with the table gear to impart rotation thereto whereby said pinion shaft drives said rotary table, a housing supported by said base, a pair of bearing means mounted on said shaft for rotatably supporting said pinion shaft within said housing, means between said bearings for maintaining the bearings in spaced relation, including end thrust bearing means, means secured to the outer end of said housing for closing the outer end thereof, and for transposing the end thrust imposed upon said end thrust bearings to said housing, and the latter said means being removably secured to said housing to permit the pinion shaft assembly including the pinion shaft, the bearings, and the rotary table drive means, to be removed through the outer end of said housing.

19. In a rotary machine of the type employed in the drilling of oil wells, the combination of a base, a rotary table including a gear rotatably supported by said base, a pinion shaft, gear means on the shaft having rolling contact with the table gear to impart rotation thereto for driving the rotary table from the pinion shaft, a pinion shaft housing supported by the base, axially spaced bearings carried by the shaft for

rotatably supporting the pinion shaft within said housing, said pinion shaft bearing means and rotary table drive means being removable as a unit through the outer end of said housing.

20. In a rotary machine for drilling wells, the combination of a base, a rotary table rotatably supported by the base, a pinion shaft, means for driving the rotary table from the pinion shaft, a housing supported by said base, a pair of bearings for rotatably supporting the pinion shaft within the housing, a pair of spaced bearing retainers for said bearings, a spacing means on said shaft between said bearings, end thrust bearing means interposed between the spacing means and the outer of said bearings, and means for securing the outer bearing retaining means to the outer end of said housing.

21. In a rotary machine for drilling wells, the combination of a base, a rotary table rotatably supported by the base, a pinion shaft, means for driving the rotary table from the pinion shaft, a housing supported by said base, a pair of bearings for rotatably supporting the pinion shaft within the housing, a pair of spaced bearing retainers for said bearings, a spacing means on said shaft between said bearings, end thrust bearing means interposed between the spacing means and the outer of said bearings, means for securing the outer bearing retaining means to the outer end of said housing, the latter said means being removably secured in position to permit the pinion shaft assembly, including the pinion shaft, retainers, bearings, and rotary table drive means, being removed from the outer end of said housing as a unit.

22. In combination with a rotary machine, a rotary table drive means including a pinion shaft, a housing for the pinion shaft, bearings for rotatably supporting the pinion shaft in the housing, the pinion shaft extending from the housing, a quill shaft journaled on the pinion shaft, means for driving the quill shaft, means for connecting the quill shaft directly to the pinion shaft, and means for connecting the quill shaft to the pinion shaft through a train of change speed gears.

23. In combination with a rotary machine, a rotary table drive means including a pinion shaft, a housing for the pinion shaft, bearings for rotatably supporting the pinion shaft in the housing, the pinion shaft extending from the housing, a quill shaft journaled on the pinion shaft, means for driving the quill shaft, means for connecting the quill shaft directly to the pinion shaft, means for connecting the quill shaft to the pinion shaft through a train of change speed gears, a housing for the said means for connecting the quill shaft with the pinion shaft, and means for actuating the said connecting means including an actuating lever extending from said housing.

24. In combination with a well drilling rotary machine, of a rotary machine table drive including a pinion shaft, means for rotatably supporting the pinion shaft, a quill shaft journaled on the pinion shaft, a drive sprocket removably secured to the quill shaft, a change speed gear housing within which the pinion shaft is journaled, means within the housing for directly connecting the quill shaft to the pinion shaft, means within said housing for connecting the quill shaft to the pinion shaft through a train of change speed gears, and means for actuating the said quill and pinion shaft connecting means.

25. In a rotary machine for drilling wells, the

combination of a base having a vertically extending annular flange, an opening in said flange, a housing extending outwardly from said flange and said opening of said flange, a rotary table rotatably supported by said base, a pinion shaft assembly mounted within said housing, said pinion shaft assembly including spaced inner and outer bearing supporting means, bearings supported thereby, and a rotary table drive pinion, and being removable outwardly through the outer end of said housing, said inner bearing means having limited axial freedom and closing the opening in said annular flange, and said outer bearing supporting means being axially immovable in operation.

26. In a rotary machine, the combination of a base having a vertical opening therein, a table mounted in the vertical opening from the top thereof, a supporting bearing carried by the base for rotatably supporting said table, a closure ring secured to said table, said closure ring having a curved annular mud flange interposed between the base and the table near the lower end of said table to protect said supporting bearing from foreign matter.

27. In a rotary machine, the combination of a base having a vertical opening therein, a table mounted in the vertical opening from the top thereof, supporting bearing means between the table and the base for rotatably supporting said table, a closure ring interposed between the base and the table near the lower end of said table, upthrust bearing means supported by said closure ring and a portion of said closure ring being of greater diameter than the opening in said base surrounding the upthrust bearing to form a barrier for deflecting foreign matter from the entrance to the bearings between the base and the table.

28. In a rotary machine, the combination of a base having a vertical opening therein and an annular recess in said base surrounding said opening, a table mounted in the opening, a supporting bearing between the table and the base for rotatably supporting said table, a closure ring positioned in part in said recess and being secured to the lower end of said table, an upthrust bearing between said base and closure ring, said closure ring being formed to provide a lubricant reservoir in which the upthrust bearing operates.

29. In a rotary machine, the combination of a base having a vertical opening therein, a table mounted in the vertical opening, supporting bearings means between the base and the table for rotatably supporting the table, the table having a depending skirt extending downwardly in the opening of said base, an upthrust bearing between the table and the base, a ring adjustably secured to the downwardly depending skirt of said table for supporting said upthrust bearing, and means secured to the ring and adapted to engage the skirt to lock the ring in adjusted position, the latter said means including a threaded pin member secured to the ring, a lock block slidably mounted on said pin member and having a projection to engage a notch in said table, a nut threaded on said pin member to clamp the block to said ring, means to prevent rotation of said block when in clamped position, a shoulder formed on said block, a compression spring positioned on said shoulder at one end and against the nut at the other end to yieldably hold the lock block in clamped position in the event that the nut becomes unscrewed from

said block, and means to limit the distance said nut can become unscrewed.

30. In a rotary machine for well drilling, the combination of a base, a rotary table, a supporting bearing assembly on said base for rotatably supporting the table, an inner annular upstanding wall in the base completely enclosing the supporting bearing assembly circumferentially to define a separate lubricant chamber for the bearing, an outer upstanding annular wall on the base cooperating with the table to define a separate lubricant chamber between the inner and outer annular walls, an opening in said outer wall below the upper edge thereof and drive means insertable through said opening to rotate within the outer lubricant chamber and drive the table.

31. In a rotary machine for well drilling, the combination of a base, a rotary table having an annular bevel gear ring and a reduced annular portion beneath the gear ring, a supporting bearing mounted on the base beneath the reduced annular portion of the table to rotatably support the latter, an inner annular upstanding wall in the base completely enclosing the supporting bearing circumferentially and overlapping the reduced annular portion of the table to define a separate lubricant chamber for the bearing, an outer upstanding annular wall on the base cooperating with the table to define a separate enclosed lubricant chamber between the inner and outer annular walls, an opening in said outer wall below the upper edge thereof, and drive means insertable through said opening to rotate within the outer lubricant chamber and drive the bevel gear ring.

32. In a rotary machine for drilling wells, the combination of a base having a vertically extending annular flange, a rotary table rotatably supported by the base and cooperating with said annular flange to form a complete enclosure around the table, an opening in said flange, a housing extending outwardly from the flange and having an opening coextensive with the opening in the flange, a pinion shaft assembly mounted within the housing, the pinion shaft assembly including a shaft, a pinion, a pair of spaced bearing retainers mounted within the housing, bearings mounted within the retainers to rotatably support the shaft, said retainers being removable outwardly through the outer end of said housing, the inner bearing retainer normally closing the opening in the annular flange, and said outer bearing retainer closing the outer end of the housing.

33. In a rotary machine for drilling wells, the combination of a base having a vertically extending annular flange, a rotary table rotatably supported by the base and cooperating with the annular flange to form a complete enclosure around the table, an opening in the flange below the upper edge thereof, an integrally formed housing extending outwardly from said flange and having a circular opening coextensive with the opening in said flange, a pinion shaft assembly mounted within said housing, and including a shaft, a pinion, a pair of spaced circular bearing retainers mounted within the housing, bearings mounted within the retainers to rotatably support the shaft, and separate means cooperating with the housing to prevent rotation of the bearing retainers.

34. In a rotary machine for drilling wells, the combination of a base having a vertically extending annular wall, a rotary table having a

gear ring and rotatably supported by said base and cooperating with said annular wall to form a complete enclosure around the table, an opening in the flange below the upper edge thereof, an integrally formed housing extending outwardly from the flange and having a circular opening coextensive with the opening in the flange, a pinion shaft assembly mounted within said housing and including a shaft, a pinion meshing with the gear ring on the table, bearing means aligned in said housing to rotatably support the shaft, and a removable inspection hole cover in the housing to permit inspection of the gear meshing action between the pinion and gear ring.

35. In a rotary machine for drilling wells, the combination of a base having a vertically extending annular wall, a rotary table having a gear ring and rotatably supported by the base and cooperating with the annular wall to form a complete enclosure around the table, an opening in the flange below the upper edge thereof, an integrally formed housing extending outwardly from the flange and having a circular opening coextensive with the opening in the flange, a pinion shaft assembly mounted within the housing and including a shaft, a pinion meshing with the gear ring on the table, a pair of bearing retainers mounted within the housing, bearings mounted within the retainers to rotatably support the shaft, a removable inspection hole cover in the housing, means cooperating with one of said bearing retainers and said inspection hole cover to prevent the rotation of the retainer.

36. In a rotary machine for drilling wells, the combination of a base having a vertically extending annular wall, a rotary table having a gear ring and rotatably supported by said base and cooperating with the annular wall to form a complete enclosure around the table, an opening in the flange below the upper edge thereof, an integrally formed housing extending outwardly from the flange and having a circular opening coextensive with the opening in the flange, a pinion shaft assembly mounted within the housing and including a shaft, a pinion meshing with the gear ring on the table, a pair of bearing retainers mounted within the housing, bearings mounted within the retainers to rotatably support the shaft, the inner of said bearing retainers adjacent to the pinion end being slidably mounted within the housing, and the outer of the bearing retainers being rigidly fixed within the housing.

37. In a rotary machine, the combination of a base having a vertically extending opening there-through, a rotary table rotatably supported by the base in the opening, the base being provided with an outwardly extending pinion shaft supporting housing, a pinion shaft rotatably supported by spaced bearings within the housing, drive means carried by the shaft and adapted to drive the rotary table, locking means mounted on the shaft within the housing, means pivoted within the housing for swinging into engagement with the lock means to hold the shaft from rotation, means extending through the housing for operating the latter swinging means to and from engagement with the locking means, said operating means including a lost motion connection so that the operating means has a greater angular travel than the angular travel of the swinging lock means.

38. In a rotary machine, the combination of a base having a vertically extending opening

therethrough, a rotary table rotatably supported by the base in the opening, the base being provided with an outwardly extending pinion shaft supporting housing, a pinion shaft rotatably supported by spaced bearings within the housing, drive means carried by the shaft and adapted to drive the rotary table, locking means mounted on the shaft within the housing, means pivoted within the housing for swinging into engagement with the lock means to hold the shaft from rotation, means extending through the housing for operating the latter swinging means to and from engagement with the locking means, said operating means including a lost motion connection so that the operating means has a greater angular travel than the angular travel of the swinging lock means, and counterweight means adapted to hold the lock-engaging means in either the engaged or disengaged position.

39. In a rotary machine of the type employed in the drilling of oil wells, the combination of: a base, a rotary table including a gear rotatably supported by said base, a pinion shaft, gear means on the shaft having rolling contact with the table gear to impart rotation thereto whereby said pinion shaft drives said rotary table, a housing supported by said base, and a pair of bearing means for rotatably supporting said pinion shaft, said bearing means being contained in said housing, said pinion shaft and said bearing means being removable as a unit from the end of said housing, while said housing is supported by said base.

40. In a rotary machine of the type employed in the drilling of an oil well, the combination of: a base having an upstanding wall, an opening in said wall, and a housing extending outwardly from said wall in communication with said opening, a table rotatably supported by said base, said base, upstanding wall, and said table defining a chamber, a ring gear on said table within said chamber, and a pinion shaft assembly including a pinion shaft, axially spaced supporting bearings and a drive pinion having rolling contact with the ring gear to impart rotation thereto, said pinion shaft assembly resting in said lubricant chamber and said housing, and being removable outwardly through said housing.

41. In a rotary machine of the type employed in the drilling of an oil well, the combination of, a base having an upstanding wall, an opening in said wall, and a housing extending outwardly from said wall in communication with said opening, a table rotatably supported by said base, said base, upstanding wall, and said table defining a chamber, a ring gear on said table within said chamber, and a pinion shaft assembly including a pinion shaft, axially spaced supporting bearings and a drive pinion having rolling contact with the ring gear to impart rotation thereto, said pinion shaft assembly resting in said lubricant chamber and said housing, and being removable outwardly through said housing, said pinion shaft assembly including means for closing said opening in said upstanding wall.

42. In a rotary machine of the character employed in drilling oil wells, the combination of, a base having a central opening, and a recess formed in the base around the lower end of said central opening, a rotary table rotatably supported on said base, and having an extension projecting through said central opening, a hold-down bearing in said recess engaging said base, and a closure member separate from said hold-down bearing and adjustably secured to said ex-

tension for completely closing the lower end of said recess and for supporting said hold-down bearing.

43. In a rotary machine of the type employed for drilling oil wells, the combination of, a base, a rotary table including a gear rotatably supported by said base, a pinion shaft, gear means on the shaft having rolling contact with the table gear to impart rotation thereto whereby said pinion shaft drives said table, a closed housing having an inner and an outer opening integral with said base, and a pair of bearing means for supporting said pinion shaft, said bearing means resting in said housing and being held in alignment thereby, said shaft, driving means and bearing means being insertable into said housing through the outer opening thereof.

44. In a rotary machine of the type employed for drilling oil wells, the combination of, a base, a rotary table supported on said base, a ring gear secured to said table, means forming a closed chamber in which said ring gear is located, there being a chamber opening for said chamber, a housing supported by said base in communication with said chamber opening, the outer end of said housing having an entrance opening, a pinion assembly including a pinion shaft, a pair of bearings for said pinion shaft, and a pinion secured to said pinion shaft having rolling contact with the ring gear to impart rotation thereto, said pinion assembly being insertable through said entrance opening so that said pinion meshes with said ring gear, and said pair of bearings rest in said housing, and means constituting a port of said pinion assembly for closing said chamber opening when said pinion assembly is installed.

45. In a rotary machine of the type employed for drilling oil wells, the combination of a base, a rotary table supported by said base, a drive shaft, means whereby said drive shaft drives said table, a fully closed housing supported by said base, bearing means for said shaft in said housing, and lock means for said shaft in said housing.

46. A rotary machine including a base casting having an outer vertically extending flange, an inner flange, and a casing; a cover means for said casing, a rotary table journaled upon said inner flange and forming a seal with said outer flange, a ring gear mounted upon said table, a bearing means mounted in said outer flange adjacent said casing, a bearing carried by said cover means in alignment with said last named bearing, a shaft journaled in said bearings extending from said casing into the annular space between said outer and inner flanges, and a pinion mounted upon the extended end of said shaft and in operative engagement with said ring gear.

47. In a rotary machine, the combination of a base, a rotary table, supporting bearings between the base and the table for rotatably supporting the table on the base, the table being formed with a downwardly depending skirt extending into an opening formed in the base, a closure ring secured to the lower end of the skirt, a shoulder provided on the base below the supporting bearings, an anti-friction upthrust bearing interposed between the closure ring and the shoulder, the closure ring being adjustably secured to the skirt and the closure ring and the base being formed to provide a close fit around the outer periphery of the clo-

sure ring to prevent the entrance of foreign matter into the upthrust bearing.

48. In a rotary machine, the combination of a base, a rotary table, supporting bearings between the base and the table for rotatably supporting the table on the base, the table being formed with a downwardly depending skirt extending into an opening formed in the base, a closure ring adjustably secured to the lower end of the skirt, a shoulder provided on the base below the supporting bearings, an anti-friction upthrust bearing interposed between the closure ring and the shoulder, the closure ring and the base being formed to provide a close fit around the outer periphery of the closure ring to prevent the entrance of foreign matter into the upthrust bearing, the closure ring being adjustably secured to the skirt to enable adjustment of the closure ring on the lower end of the skirt to adjust the bearing clearance between the supporting and the upthrust bearings, and lock means to lock the closure ring in its adjusted position.

49. In a rotary machine of the character employed in drilling oil wells, the combination of: a base having a central opening, and a recess formed around the lower end of said central opening; a rotary table rotatably supported on said base, and having an extension projecting through said central opening; a hold-down bearing in said recess engaging said base; a closure ring secured to said extension for completely closing the lower end of said recess and for supporting said hold-down bearing; and lubricant supply means for filling said recess with lubricant.

50. In a rotary machine of the character employed in drilling oil wells, the combination of a base having a central opening, a recess formed around the lower end of said central opening, the rotary table rotatably supported on said base and having a downwardly projecting skirt, a hold-down bearing mounted in the recess engaging the base, a supporting bearing interposed between the table and the base, and co-operating means adjustably secured to the skirt providing a close fit between the skirt and the base for resisting the entrance of foreign matter into said recess.

51. In a rotary machine of the type employed for drilling oil wells, the combination of: a base; a rotary table rotatably supported by said base; a pinion shaft; means whereby said pinion shaft drives said table; a housing supported by said base; a pair of bearing supporting means, bearings supported thereby for supporting said pinion shaft, said bearing supporting means resting in said housing and being held in alignment thereby; and means for securing one of said bearing supporting means from axial movement in said housing, the other of said bearing supporting means being free to move axially in said housing.

52. In a rotary machine of the type employed for drilling oil wells, the combination of a base, a rotary table rotatably supported on said base, a gear secured to said table, means forming an enclosed chamber in which said gear is located, there being an opening from said chamber, a housing formed integral with the base in communication with the chamber opening, the outer end of said housing having an entrance opening, and a pinion shaft assembly including a pinion shaft, a pair of spaced bearings for the pinion shaft and a pinion secured

to the pinion shaft, said pinion having rolling contact with the table gear to impart rotation thereto, said bearings being wholly mounted within and enclosed by the housing, and said pinion shaft assembly being insertable through the entrance opening so that the pinion meshes with the gear.

53. In a rotary machine for drilling wells having a base with a vertically extending opening therethrough, a rotary table rotatably supported by the base in the opening, an outwardly extending pinion shaft housing secured to said base, a pinion shaft rotatably supported by bearing means within said housing, and drive means carried by the shaft and adapted to drive the rotary table, in combination with lock means mounted on the shaft within the housing, means including a pivotally mounted element within the housing for selective engagement with the lock means to hold the shaft from rotation, a pivotally mounted actuating element positioned without the housing, and means operatively connecting said elements, said means including a lost motion connection so that one element will have an angular range of travel greater than the other.

54. In a rotary machine for drilling wells having a base with a vertically extending opening therethrough, a rotary table rotatably supported by the base in the opening, an outwardly extending pinion shaft housing secured to said base, a pinion shaft rotatably supported by bearing means within said housing, and drive means carried by the shaft and adapted to drive the rotary table, in combination with lock means mounted on the shaft within the housing, means including a pivotally mounted element within the housing for selective engagement with the lock means to hold the shaft from rotation, a pivotally mounted actuating element positioned without the housing, and means operatively connecting said elements, said means including a lost motion connection so that the first named element will be free to have a limited amount of movement when the actuating element is stationary and in the engaged position.

55. In a rotary machine for drilling wells having a base with a vertically extending opening therethrough, a rotary table rotatably supported by the base in the opening, an outwardly extending pinion shaft housing secured to said base, a pinion shaft rotatably supported by bearing means within said housing, and drive means carried by the shaft and adapted to drive the rotary table, in combination with lock means mounted on the shaft within the housing, means including a pivotally mounted element within the housing for selective engagement with the lock means to hold the shaft from rotation, a pivotally mounted actuating element positioned without the housing, and means operatively connecting said elements, said means including a lost motion connection so that the first-named element will be free to move a limited amount independently of the other element.

56. In a rotary machine for well drilling, the combination of a base having an opening therethrough, a rotary table having a downwardly depending skirt extending through said opening, supporting bearing means carried by the base for rotatably supporting the table, means carried by the lower end of the skirt and fitting in part within an annular recess in the base for supporting upthrust bearing means between the

table and the base, the latter said supporting means including an annular flange around the outer periphery of the upthrust bearing means to retain a head of lubricant around the upthrust bearing means, said flange being offset radially outward below the recess to a diameter greater than the diameter of the annular recess in the base to provide a barrier against the impingement of mud into the space between the flange and the recess in the base.

57. In a rotary machine, the combination of a base having a vertical opening therethrough, a rotary table including a gear ring mounted thereon, means including an upstanding wall on said base cooperating with the table to enclose the gear and to define the outer periphery of a gear lubricant chamber, an opening in said wall below the upper edge thereof, supporting bearing means interposed between the rotary table and the base, an annular flange completely surrounding the supporting bearing means on their outer periphery and defining the outer periphery of a bearing lubricant chamber and the inner periphery of the gear lubricant chamber, said annular flange extending vertically upward substantially beyond the upper level of said supporting bearing to form a barrier to hold lubricant within the bearing chamber formed and to hold the lubricant from mixing with the lubricant in the gear lubricant chamber, said gear ring being secured to the rotary table above the annular flange, a pinion insertable through the opening in said wall to rotate in said gear lubricant chamber and adapted to mesh with the gear ring, a shaft for rotatably supporting the pinion, means for driving the shaft to drive the rotary table, and separate means for conducting lubricant to the bearing lubricant chamber and to the gear ring lubricant chamber.

58. In a rotary machine, the combination of a base having a vertical opening therein, an annular recess in said base surrounding said opening, a table mounted in the vertical opening from the top thereof, a supporting bearing carried by the base for rotatably supporting said table, a closure ring secured to said table, said closure ring having an annular flange interposed in part within said recess between the base and the table near the lower end of said table to protect said supporting bearing from foreign matter.

59. In a rotary machine for drilling wells, the combination of a base, a rotary table rotatably supported by the base, a bearing housing supported on said base, a shaft positioned axially of a bore in said housing, a pinion on said shaft insertable through said bore and adapted to drive said table, radial bearing means positioned within the bore adjacent said pinion to rotatably support the inner end of said shaft, and bearing means supported adjacent the outer end of said housing to rotatably support the outer end of the shaft, said latter bearing means including thrust carrying means to take the axial end thrust transmitted to the shaft by said pinion.

60. In a rotary machine for drilling wells, the combination of a base, a rotary table rotatably supported by the base, a bearing housing supported on said base, a shaft positioned axially of a bore in said housing, a pinion on said shaft insertable through said bore and adapted to drive said table, radial bearing means positioned within the bore adjacent said pinion to rotatably

support the inner end of said shaft, bearing means supported adjacent the outer end of said housing to rotatably support the outer end of the shaft, said latter bearing means including thrust carrying means to take the axial end thrust transmitted to the shaft by said pinion, and means to adjust the axial end play of said shaft relative to said thrust carrying means.

61. In a rotary machine for drilling wells, the combination of a base, a rotary table rotatably supported by the base, a bearing housing supported on said base, a shaft positioned axially of a bore in said housing, a pinion on said shaft insertable through said bore and adapted to drive said table, axially spaced radial bearing means within said bore for rotatably supporting said shaft, and thrust bearing means to take the axial end thrust transmitted to the shaft by said pinion.

62. In a rotary machine for drilling wells, the combination of a base, a rotary table rotatably supported by the base, a bearing housing supported on said base, a shaft positioned axially of a bore in said housing, a pinion on said shaft insertable through said bore and adapted to drive said table, axially spaced radial bearing means within said bore for rotatably supporting said shaft, thrust bearing means to take the axial end thrust transmitted to the shaft by said pinion, and means to adjust the axial end play of said shaft relative to said thrust bearing means.

63. In a rotary machine for drilling wells, having a base, a table rotatably mounted on the base, a drive pinion adapted to drive said table, a pinion shaft rotatably supported on said base to drive said pinion, in combination with a drive sleeve rotatably mounted on the shaft, said sleeve having a drive sprocket and a drive pinion formed thereon, a gear casing on the base being movable axially of the pinion shaft to a position to enclose said drive pinion, means to detachably secure the casing to the base in said position, a bearing in said casing to rotatably support the outer end of said shaft, change speed gears within said casing adapted to be driven by said drive pinion, means within said casing for releasably connecting the drive sleeve directly to the shaft, means within said housing for releasably connecting the drive sleeve to the shaft through said change speed gears driven by said drive pinion, and means operable from without said casing for selectively actuating the aforesaid connecting means.

64. In a rotary machine, the combination of a base, a rotary table having a gear and being rotatably supported by the base, means including a vertically extending annular wall on said base cooperating with the table to form a complete enclosure around the gear, an opening in the wall, a lateral extension on the base having an opening co-extensive with the opening in said wall and terminating with a flange face, a pinion insertable through said opening to mesh with the table gear, a shaft having a drive member to drive said pinion, bearing means to support said shaft, closure means abutting said flange face for closing the opening in said extension, said annular wall, extension and closure means cooperating to define an enclosure for said gear and pinion, a lock element carried by said shaft within said enclosure, lock means positioned within said enclosure and adapted to releasably engage said lock element to secure said pinion against rotation, and means extending through

the wall of said enclosure for operating said lock means from outside the enclosure.

65. In a rotary machine, a base, a table rotatably mounted on the base, a gear carried by the table, a drive means for driving the gear, including a pinion and a pinion shaft, means cooperating with the table and the base forming an enclosure for the gear, pinion and pinion shaft to prevent the admission of foreign matter thereto, lock means mounted within the enclosure to engage the drive means to lock the gear from rotation, and means extending through the enclosure for actuating said locking means.

66. In a rotary machine, a base, a table ro-

tatably mounted on the base, a gear carried by the table, a drive means for driving the gear, including a pinion and a pinion shaft, means cooperating with the table and the base forming an enclosure for the gear, pinion and pinion shaft to prevent the admission of foreign matter thereto, lock means including a pivotally mounted locking element mounted within the enclosure to engage the drive means to lock the gear from rotation, and means extending through the enclosure for actuating said locking means.

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CERTIFICATE OF CORRECTION.

Patent No. 2,005,137.

June 18, 1935.

DAVID S. FAULKNER, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, first column, line 59, claim 5, for "nd" read end; page 6, second column, line 74, claim 19, after "base" strike out the period and insert a comma; and page 7, second column, line 12, claim 25, after "bearing" insert the word supporting; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 20th day of August, A. D. 1935.

(Seal)

Leslie Frazer
Acting Commissioner of Patents.