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ROTARY DRILLING APPARATUS.

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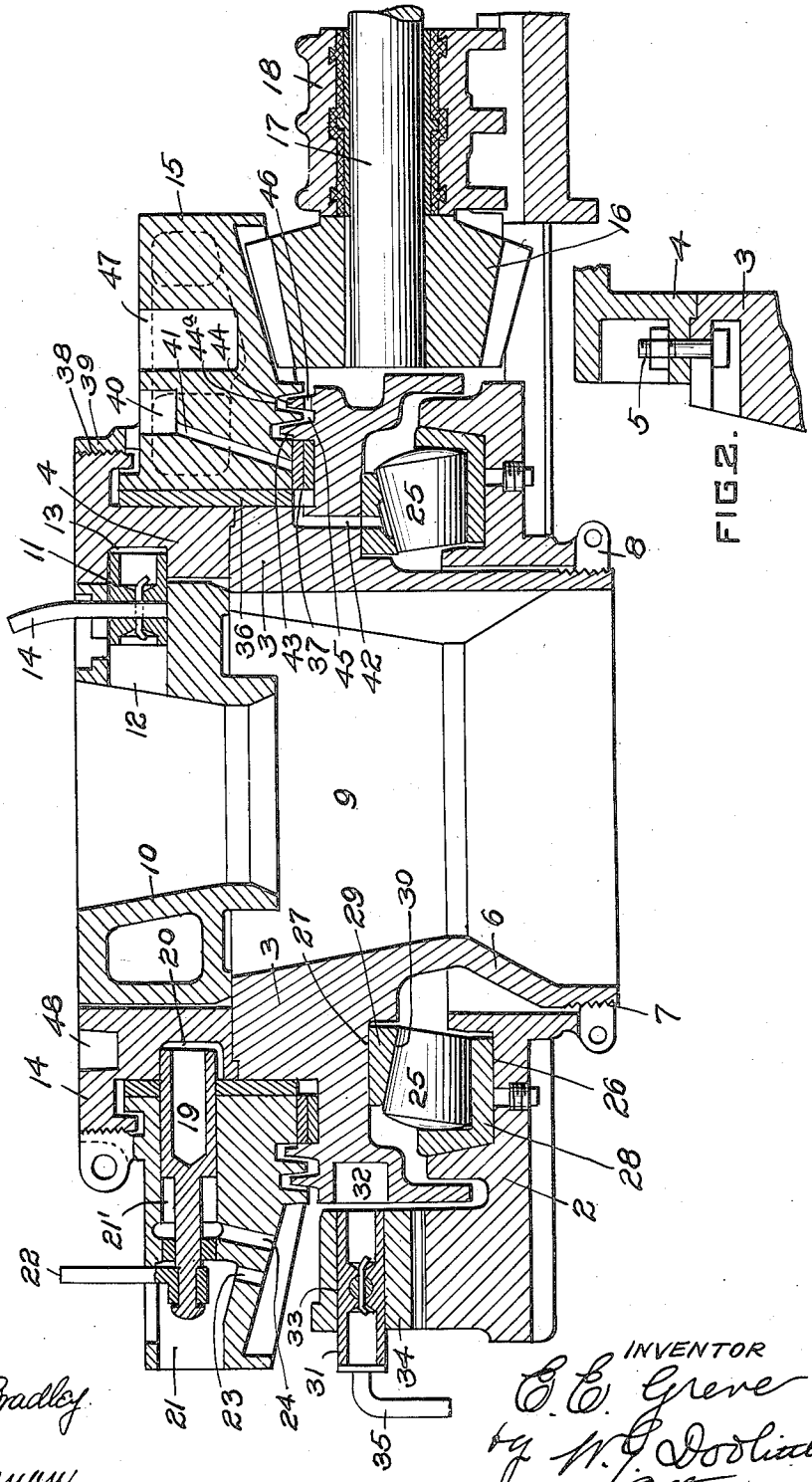


FIG. 1.



FIG. 2.

WITNESSES

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# UNITED STATES PATENT OFFICE.

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## ROTARY DRILLING APPARATUS.

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*To all whom it may concern:*

Be it known that I, EDGAR E. GREVE, a citizen of the United States, residing at Bellevue, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Rotary Drilling Apparatus, of which the following is a specification.

My invention relates to improvements in rotary drilling machines, and more particularly to what are known as hydraulic rotary drilling machines, for drilling oil and other wells.

Machines of the class to which my invention relates usually include a rotatable centrally apertured table, means for rotating the table, a drive ring or spider mounted on and connected with the table, said spider or drive ring being adapted to receive either slips or bushings, a sectional drill stem, and a grip or grief stem connecting the drill stem and the rotary table through the bushings. These parts are arranged so that the grip stem has a longitudinal movement through the bushings during the operation of drilling. The parts are also of such a character as to permit the grip stem and the sectional drill stem of pipe to be lowered or raised through the rotary.

In some machines, provision is made for connecting and disconnecting the sectional drill pipe or stem, and in the present invention, I show a machine of this character.

In the operation of rotary drilling machines of the character to which the present invention relates, it has been found that the constructions heretofore employed, particularly in deep well drilling, have given considerable trouble, due to the lateral strains to which the parts are subjected by the lateral or swaying movements of the heavy long drill pipe.

The present invention is especially directed to a construction embodying a compact, strong, and efficient structure designed to greatly reduce lateral movement or play of the operative parts and a construction embodying replaceable wearing parts and adjusting means coacting with anti-friction means.

In the accompanying drawings which illustrate an application of my invention,

Fig. 1 is a vertical sectional view of a drilling machine embodying my invention; and

Fig. 2 is a detail view particularly showing means for connecting the upper and lower portions of the rotary table.

Referring to the drawings, 2 designates a bed plate or base portion upon which a rotary table is mounted. The rotary table, as illustrated and as preferred, comprises what may be termed the body portion 3 and a top portion 4. As shown, these parts are made separable and joined together by a series of bolts 5, but the table may be formed as an integral structure. The upper part of the body is of reduced diameter, while the intermediate part is considerably larger, so that a substantially horizontal ledge is formed on the body intermediate the top and bottom thereof. Body portion 3 of the table is formed with a depending part 6 having at its lower end an externally threaded portion 7, the latter being designed to be entered in a thrust collar 8 in contact with the base 2.

The rotary table is provided with a central opening 9 adapted to receive a spider or drive ring 10, and the latter structure is adapted to receive either slips or a bushing, not shown. Spider 10 is locked to the upper portion of the table by a slidable bolt or pin 11 operable in recesses 12 and 13 respectively formed in said spider and table, said bolt being designed to be manipulated by the upwardly projecting lever 14. In cases where the larger drill stems are used, bushings or slips may be positioned in contact with the walls of opening 9. In this instance, of course, the spider 10 is removed from the machine.

For the purpose of rotating the table and other parts of the apparatus, I provide a separable geared drive-member 15 carried on the horizontal ledge formed on the body of the table. Said member has its gear-teeth in mesh with the beveled gear-teeth of driving wheel 16. Driving wheel 16 is mounted on an end of shaft 17, and 18 designates bearings for said shaft. Shaft 17 may be driven by any suitable means, not shown.

The rotary table which is designed to be rotated by the drive-member 15, during the operation of drilling, is locked in driving

relation with member 15 by means of one or two slidable bolts or pins 19 (one bolt only being shown). Bolt 19, as shown, is in the position to lock the table and drive member 15 together, it having a portion entered in a recess 20 of the table and a portion disposed in an opening or chamber 21 of member 15, said bolt being designed to be moved into and out of the recess by a handle or lever 22. 23 and 24 designate drain passages formed in member 15, and communicate respectively with the chamber or opening 21 and a chamber 21', whereby mud, fluids, etc., that may be caught in the said chambers or openings is passed free of the apparatus.

The rotary table is supported by anti-friction means carried on the base-plate. The anti-friction means illustrated comprise a series of conical rollers 25 disposed with their axes on a plane slightly inclined to the horizontal. For the purpose of receiving the roller bearings, the base is provided with an annular raceway 26 and the table is cut away, as shown at 27. Interposed between the rollers and the raceway, I provide an L-shaped roller receiving and wear plate-member 28, and between the rollers and the table, a member 29 having an inclined roller contacting face 30. These bearing means, arranged as shown, aid in preventing or reducing the lateral play or movement of the table while the same is rotating.

31 designates a slidable pin for locking the table to the base when it is desired to rotate member 15 independently of the table. The drawings show pin 31 moved away from a recess 32 in the table and disposed in an opening 33 formed in an extension 34 of the base, while in the position just described, it will be understood that the table is free to rotate. The pin or bolt 31 is moved by means of a handle 35.

Interposed between the rotary table and the drive member 15, I provide vertically extending removable bearing and wearing means 36, and located adjacent the lower edge of means 36 are anti-friction means 37. Means 37, as illustrated, comprise two flat horizontally disposed rings, and the first mentioned means an annular plate or ring of the desired height and thickness.

The upper portion 4 of the rotary table is threaded as shown at 38 for the purpose of engaging the interior threads of a thrust-ring or collar 39. It will be understood that the thrust ring 39 is designed to take care of the adjustment relatively to the anti-friction means 37, and that it cooperates with collar 8 for maintaining the parts in compact relationship and prevents vertical movement thereof.

40 designates an oil reservoir formed in member 15, and 41 a passage leading therefrom to the anti-friction means 37. By these means, the space containing means 37 is kept flooded with oil and the overflow is conveyed through a passage 42 to the space surrounding the bearings 25, and from thence out of the apparatus through the space between the drive wheel 16 and the base.

Dirt and other foreign matter is prevented from reaching the bearings or means 36 and 37 by the employment of members or tongues 43 and 44 entered in grooves 44a. It will be understood that any foreign matter working inwardly towards the bearings will be caught in the space 45, and will be thrown outwardly through a series of openings 46, free of the machine. 47 designates a pocket of member 15 adapted to receive an end of a tong carrying member, not shown, employed in connection with screwing and unscrewing the drill pipe sections. The rotary table is also provided with a similar pocket 48 to receive another tong member used in the operation of connecting and disconnecting the pipe sections.

In operation, assuming drilling is being performed, the parts are in a position shown by the drawings, that is to say, the table is locked in driving relation with drive member 15 by the bolts 19 and unlocked from the base, due to the fact that the bolt 31 is withdrawn from engagement with the table. When it is desired to connect or disconnect a drill pipe section, the drill pipe is raised in the usual way, the housing, not shown, removed from the spider 10, or out of contact with the inclined walls of the table, as the case may be, and slips (not shown) placed in position for the purpose of supporting the section or sections below the rotary table. Bolt 19 is moved outwardly from the recess 20, thus unlocking the driving member 15, and the table and bolt 31 moved inwardly to lock the table to the base portion. With the parts in the positions just described, the driving member may be rotated independently of the table.

What I claim is:

1. In a rotary drilling machine, an apertured rotary table, a separable geared driving member, a driving gear cooperating with said member, means operable for locking the driving member and table in driving relation, a vertically extending removable bearing member disposed between the table and driving member, and removable means on the table for holding the driving member and bearing member in position on the table.

2. In a rotary drilling machine, an apertured rotary table, a separable geared driving member carried thereby, a driving gear cooperating with said member, means operable for locking the driving member and table in driving relation, a vertically ex-

tending bearing and horizontally disposed anti-friction means between the table and the driving member, and an annular channel on the table for the reception of the horizontally disposed anti-friction means.

3. In a rotary drilling machine, a base portion, a raceway in said base portion having bearings therein, a rotary table mounted on said bearings, a separable geared driving member, a driving gear cooperating with said member, vertically extending bearings disposed between the table and the driving member, removable means on the table overhanging said driving member and holding it on the table, means operable for locking the driving member and table in driving relation, and means operable for holding the table against rotation when it is desired to rotate only the driving member.

4. In a rotary drilling machine, an apertured rotary table, a separable geared driving member, a driving gear cooperating with said member, means operable for locking the table and said member in driving relation, anti-friction means disposed between the table and the driving member, said anti-friction means including a vertically extending annular member and horizontally disposed rings, and a channel on said table for the reception of said rings.

5. In a rotary drilling machine, a base portion, bearings in the base portion, a rotary table supported on the bearings and having a depending portion, a separable geared driving member, a driving gear cooperating with said member, a thrust collar engaging the depending portion of the table, a thrust collar engaging the upper portion of the table, and retaining the driving member in position.

6. In a rotary drilling machine, a base portion, bearings in the base portion, a rotary table supported on the bearings and having a depending portion, a separable geared driving member, a driving gear cooperating with said member, a thrust collar engaging the depending portion of the table, a thrust collar engaging the upper portion of the table, and anti-friction means disposed between the drive member and table.

7. A rotary drilling machine comprising a base, a rotary table supported thereon, a drive member, anti-friction bearings between the drive member and table, and means for preventing the entrance of mud into said anti-friction bearings comprising cooperating tongues and grooves on the table and drive member, and means permitting material to drain from the grooves in the table.

8. In a rotary drilling machine, a base portion, a raceway in said base portion having bearings therein, a rotary table mounted on said bearings, a separable geared driving member, a driving gear cooperating therewith, antifriction means disposed between the table and driving member, an oil reservoir on the driving member, and ports for the passage of oil from the reservoir to the anti-friction means and thence to the bearings in the base portion.

9. In a rotary drilling machine, an apertured rotary table designed to support a string of pipe, a separable geared driving member supported on the table, means operable for locking the table and driving member in driving relation, means on the table overhanging the drive member for normally preventing vertical movement of the drive member relatively to the table, and anti-friction means disposed between the table and the driving member.

10. A rotary drilling machine comprising a base, a rotary table supported thereon, a driving member, anti-friction bearings between the drive member and table, and means for preventing the entrance of mud into said anti-friction bearings comprising cooperating tongues and grooves on the table and drive member.

11. In a rotary drilling machine, an apertured rotary table comprising a main body member and an upper detachable member, a separable driving member, a driving means cooperating with said member, means operable for locking the drive member and table in driving relation, and a vertically extending removable bearing member disposed between the table and driving member.

12. In a rotary drilling machine, an apertured rotary table comprising a main body member and an upper detachable member, a separable driving member, a driving means cooperating with said member, means operable for locking the drive member and table in driving relation, a vertically extending bearing and horizontally disposed anti-friction means between the table and driving member.

13. In a rotary drilling machine, an apertured rotary table, a separable driving member carried on the table, a driving means cooperating with said member, means operable for locking the driving member and table in driving relation, and means on the table engaging the driving member for normally holding said driving member against vertical movement relatively to the table.

14. In a rotary drilling machine, an apertured rotary table, a separable driving member, a driving means cooperating with said member, means operable for locking the driving member and table in driving relation, and vertically adjustable means on the table engaging the driving member for normally holding said driving member against vertical movement relatively to the table.

15. A rotary drilling machine comprising a base, an apertured rotary table thereon, a separable driving member, a driving means

cooperating with said member, means operable for locking the driving member and table in operative relation, and vertically adjustable means engaging the driving member for normally holding said driving member against vertical movement relatively to the table.

16. A rotary drilling machine comprising a base, an apertured rotary table thereon, said table having a reduced upper part and a horizontal ledge thereon intermediate its reduced upper part and its lower end, a driving ring surrounding the reduced upper portion of the table and supported on said ledge, the body of the drive ring being disposed in a plane above the ledge, and bearing means between the ledge and drive ring.

17. A rotary drilling machine comprising a base, an apertured rotary table thereon, said table having a reduced upper part and a horizontal ledge thereon intermediate its reduced upper part and its lower end, a drive ring surrounding the reduced upper portion of the table and supported on said ledge, the body of the drive ring being disposed in a plane above the ledge, bearing means between the ledge and drive ring, and a vertical bearing surface disposed between the reduced upper portion of the table and the drive ring.

18. A rotary drilling machine comprising a base, an apertured rotary table thereon, said table having a reduced upper part thereon and a ledge intermediate the reduced upper part of the table and its bottom, a drive ring surrounding the reduced upper part of the table and carried on the ledge by suitable bearing means, and a vertical bearing ring between the reduced upper part of the table and the drive ring and of a height substantially equal to the thickness of the drive ring.

In testimony whereof I affix my signature in presence of two witnesses.

EDGAR E. GREVE.

Witnesses:
LOIS WINEMAN,
WM. H. PARMELEE.