

Nov. 5, 1935.

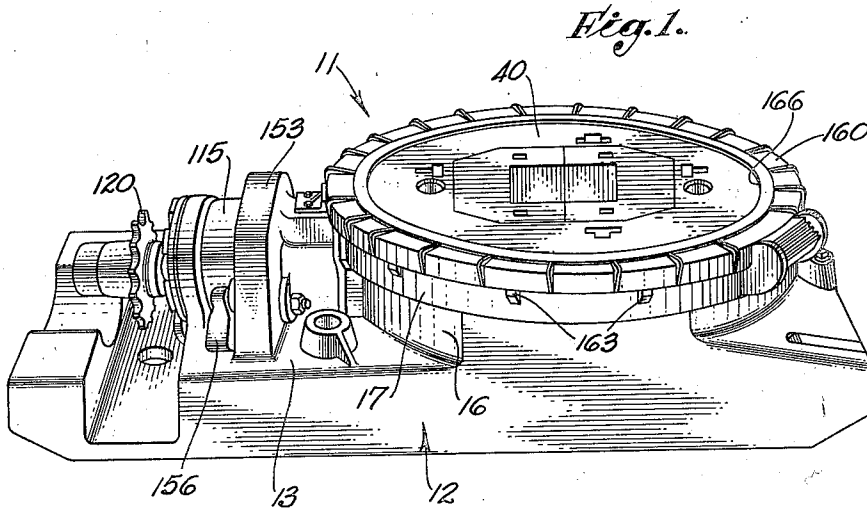
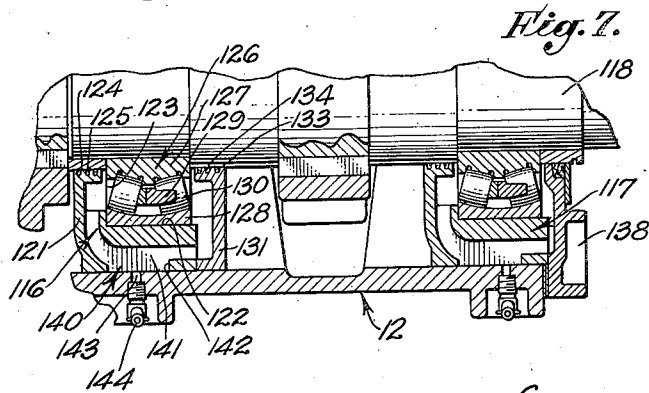
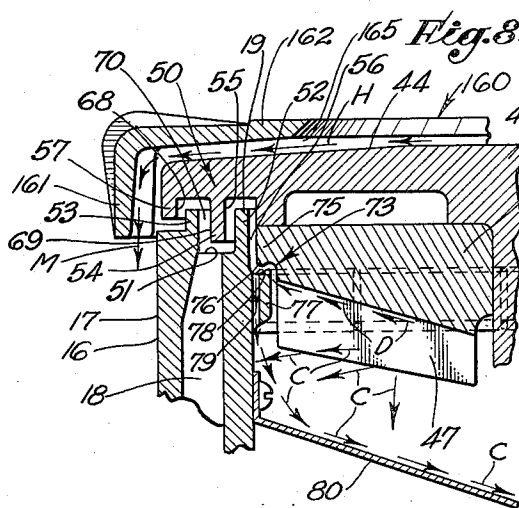
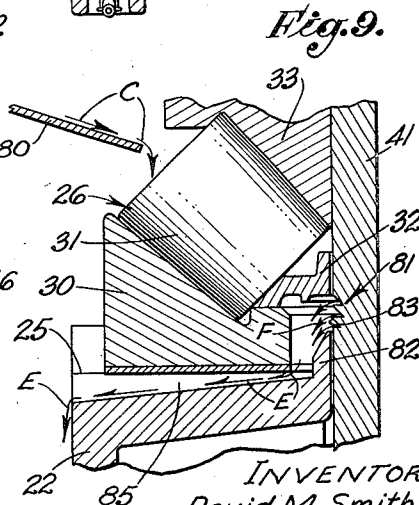
D. M. SMITH

2,020,004

OIL INCLOSED ROTARY

Filed June 3, 1931

4 Sheets-Sheet 1



INVENTOR.
David M. Smith,
BY
F. H. K. K. K.
ATTORNEY.

Nov. 5, 1935.

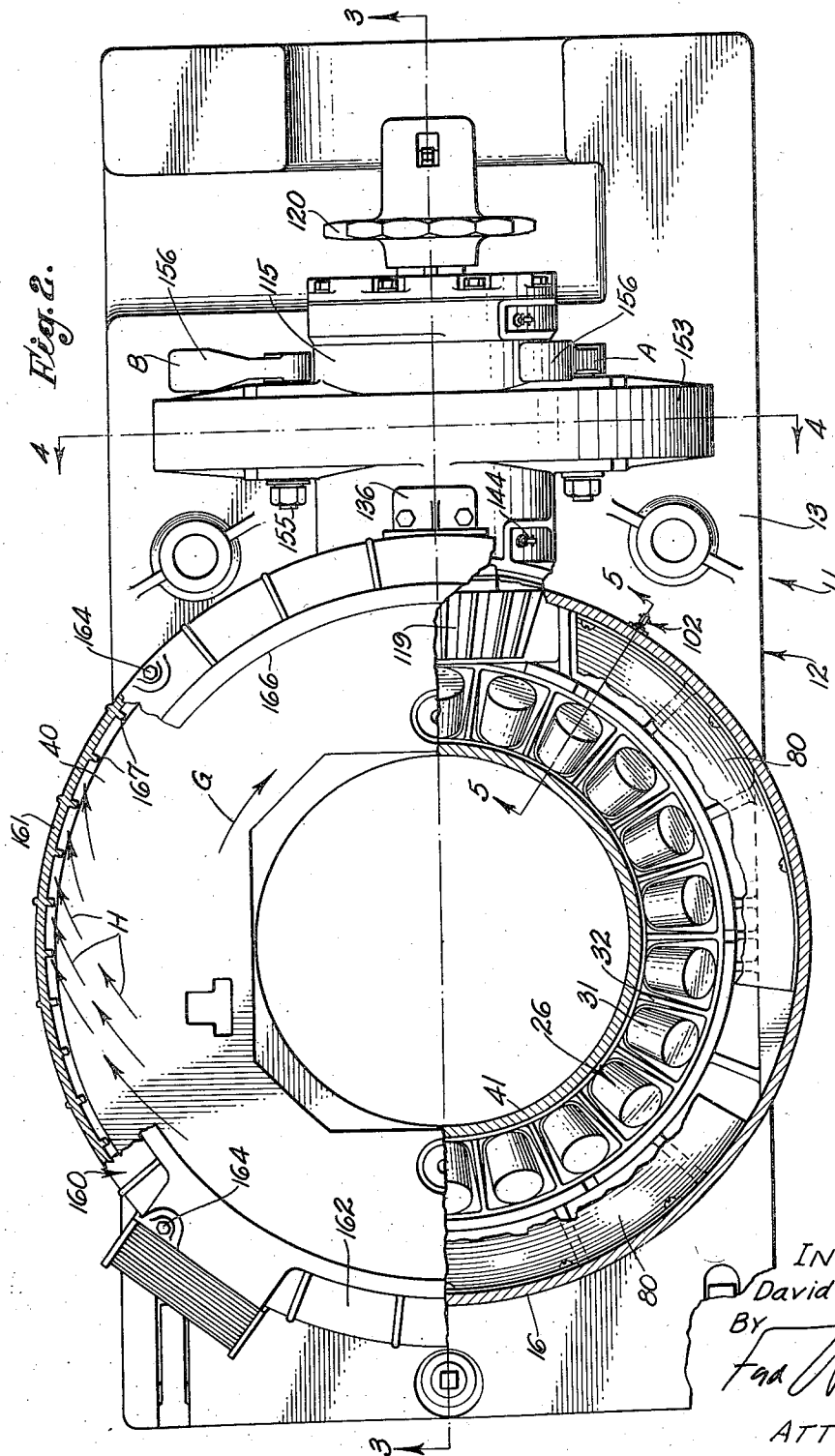
D. M. SMITH

2,020,004

OIL INCLOSED ROTARY

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4 Sheets-Sheet 2



INVENTOR:

David M. Smith,

By

For M. Smith

ATTORNEY.

Nov. 5, 1935.

D. M. SMITH

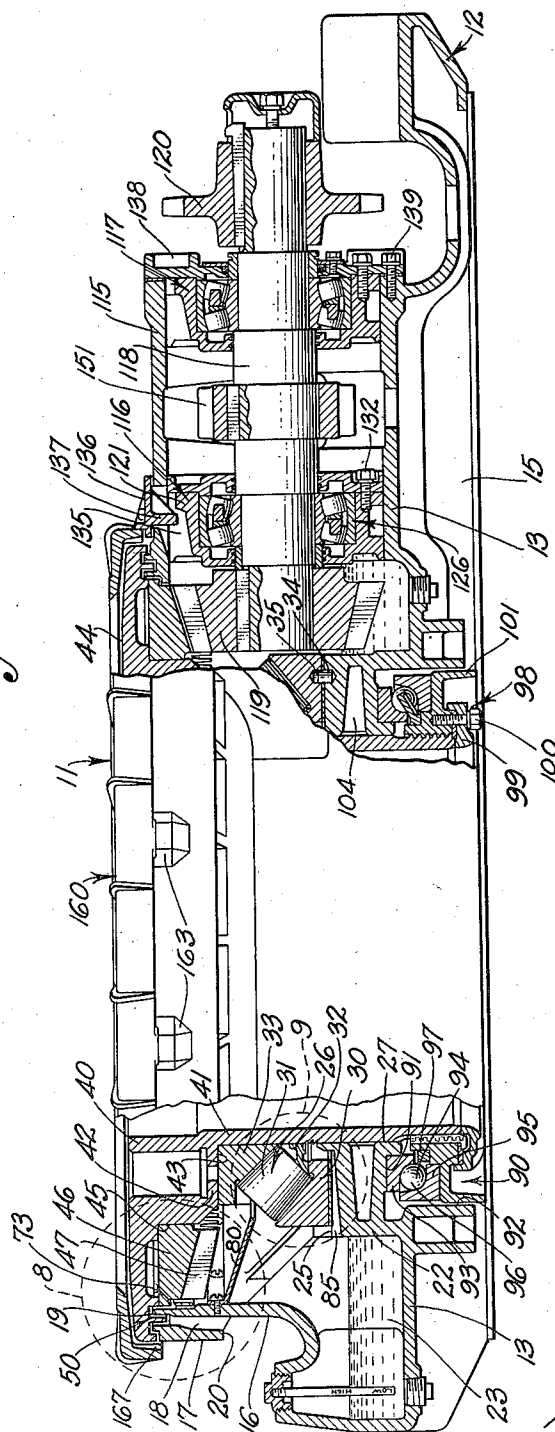
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OIL INCLOSED ROTARY

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4 Sheets-Sheet 3

Fig. 3.



INVENTOR:
David M. Smith,
BY
and *W. H. Smith*
ATTORNEY.

Nov. 5, 1935.

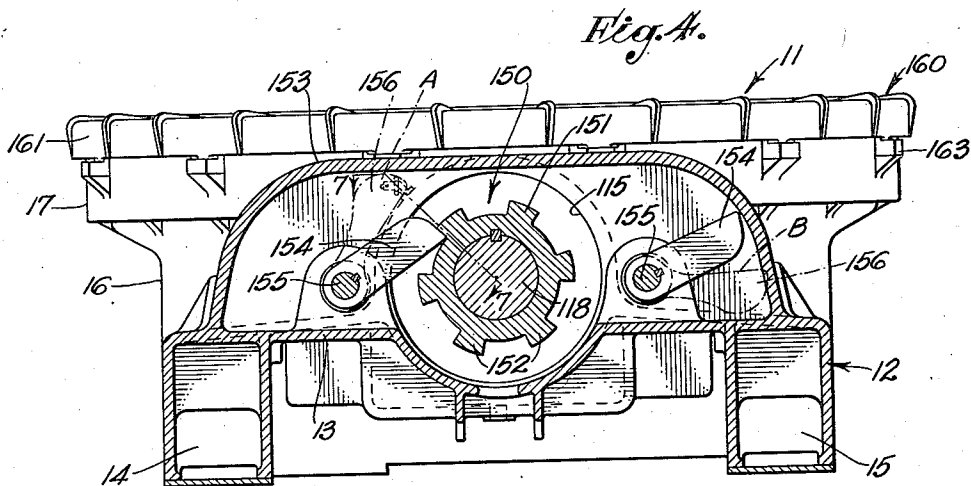
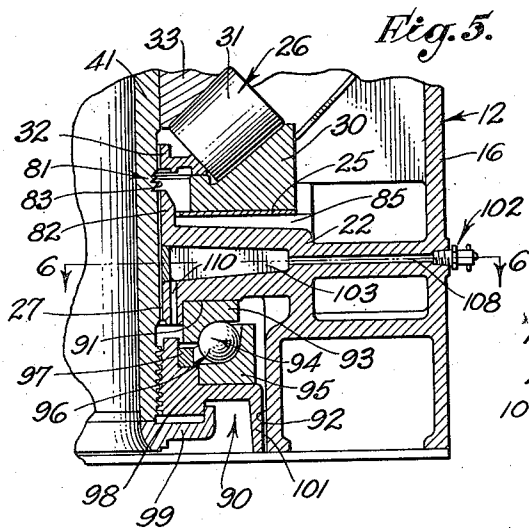
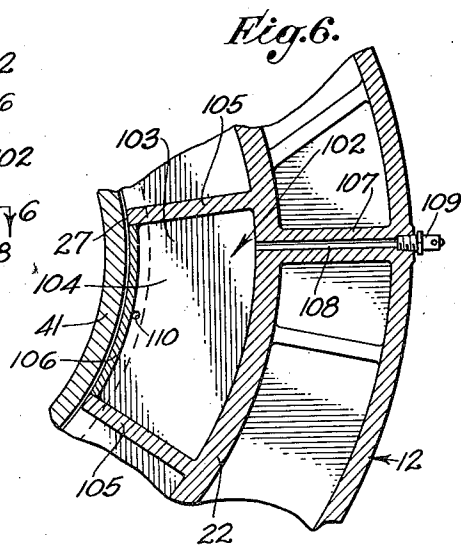
D. M. SMITH

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OIL INCLOSED ROTARY

Filed June 3, 1931

4 Sheets-Sheet 4



INVENTOR:
David M. Smith,
By
F. M. K. K. K.
ATTORNEY.

UNITED STATES PATENT OFFICE

2,020,004

OIL INCLOSED ROTARY

David M. Smith, Hermosa Beach, Calif., assignor
to Emsco Derrick & Equipment Company, Los
Angeles, Calif., a corporation of California

Application June 3, 1931, Serial No. 541,771

9 Claims. (Cl. 255—23)

My invention relates to rotary machines of the character employed in drilling oil wells by the so-called rotary system.

In the oil well drilling industry a rotary machine is placed on the derrick floor of a well. A drill pipe extends through a rotary table of the rotary machine and carries a bit at its lower end. In the present common form of rotary machine the rotary table has a bevel or ring gear which is driven by a pinion mounted on a pinion shaft journaled in bearings of the rotary machine. A sprocket is secured to the outer end of the pinion shaft, which sprocket is driven from a draw-works of the derrick by a chain and sprocket arrangement. The rotary table rotates the drill pipe and the bit, the bit sinking the well.

Oil wells today are being drilled to exceedingly great depths, necessitating larger and heavier drilling apparatus, which consequently materially increases the already tremendous strains to which rotary machines are subjected during operation. As a result the working parts of rotary machines have been made more and more rugged and massive to endure these strains and a consequent necessity has arisen for suitable lubrication of these working parts to minimize friction and to reduce wear.

It is an object of my invention to provide a rotary machine in which all of the working parts are completely inclosed and constantly lubricated.

It is another object of the invention to provide an oil inclosed rotary machine in which the bevel ring gear of the rotary table, the pinion, and a main table thrust bearing included in the machine are all operable in a common bath of oil.

Another valuable feature of the invention lies in the fact that the pinion shaft bearings of the machine are of unitary type so that the entire pinion shaft assembly can be assembled before being inserted into a pinion shaft housing included in the base of the machine.

Another feature of the invention resides in the provision of a floating bearing which supports the pinion shaft at the inner end thereof adjacent the pinion, and an outer thrust bearing supporting the outer end of the pinion shaft, which is secured to the base of the machine after the pinion shaft assembly is positioned in its housing.

It is another object of my invention to provide the inner floating bearing, supporting the pinion shaft as described in the above paragraph, with a bearing carrier which includes means for preventing the rotation thereof but allows this bearing carrier to move longitudinally relative

to the pinion shaft and the housing to allow for expansion.

Still another important feature of my invention lies in the fact that the rotary table top is flanged to overhang the ring gear and cooperates with the base of the machine to completely inclose the ring gear.

Another unique feature of my invention is that the tapered roller bearing which journals the rotary table on the base of the machine is designed so that the axes of the rollers included in the bearing are disposed at an angle to the horizontal so that the faces of the rollers lie in a plane at a steep angle from the horizontal to facilitate the centering of the table on the base.

Another important feature of the invention is that the pinion shaft lock and lock pawls of the machine are entirely inclosed within the pinion shaft housing, the pawls being operated by lever means from the exterior of the housing.

It is another object of my invention to provide in a rotary machine of the type described an oil reservoir in which a body of lubricant is maintained, in which the pinion of the machine is rotatable, the pinion being operable to carry or splash the lubricant to the rotary table ring gear meshing therewith.

All of the above noted objects and features of the invention will be made evident and other features and advantages will be brought out in the following specification, describing the invention in detail in connection with the accompanying drawings, and the appended claims.

Referring to the drawings:

Fig. 1 is a perspective view of a rotary machine embodying the features of my invention.

Fig. 2 is a top plan view of the rotary machine shown in Fig. 1, this view having parts broken away to show certain details of construction.

Fig. 3 is a longitudinal sectional view of the rotary machine taken as indicated by the line 3—3 of Fig. 2.

Fig. 4 is a vertical section taken as indicated by the line 4—4 of Fig. 2, this view showing the rotary table locking arrangement of the invention.

Fig. 5 is a fragmentary section taken as indicated by the line 5—5 of Fig. 2 and showing the manner in which a lower rotary thrust bearing of the invention is lubricated.

Fig. 6 is a horizontal section taken as indicated by the line 6—6 of Fig. 5.

Fig. 7 is an enlarged fragmentary section taken on a plane indicated by the line 7—7 of Fig. 4,

this view showing the manner in which the pinion shaft bearings of the invention are lubricated.

Fig. 8 is an enlarged fragmentary sectional view comparable to that portion of Fig. 3 within the dotted line circle 8.

Fig. 9 is an enlarged fragmentary sectional view comparable to that portion of Fig. 3 within the dotted line circle 9.

Referring first to Figs. 1 to 4 inclusive, I show a rotary machine generally designated by the numeral 11 which includes a base casting 12 providing a horizontal wall 13 having depending sides of double walled construction forming skids 14 and 15. Formed integrally with the horizontal wall 13 adjacent one end thereof is a vertically extending annular wall 16, this wall being of a diameter equal to the width of the horizontal wall 13 as defined by the skids 14 and 15. Adjacent to its upper edge the annular wall 16 is increased in thickness and is cored to form an annular rim 17 having series of vertical passages 18 extending from the upper edge 19 of the wall 16 to the lower edge 20 of the rim 17. Formed also integrally with the wall 13 is a vertically extending annular wall 22 which is of somewhat smaller diameter than the vertical wall 16 and cooperates with this wall 16 and the horizontal wall 13 to form an oil reservoir 23. The wall 22 extends upwardly from the wall 13 a comparatively short distance relative to the wall 16 and is of considerably greater thickness than this wall for the purpose of providing an upper horizontal surface 25 for the support of a rotary table bearing generally designated by the numeral 26 in Figs. 2 and 3. The inner annular surface 27 of the wall 22 defines an opening which extends through the horizontal wall 13, this opening being concentric with the vertically extending annular wall 16.

The bearing 26 is preferably of the tapered roller type and comprises a lower stationary race 30, tapered rollers 31 spaced by a roller retainer 32, and an upper rotatable race 33. The lower race 30 is prevented from rotation relative to the base 12 by a series of dowel pins 34 which project upwardly from the surface 25 of the wall 22 and extend into depressions 35 formed in the lower face of the race 30. The bearing 26 is preferably designed so that the axes of rotation of the tapered rollers 31 are positioned at approximately 45° from the vertical so that the upper faces of these rollers lie in a plane at a relatively steep angle from the horizontal to facilitate the centering of a rotary table 40 which is journaled by the bearing 26. The rotary table 40 includes a vertically extending cylindrical wall 41 of such an external diameter as to engage the inner surface 27 of the wall 22 in a running fit, this wall 41 terminating upwardly in an annular shoulder 42, providing a downwardly facing horizontal surface 43 against which the race 33 abuts and to which this race is secured by any suitable means.

Formed integrally with the wall 41 of the table 40 is a horizontally extending flange forming the table top 44 of the rotary table 40. Pressed over the vertical annular surface 45 of the shoulder 42 against the under face of the table top 44 is a ring gear 46 provided with downwardly facing bevel teeth 47. The ring gear 46 has an internal diameter slightly greater than the outer diameter of the bearing 26 and an external diameter slightly less than the internal diameter of the annular wall 16.

Formed between the wall 16 of the base 12 and

the table top 44 is a mud fluid seal generally designated by the numeral 50 in Figs. 3 and 8, the details of this seal being best shown in Fig. 8. Referring to these two figures, I show the seal 50 as including an annular groove 51 formed in the upper edge 19 of the wall 16, this groove providing an inner upwardly extending lip 52 and an outer upwardly extending lip 53. The groove 51 extends through and communicates with the vertical passages 18. Formed on the under surface of the table top 44 is a depending annular ridge 54 which extends downwardly into the groove 51. The inner vertical annular surface 55 of the ridge 54, the horizontal under surface of the table top 44, and the outer vertical annular surface of the ring gear 46 cooperate with the inner lip 52 to form an annular passage 56 between the bottom of the groove 51 and the interior of the base casting 12, this passage 56 in cross-section having the form of an inverted U. Formed on the periphery of the table top 44 is a depending annular flange 57 providing an inner vertically extending annular surface 68 which cooperates with the under surface of the table top, the outer vertical annular surface 69 of the ridge 54, and the upwardly extending outer lip 53, to form a narrow annular passage 70 communicating between the bottom of the groove 51 and the exterior of the rotary machine 11, this passage 70 in cross-section also having the form of an inverted U as shown.

Provided adjacent the mud fluid seal 50 is an oil saving means generally designated by the numeral 73 in Figs. 3 and 8. Provided on the periphery of the ring gear 46 is an outwardly extending flange 75, the under surface of which is formed to provide a depending annular bead 76. Formed on the inner surface of the wall 16 directly below the bead 76 is an annular shoulder 77 in the upper edge of which is formed an annular trough 78. The bead 76 overhangs the trough 78 in the manner shown. Provided in the shoulder 77 are a series of vertical drain openings 79 extending from the trough 78 to the lower surface of the shoulder 77.

Secured to the inner surface of the wall 16, as by screws or other means, are a number of downwardly sloping drip pans 80. These drip pans 80 are positioned directly below and adjacent the shoulder 77 and are provided for the purpose of delivering lubricating fluid from the troughs 78 to the bearing 26. The drip pans 80 are shown to be three in number and positioned in spaced relationship around the annular wall 16, but it is of course apparent that the number of these pans is immaterial.

Referring to Figs. 3, 5, and 9, the numeral 81 designates an oil throw-off means which is adapted to return lubricating fluid from the bearing 26 to the oil reservoir 23. This throw-off means 81 includes a narrow vertically extending annular flange 82 formed on the inner periphery of the bearing supporting surface 25 of the wall 22. Formed on the outer surface of the cylindrical wall 41 of the rotary table 40 at a point directly above the flange 82 and directly below the bearing retainer 32, are a plurality of annular grooves 83. The grooves 83 are adapted to prevent lubricating fluid from finding its way downwardly between the wall 41 and the flange 82 of the wall 22 by reason of the fact that these grooves collect any fluid which might be flowing downwardly on the surface of the wall 22, this fluid being thrown outwardly over the flange 82 by centrifugal force as the rotary

table revolves. Provided in spaced relationship in the upper surface 25 of the wall 22 are a plurality of downwardly and outwardly sloping drain channels 85. These drain channels 85 extend from the base of the flange 82 to the outer periphery of the annular wall 22, and are provided for the purpose of delivering lubricating fluid thrown from the grooves 83 and fluid flowing from the bearing 26 back into the oil reservoir 23.

The rotary machine 11 is provided with an auxiliary thrust bearing or hold-down bearing, generally designated by the numeral 90 in Figs. 3 and 5, this bearing being provided to take upward thrust imparted to the rotary table 40 and thus maintain a proper relationship between the table 40 and the bearing 26. In Figs. 3 and 5, I show the inner annular surface 27 of the wall 22 formed to provide a recess including a downwardly facing ledge 91 and a vertically extending annular wall 92. Suitably secured to the ledge 91 is a stationary race 93 of a bearing 94. The bearing 94 also includes a rotatable race 95, balls 96, and a ball retaining member 97, the race 95 being secured to and supported by a bearing carrier designated by the numeral 98.

The bearing carrier 98 is secured to the lower end of the cylindrical wall 41 by a threaded connection and is keyed thereto in the manner indicated in the drawings for the purpose of preventing relative rotation between the carrier 98 and the wall 41 of the rotary table. A lock plate 99 contacting the lower faces of the wall 41 and the carrier 98 is secured by cap screws 100. The bearing carrier 98 is preferably provided with a vertically extending annular flange 101 which is of such a diameter as to provide a very slight clearance between this flange and the annular wall 92, said carrier and flange structure comprising a closure member for the purpose of excluding mud fluid, water, or other foreign substance from the bearing 94. The bearing 94 is lubricated by lubricating means generally designated by the numeral 102 of Figs. 5 and 6. Formed in the wall 22 in a plane between the bearing 26 and the bearing 94 is a lubricant chamber 103.

For the purpose of conveniently forming this chamber 103 and to lighten the construction of the base casting 12, I provide in the surface 27 of the wall 22 a cored annular recess 104 which is webbed at suitable intervals. Positioned between the inner ends of two of these webs 105 indicated in Fig. 6 at a suitable point on the machine, indicated by the line 5-5 of Fig. 2, is a closure plate 106 which is secured to the webs 105 as by welding to form the completely inclosed chamber 103.

Connecting the wall 22 with the wall 16 is a web 107 through which is formed a cored passage 108 which communicates between the chamber 103 and the exterior of the wall 16. Threadedly closing the outer end of the passage 108 is a lubricating plug 109, such as an "Alemite" fitting, through which a lubricating fluid or grease may be delivered to the chamber 103. Communicating between the chamber 103 and the bearing recess formed by the walls 91 and 92 is a port 110 adapted to deliver lubricant from the chamber 103 to the bearing 94. The port 110 is preferably positioned, as is indicated in Figs. 5 and 6, at a point inside the inner periphery of the bearing 94 so that the lubricant will be caused to flow outwardly through the

bearing by centrifugal force as the rotary table 40 is rotated.

Formed integrally with the base casting 12 is a cylindrical pinion shaft housing 115, the axis thereof being perpendicular to the axis of the rotary table and parallel with the longitudinal axis of the base 12. Journalled in the housing 115 by inner and outer bearings, generally designated by the numerals 116 and 117 respectively, is a pinion shaft 118. The pinion shaft 118 carries at its inner end a bevel pinion 119 which meshes with and serves to rotate the bevel ring gear 46. Keyed to the extreme outer end of the pinion shaft 118 is a sprocket 120 adapted for a chain engagement with a source of power not shown.

Referring to Figs. 3 and 7, the inner bearing 116 includes a bearing carrier 121 which is slidable longitudinally within the cylindrical housing 115 and in which is formed an axial annular recess providing a cylindrical wall 122 and a vertical wall 123. The wall 123 is provided with an axial opening 124 through which the pinion shaft extends, and suitable packing is provided therein as indicated at 125 in Figs. 3 and 7. Positioned in the recess of the bearing carrier 121 is a bearing 126, preferably of the double roller type, which includes an outer stationary race 128 contacting the cylindrical wall 122 and an inner race 127 secured to the pinion shaft 118. Between these races is confined a roller retainer 129 carrying a plurality of rollers 130. Closing the bearing recess of the bearing carrier 121 is a cover plate 131 which is secured to the carrier 121 by screw means 132. The plate 131 is adapted to be pressed against the outer race 128 and prevents the rotation thereof relative to the bearing carrier 121. The plate 131 is provided with an axial opening 133 through which the pinion shaft extends and suitable packing is provided therein, as indicated at 134 in the drawings. Formed in the outer periphery of the bearing carrier 121 is a longitudinal slot 135. Adjacent the slot is an inspection opening formed in the housing 115, which opening is covered by a lock plate 136 having a depending key 137 adapted for slidable reception into the slot 135. It will be seen that the key 137 prevents rotation of the bearing carrier relative to the housing 115 but allows the carrier 121 to move longitudinally therein to accommodate expansive forces.

The outer bearing carrier 117 and its included roller bearing is identical with the arrangement of the bearing carrier 116 and its included bearing, just described, with the exception that a cover plate 138, comparable to the cover plate 131, is rigidly secured to the housing 115 by screw means as shown at 139 in Fig. 3. Each of the bearing carriers 116 and 117 is provided 60 with individual lubricating means and as the arrangement is identical in each of these bearings, I will describe only the lubricating means 140 in connection with the carrier 116.

The lubricating means 140 includes a cored passage 141 which communicates with both sides of the bearing 126 through the walls of the carrier 121, as defined by the exterior thereof, and the recess formed by the cylindrical wall 122 and the vertical wall 123. Communicating with the cored passage 141 is a passage 142 extending outwardly to the outer periphery of the carrier 121. Formed in the housing 115 at a point adjacent the passage 142 is a port 143 which is threadedly closed by a lubrication plug 144 75

through which oil or grease may be introduced. It will be seen that lubricant thus introduced will travel through the port 143 and the passages 142 and 141 to completely fill the space surrounding the bearing 126, this space being defined by the cylindrical wall 122, the vertical wall 123, and the cover plate 131.

As best shown in Fig. 4, the pinion shaft 118 is provided with a lock means, generally designated by the numeral 150, which includes a cylindrical sleeve 151 keyed to the shaft 118 intermediate the bearing carriers 116 and 117, this sleeve 151 being provided with a plurality of radial teeth or projections 152. The housing 115 is laterally extended to provide an inclosed casing 153 for the reception of a pair of lock pawls 154. One of the pawls 154 is pivotally mounted on a shaft 155 on each side of the sleeve 151, these shafts 155 being journaled in the walls of the casing 153, as best shown in Fig. 2. Secured to each of the shafts 155 on the exterior of the casing 153 is a weighted lever 156. The relation between the lock pawls 154 and the levers 156 is such that when the levers 156 are in a raised position and resting against the housing 115, as indicated at "A" in Figs. 2 and 4, the lock pawls are in engagement with certain of the projections 152 of the sleeve 151, at which time the pinion shaft 118 and consequently the rotary table 40 are locked against rotation. Likewise, when the levers 156 are in a lowered position and resting on the horizontal top wall 13, as indicated at "B" in Figs. 2 and 4, the lock pawls are in a disengaged position and the pinion shaft 118 and the rotary table 40 are free to rotate.

For the purpose of preventing mud fluid from being thrown outwardly from the rotary table over the derrick floor by centrifugal force, and as a means of guarding workmen from possible injury, I provide a ring guard 160 adapted to cover the outer portions of the rotary table, as shown best in Figs. 2, 3, and 8. The ring guard 160 comprises a flanged ring providing a vertically extending annular wall 161 surrounding the periphery of the rotary table top 44, and a horizontally extending plate 162, formed integrally with the wall 161.

Provided in suitably spaced relationship on the exterior of the wall 16 are a plurality of outwardly extending lugs 163 upon which the bottom edge of the wall 161 rests, the ring guard being held rigid relative to the base casting 12 by cap screws 164 extending through the horizontal plate 162 and threadedly engaging these lugs. The ring gear is supported in such a manner as to provide a slight clearance, as indicated at 165, between the table top 44 and the under face of the plate 162. A central opening 166 is provided in the plate 162, this opening being of sufficient diameter to allow the drill pipe and other equipment to project upwardly there-through during the course of drilling a well. Projecting inwardly from the vertical wall 161 of the ring guard are a plurality of radially spaced fins 167 which are preferably of vertical extension. These fins 167 are formed integrally with the wall 161 and extend inwardly to a point just short of the periphery of the rotary table top 44, for a purpose to be described later.

The operation of the lubrication arrangement for the pinion 119, the ring gear 46, and the roller bearing 26, is as follows:

As the rotary table 40 is rotated by the draw-works of a derrick through the sprocket 120, the pinion shaft 118, the pinion 119, and the ring

gear 46, the pinion 119, being partly submerged in the body of lubricating fluid contained in the reservoir 23, picks up a quantity of fluid and carries it into contact with the teeth 47 of the ring gear 46. A portion of the oil adhering to the teeth 47 of the ring gear is thrown outwardly by centrifugal force against the inner surface of the wall 16 and is collected by the drip pans 80 and flows down these pans to be delivered directly to the annular bearing 26, as indicated by the arrows "C" of Figs. 8 and 9. Any of the fluid adhering to the teeth 47 of the ring gear which might be caused by centrifugal force to travel outwardly along these teeth and tend to flow upward through the passage 56, as indicated by the arrows "D" of Fig. 8, is caught by the depending bead 76 and caused to collect in the trough 78, from which it is drained through the openings 79 and delivered onto the pans 80.

The lubricating fluid delivered to the roller bearing 26 by the drip pans 80 eventually finds its way to the lower portion of the bearing and from there flows downwardly and outwardly through the drain channels 85 and into the reservoir 23, as indicated by the arrows "E" of Fig. 9. A portion of the oil from the bearing 26 will tend to adhere to the cylindrical wall 41 and will flow downwardly over the surface thereof until reaching the throw-off grooves 83, which grooves collect the fluid and throw it outwardly, 30 by centrifugal force, over the flange 82 and into the drain channels, as indicated by the arrows "F" of Fig. 9.

It will be seen that the oil saving means 73 described above and the oil throw-off means 81 just described effectively prevent any of the circulating lubricating fluid which constantly flows over the pinion 119, the ring gear 46, and the roller bearing 26, from escaping from the interior of the rotary machine.

The operation of the guard ring 160 to prevent mud fluid from being thrown outwardly over the derrick floor, and the operation of the mud fluid seal 50, is as follows:—

Referring in particular to Figs. 2 and 8, and assuming that the rotary table is rotating in a clockwise direction, as indicated by the arrow "G" of Fig. 2, it will be understood that any mud fluid that has been allowed to collect on the top of the rotary table will be thrown outwardly with great force in paths substantially tangential to the periphery of the rotary table, as indicated by the arrows "H" of Figs. 2 and 8. It is quite usual during the course of drilling a well for the rotary table to be driven at speeds ranging from 100 to 140 revolutions per minute and I have found by experiment that the force at which mud and water are thrown outward from the table is so great that the mud fluid after it has been thrown against the guard tends to follow a downwardly spiralling path over the interior surface of the guard. The fins 167 provided on the interior surface of my ring guard 160 serve to effectively prevent this spiralled flow of the mud fluid and to break up the force of the flow so that the mud fluid has no tendency to whip outwardly upon reaching the lower edge of the vertical wall 161 but is directed vertically downward, as indicated by the arrows "M" of Fig. 8.

In the event that any of the mud fluid enters the space between the table top and the base casting 12 and has a tendency to flow upwardly and inwardly through the inverted U-shaped passage 70 of the mud seal 50, this mud will, upon 75

reaching the bottom of the groove 51, flow downwardly through the vertical passages 18 provided in the rim 17. It will be seen that none of the mud fluid or water can penetrate to the interior of the machine to adulterate the lubricating fluid contained in the oil reservoir 23. This is a particularly valuable feature inasmuch as it is the usual practice while "washing down" to direct a high pressure water stream against the rotary machine and upon the derrick floor. During this "washing down" operation the water can penetrate only as far as the bottom of the groove 51 and will then be drained therefrom by the passages 18.

Although I have herein shown and described only one complete embodiment of my invention, which fully discloses the above named objects and features thereof, it is apparent that my invention should not be limited to the details of construction shown and described. I am aware of various features of the invention which might be changed and numerous embodiments thereof which might be devised, all of which come within the scope of the invention as defined by the following claims.

I claim as my invention:

1. In a rotary machine of the type used in drilling oil wells, the combination of: a base; a rotary table rotatably supported on said base; a pinion shaft; means whereby said pinion shaft rotates said rotary table; a cylindrical housing supported by said base; a bearing for rotatably supporting said pinion shaft; and a bearing retainer supported inside said cylindrical housing, said bearing retainer inclosing said bearing, said bearing retainer providing a lubricant chamber for said bearing, and said bearing retainer comprising two parts adapted to be secured together around said bearing after said bearing has been secured on said pinion shaft.

2. In a rotary machine of the type used in drilling oil wells, the combination of: a base; a rotary table rotatably supported on said base; a pinion shaft; means whereby said pinion shaft rotates said rotary table; a cylindrical housing supported by said base; a bearing for rotatably supporting said pinion shaft; and a bearing retainer supported inside said cylindrical housing, said bearing retainer inclosing said bearing, said bearing retainer providing a lubricant chamber for said bearing, and said bearing retainer comprising two parts adapted to be secured together around said bearing after said bearing has been secured on said pinion shaft, said parts providing a cylindrical wall adapted to support said bearing, and two side walls extending inwardly to said pinion shaft on opposite sides of said bearing and spaced therefrom so that said lubricant chamber is formed on opposite sides of said bearing.

3. 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 member threadedly secured to said extension for completely closing the lower end of said recess and for supporting said hold-down bearing; and means for closing the threaded joint between said closure and said extension, said means extending across said threaded joint.

4. In a rotary machine of the character em-

ployed in drilling oil wells, the combination of: a base having an opening; bearing means; a rotary table supported on said base by said bearing means, said rotary table having a cylindrical wall extending downwardly through said opening; a closure member secured to said cylindrical wall being placed around the lower end thereof below said base; a hold-down bearing between said base and said closure member; and a lock plate secured to the lower end of said closure member to close the joint between said cylindrical wall and said closure member.

5. In a rotary machine, the combination of a base, a rotary table rotatably supported on the base, a gear on said table, means including a vertically extending annular wall on the base cooperating with the table to form an inclosure around the table, an opening in said wall, said base being integrally formed with an outwardly extending pinion shaft supporting portion, a part of said extension merging into the annular wall of the base around said opening, a pinion insertable through the opening in said wall to mesh with said gear, a shaft to drive said pinion, spaced bearing retainers removably mounted and circumferentially confined within the pinion shaft supporting portion of the base, bearing means mounted within the retainers to rotatably support the shaft, closure flanges carried by said retainers to confine the bearing means longitudinally of the shaft, and means cooperating with the base to prevent the rotation of said retainers.

6. In a rotary machine, the combination of a base, a rotary table rotatably supported on the base, a gear on said table, means including a vertically extending annular wall on the base cooperating with the table to form an inclosure around the table, an opening in said wall, said base being integrally formed with an outwardly extending pinion shaft supporting portion, a part of said extension merging into the annular wall of the base around said opening, a pinion insertable through the opening in said wall to mesh with said gear, a shaft to drive said pinion, spaced bearing retainers removably mounted and circumferentially confined within the pinion shaft supporting portion of the base, bearing means mounted within the retainers to rotatably support the shaft, closure flanges carried by said retainers to confine the bearing means longitudinally of the shaft, means cooperating with the base to prevent the rotation of said retainers; and lock means for the pinion shaft positioned between said retainers.

7. In a rotary machine, the combination of a base, a rotary table rotatably supported on the base, a gear on said table, means including a vertically extending annular wall on the base cooperating with the table to form an inclosure around the table, an opening in said wall, said base being integrally formed with an outwardly extending pinion shaft supporting portion, a part of said extension merging into the annular wall of the base around said opening, a pinion insertable through the opening in said wall to mesh with said gear, a shaft to drive said pinion, a drive element mounted on said shaft, bearing retainer means removably mounted and circumferentially confined within the pinion shaft supporting portion of the base, bearing means mounted within the retainer means to rotatably support the shaft, a bearing closure flange surrounding the shaft and carried by the retainer means and positioned between one end thereof and the pin-

ion, a bearing closure flange surrounding the shaft and carried by the retainer means and positioned between one end thereof and the drive element, and means cooperating with the base to prevent the rotation of said retainer means.

8. In a rotary machine of the type used in drilling oil wells, the combination of: a base; a rotary table rotatably supported on said base; a pinion shaft; means whereby said pinion shaft rotates said rotary table; a cylindrical housing supported by said base; a bearing means including inner and outer races and bearing elements therebetween for rotatably supporting said pinion shaft; and a bearing retainer supported inside said cylindrical housing, said bearing retainer having inwardly extending walls for inclosing said bearing means, and said bearing re-

tainer providing a lubricant chamber for said bearing.

9. In a rotary machine of the type used in drilling oil wells, the combination of: a base; a rotary table rotatably supported on said base; a pinion shaft; means whereby said pinion shaft rotates said rotary table; a cylindrical housing supported by said base; a bearing means including inner and outer races and bearing elements therebetween for rotatably supporting said pinion shaft; and bearing retainer means adapted to be assembled around said bearing means after said bearing means has been placed on said pinion shaft said assembly being insertable as a whole into said cylindrical housing and said bearing retainer means supporting said bearing means in said housing.

DAVID M. SMITH.

DISCLAIMER

2,020,004.—*David M. Smith, Hermosa Beach, Calif. OIL ENCLOSED ROTARY.*
Patent dated November 5, 1935. Disclaimer filed November 8, 1937, by
the assignee, *Emsco Derrick & Equipment Company.*
Hereby enters this disclaimer to claims 1, 2, and 8 in said Letters Patent.
[*Official Gazette November 30, 1937.*]