R. E. KLINE.

ROTARY DRILLING RIG.

APPLICATION FILED JUNE 16, 1913.

1,099,453.

Patented June 9, 1914.

2 SHEETS—SHEET 1.

Fig. 1.

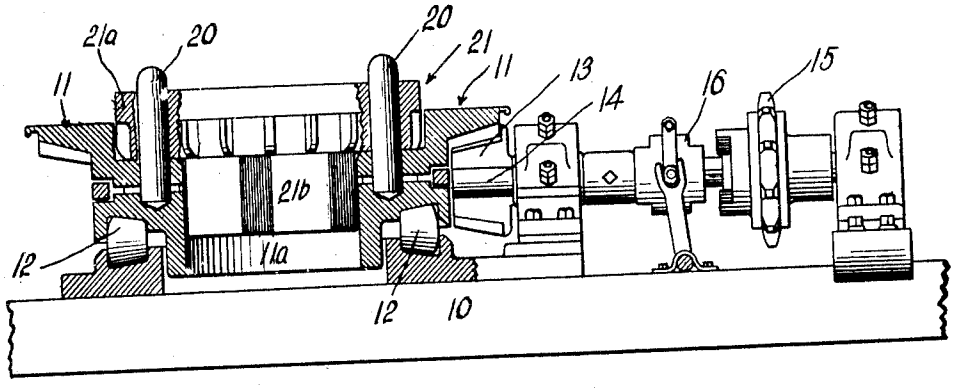


Fig. 2.

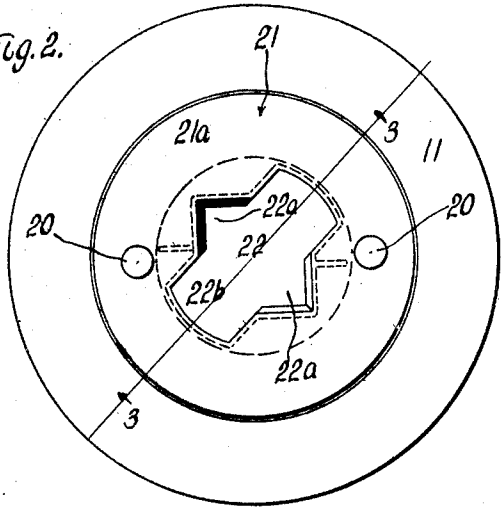


Fig. 3.

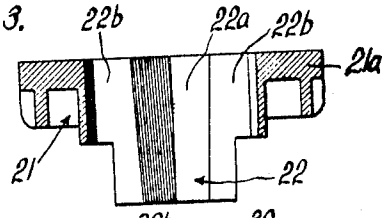


Fig. 5.

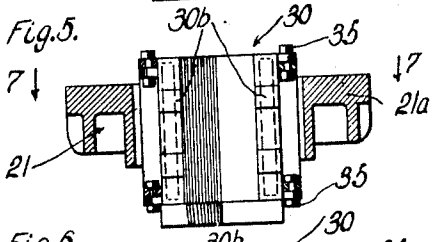


Fig. 6.

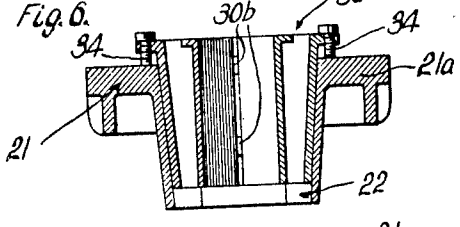


Fig. 4.

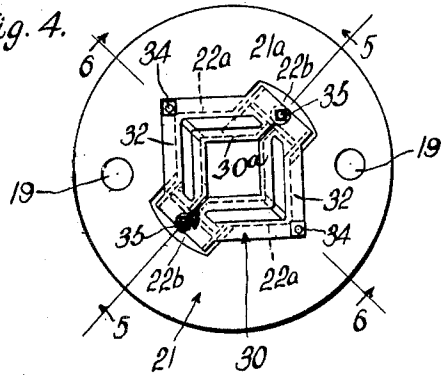
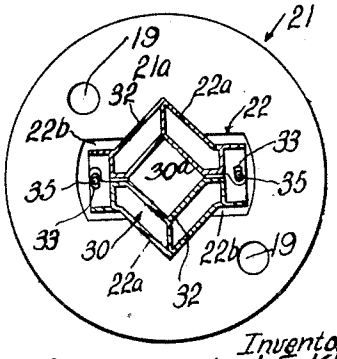


Fig. 7.



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2 SHEETS—SHEET 2.

Fig. 8.

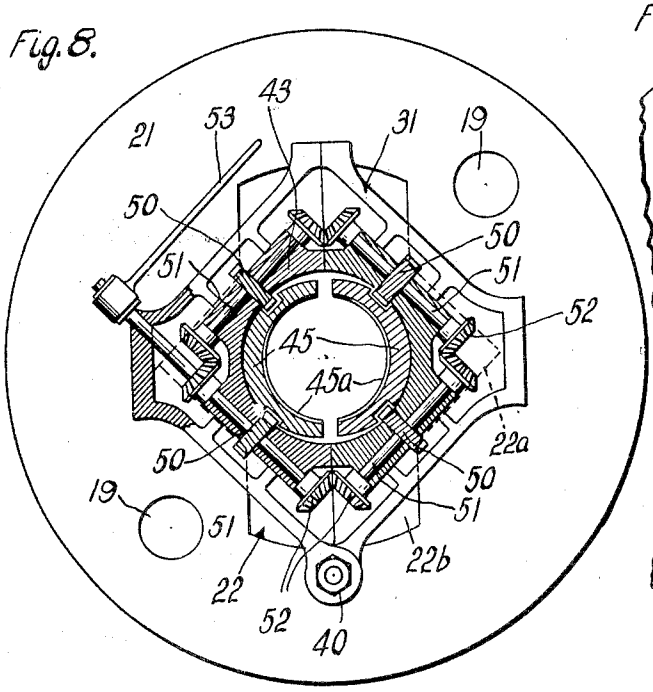


Fig. 10.

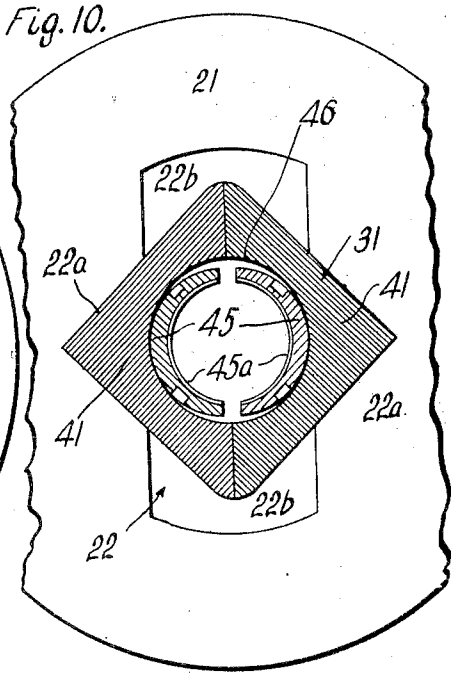


Fig. 9.

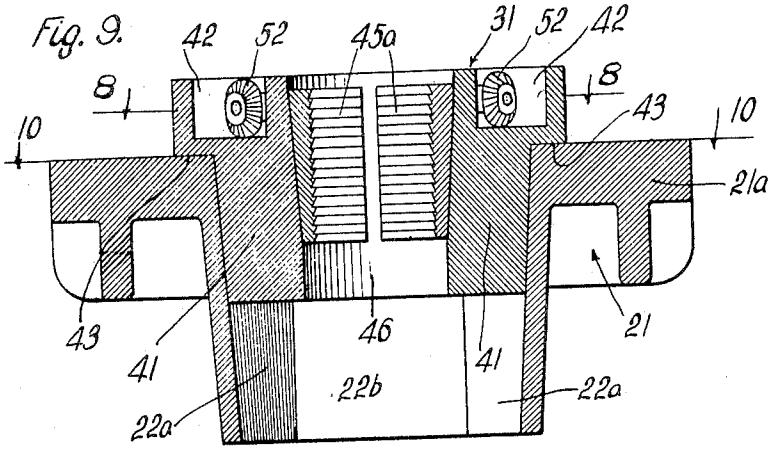
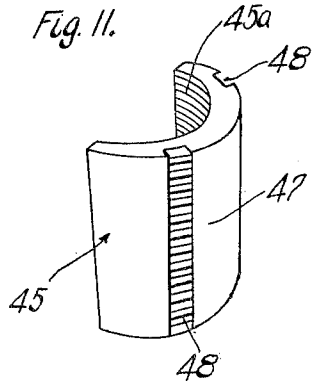


Fig. 11.



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UNITED STATES PATENT OFFICE.

RICHARD E. KLINE, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO OIL WELL SUPPLY COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION.

ROTARY DRILLING-RIG.

1,099,453. Specification of Letters Patent. **Patented June 9, 1914.**

Application filed June 16, 1913. Serial No. 773,964.

To all whom it may concern:

Be it known that I, RICHARD E. KLINE, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles, State of California, have invented new and useful Improvements in Rotary Drilling-Rigs, of which the following is a specification.

This invention relates to rotary drilling rigs or apparatus for sinking wells, and especially to that class of apparatus wherein a rotary turn table is used as a medium through which rotation is applied to the inner drilling pipe, at the same time allowing the drilling pipe to be moved vertically as the sinking of the well proceeds.

My particular invention consists in certain mechanisms and combinations whereby I provide simple, strong and efficient means for transferring the rotation of the turn table to the drilling pipe; and in certain combinations whereby I may use essentially the same apparatus for causing rotation of the drilling pipe and for assisting in raising and lowering the pipe when that is necessary. In the operation of sinking wells with a rotary drilling rig, it is now the common practice to use a drilling pipe with an upper square portion, called a stem, this square portion being commonly about twenty feet in length, the stem being engaged by parts of my apparatus to cause its rotation from the turn table; and the pipe may be continuously lowered until the top of the stem is down to the turn table. It then becomes necessary to remove the stem, insert a new joint of pipe, replace the stem and proceed. By a very simple arrangement of parts I provide that my mechanism is easily changeable to perform all the offices now performed by a "spider". These features will be more fully explained in the following specification, the preferred mechanisms therefor being shown in the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section showing a rotary drilling machine equipped with a part of my improved apparatus. Fig. 2 is a plan showing the turn table and drive ring portions thereof. Fig. 3 is a section of the drive ring as indicated by line 3—3 of Fig. 2. Fig. 4 is a plan showing the rotary driving clamp in place in the drive ring. Fig. 5 is a section taken as indicated by line 5—5 of Fig. 4. Fig. 6 is a section taken as indicated by line 6—6 of Fig. 4. Fig. 7 is a section taken as indicated by line 7—7 of Fig. 5. Fig. 8 is an enlarged plan showing the spider arrangement in place in the drive ring, with parts in section taken as indicated by line 8—8 of Fig. 9. Fig. 9 is a central vertical section of the parts shown in Fig. 8. Fig. 10 is a horizontal section taken as indicated by line 10—10 of Fig. 9. Fig. 11 is a perspective showing one of the pipe engaging slips.

In the drawings the numeral 10 may designate the base frame upon which the turn table 11 is mounted on suitable bearings 12, being rotated through the medium of gear 13 mounted on shaft 14 driven through the medium of sprocket wheel 15 and clutch 16.

The turn table 11 is provided preferably with drive pins 20; and my drive ring 21 is provided with suitable apertures 19 for reception of the drive pins; so that when the drive ring is on the turn table it will rotate therewith. The drive ring is preferably composed of an upper flange portion 21^a through which drive pins 20 project and a portion 21^b which extends downward from portion 21^a, extending into lower central aperture 11^a of the turn table, and inclosing the angular downwardly tapered vertical aperture 22 which extends through the drive ring 21. This aperture 22 has two opposite angular grooves 22^a, the walls of which approach each other inwardly, so as to make a downwardly tapering aperture. And the aperture also has opposite lateral extensions 22^b which allow the passage of the broad flat bits used in rotary drilling. In other words the vertical central aperture 22 is elongated in one horizontal axis to permit the passage of a drill bit and its opposite walls are grooved as at 22^a to engage a clamp member. The various clamps and clamping members which I utilize fit into this aperture 22 and fit against the walls of the tapering grooves 22^a, the clamps having exterior configurations similar to the configuration of the aperture 22 so as to fit its angular tapered portion.

The drive-ring 21 is adapted to receive two different forms of clamps or clamping members, one for engaging the square stem of the drilling pipe when the rotation of the table is to be imparted to the drill stem and

the other for holding slips which engage the round drilling pipe or drilling string when it is being raised or lowered and the turn table is fixed and acting simply as a support for the slips and drilling string. The first mentioned form of clamp I have shown in Figs. 4 to 7, designating it generally by the numeral 30, while the second form of clamp I have shown in Figs. 8 to 11 designating it generally by the numeral 31. Clamp 30 consists essentially of two members 32 of such configuration that when assembled, the complete clamp has an angular exterior tapered configuration similar to the angular tapered configuration of aperture 22, to fit into the tapering groove portions 22^a of that aperture. The two parts of the clamp are held together by suitable bolts 35 which pass through enlongated slots 33 in the clamp members, so as to allow a certain amount of relative movement between the two members. This slight relative movement allows the central square aperture 30^a of the clamp to be adjusted in size, to fit closely upon the stem of the drilling pipe, but at the same time it will allow the drilling pipe suitable motion. In order to keep the clamp members from slipping down into the tapered aperture 22, and to thereby keep the clamp members from gripping the drilling pipe stem too tightly, I have provided suitable stops in the form of stud screws 34 which bear upon the upper surface of drive ring 21 and hold the clamp members accurately in such position as is found necessary to fit as closely as possible into the drive ring and around the stem without binding tightly upon the stem. And, to provide bearing surfaces between the opposite members of the clamp, I provide bosses 30^b which may be surfaced down to allow the members to be adjusted toward each other to keep the central square aperture of the correct size, as said aperture is worn larger by the movement of the stem. These provisions make my construction such that the stem is at all times effectually engaged in the square aperture; lost motion being reduced to a minimum and the driving of the stem being thereby made positive and direct.

It will be seen from the drawings that I have constructed these clamps with webs and flanges so as to be as strong, and at the same time as light as possible. The clamps may be easily removed from the drive rings by merely lifting upwardly thereon; and may be separated and removed from the drilling pipe stem by merely removing the bolts 35.

When it is desired to raise or lower pipe in the well, the clamp 30 may be removed from the drive ring, and the clamp 31 inserted therein. The clamp 31 is constructed with two members hinged together at 40 and each having a lower body portion 41 whose exterior configuration is angular and tapered similar to the angular tapered configuration of aperture 22; so that the clamp members may fit down in the aperture 22 and be thus held fairly tightly, although it is not desirable that they be wedged too tightly into place in the aperture and forced very tightly together, as this would interfere with their removal from the drive ring. Each of the members of the clamp 31 has an upper flanged portion 42 which presents shoulders 43 bearing upon the upper surface of the drive ring 21, thus supporting the clamp upon the drive ring. Within these upper flanged portions 42 of the clamp I prefer to mount a suitable manually operable means for raising the slips 45 which fit within the inner circular bore 46 of the clamp. This inner circular bore 46 of the clamp tapers downwardly, as is clearly shown in Fig. 9, and the outer curved surfaces 47 of the slips are correspondingly shaped, except that the radius of these curved surfaces is less than the radius of the bore 46; so that the slips fit into the bore as is shown in Figs. 8 and 10, bearing only along the central part of their outer surfaces. This difference of curvature not only allows the slips to move downwardly in the bore 46 to a position where the radius of the bore is less than at its upper end, but also provides that the slips may be more or less rockingly supported so as to adjust themselves to the pipe around which they engage and with which their teeth 45^a engage. At the back of each of the slips I provide two gear racks 48, the teeth being preferably cast or otherwise formed in the slips themselves, and being of such formation that they may more or less loosely engage with the teeth of gears 50. The gears 50, four in number, are mounted upon suitable shafts 51 interconnected by gears 52 so as to all be movable by the simple movement of a hand lever 53 mounted upon one of the shafts. A movement of the lever 53 will easily move the slips 45 upwardly to disengage a pipe.

By the mechanisms herein described, I provide a simple apparatus, which by simple and easily made changes, may be used for imparting rotary motion to a rotary drilling apparatus or for assisting in raising or lowering pipe in the well. The details of my apparatus may be largely varied by changing the fundamentals by which I accomplish these useful results.

Having described a preferred form of my invention, I claim:

1. In a rotary drilling rig, the combination of a turn table, a drive-ring having a central downwardly tapering aperture, a clamp having an exterior taper which conforms to the taper of the central aperture

of the drive ring, and means for adjusting the vertical position of the clamp with respect to the drive-ring.

2. In a rotary drilling apparatus, the combination of a turn-table, a drive ring mounted thereon having a vertical aperture of angular cross-section tapering downwardly therethrough, a clamp having similar angular tapered exterior configuration to fit within said drive ring aperture, and adjustable stop means to support the clamp on the drive ring.

3. In a rotary drilling apparatus, the combination of a turn-table, a drive ring mounted thereon having a vertical aperture of angular cross-section tapering downwardly, and a pair of clamp members secured together to form a clamp with a square interior aperture and an angular tapered exterior to fit within said drive ring aperture.

4. In a rotary drilling apparatus, the combination of a turn-table, a drive ring mounted thereon having a vertical aperture of angular cross-section tapering downwardly, a pair of clamp members secured together to form a clamp with a square interior aperture and an angular tapered exterior to fit within said drive ring aperture, and adjustable stop means to support the clamp on the drive ring.

5. In a rotary drilling rig, the combination with a turn table, of a drive-ring having a central opening provided with angularly disposed flat faces which are inclined downwardly toward the axis of the drive-ring, and a clamp comprised of a plurality of members having exterior faces which correspond with the flat faces of the central opening of the drive-ring, said clamp members vertically movable with relation to the drive-ring and in contact with the flat faces thereof.

6. In a rotary drilling apparatus, the combination of a drive ring having a vertical aperture of non-circular cross section tapering downwardly, a drill stem engaging member having an exterior tapered configuration to fit within said aperture, and means to support said member on the drive ring to prevent the member from wedging tightly into the aperture.

7. In a rotary drilling apparatus, the combination of a drive ring having a vertical aperture therethrough of non-circular cross-section tapering downwardly, a drill stem engaging member having an exterior tapered configuration to fit within said aperture, and adjustable studs on said member adapted to engage the upper face of the drive ring to support said member loosely in the aperture of the ring.

8. In a rotary drilling apparatus, the combination of a drive ring having a downwardly tapering aperture of non-circular cross-section, and a drill stem clamp having an exterior tapered configuration to fit said aperture, said clamp composed of two halves loosely secured together.

9. In a rotary drilling apparatus, the combination of a drive ring having a downwardly tapering aperture of non-circular cross section, and a drill stem clamp having an exterior tapered configuration to fit said aperture, said clamp composed of two halves loosely secured together, and adjustable stop means for supporting the clamp loosely in said drive ring aperture.

10. In a rotary drilling apparatus, the combination of a drive ring having a downwardly tapering aperture of non-circular cross section, and a drill stem clamp having an exterior tapered configuration to fit said aperture, and having a vertical square aperture for reception of a drill stem, said clamp composed of two halves separated by a vertical plane diagonal to the square aperture, and adjustable studs on the clamp halves adapted to rest upon the upper surface of the drive ring to support the clamp loosely in the drive ring aperture.

11. In a rotary drilling apparatus, the combination of a drive ring having a downwardly tapering aperture of non-circular cross section, and a drill stem clamp having an exterior tapered configuration to fit said aperture, and having a vertical square aperture for reception of a drill stem, said clamp composed of two halves separated by a vertical plane diagonal to the square aperture, and loosely secured together, and adjustable studs on the clamp halves adapted to rest upon the upper surface of the drive ring to support the clamp loosely in the drive ring aperture.

12. In a rotary drilling apparatus, the combination of a drive ring having a vertical aperture therethrough, the cross section of said aperture being elongate along one horizontal axis and presenting opposite V-shaped notches on the transverse horizontal axis, and a drill stem engaging member having an angular tapered exterior adapted to fit into the notch portions of said aperture.

13. In a rotary drilling apparatus, the combination of a drive ring having a vertical aperture therethrough, the cross section of said aperture being elongate along one horizontal axis and presenting opposite V-shaped notches on the transverse horizontal axis, and a drill stem engaging member having an angular tapered exterior adapted to fit into the notch portions of said aperture, and means for supporting said member loosely in the aperture.

14. In a rotary drilling apparatus, the combination of a drive ring having a vertical aperture therethrough, the cross section of said aperture being elongate along one horizontal axis and presenting opposite V-shaped notches on the transverse horizontal

axis, and a drill stem engaging member having a square tapered exterior adapted to fit into the notch portions of said aperture.

15. In a rotary drilling apparatus, the combination of a drive ring having a vertical aperture therethrough, the cross section of said aperture being elongate along one horizontal axis and presenting opposite V-shaped notches on the transverse horizontal axis, and a drill stem engaging member having a square tapered exterior adapted to fit into the notch portions of said aperture, and means for supporting said member loosely in the aperture.

16. In a rotary drilling apparatus, the combination of a drive ring having a vertical aperture therethrough, the cross section of said aperture being elongate along one horizontal axis and presenting opposite V-shaped notches on the transverse horizontal axis, a drill stem clamp composed of two halves separated along a vertical plane having a square tapered exterior to fit into the notch portions of said aperture, and means for supporting said halves loosely in said aperture.

17. In a rotary drilling apparatus, the combination of a drive ring having a vertical aperture therethrough, the cross section of said aperture being elongate along one horizontal axis and presenting opposite V-shaped notches on the transverse horizontal axis, a drill stem clamp composed of two halves separated along a vertical plane having a square tapered exterior to fit into the notch portions of said aperture, said halves being loosely secured together, and means for supporting said halves loosely in said aperture.

18. In a rotary drilling rig, the combination with a turn-table, of a drive member having a central vertical aperture one horizontal axis of which is adapted to permit the passage of a drill bit, the other horizontal axis of the aperture being of less length, and means in the shorter axis of the opening for engaging a clamp-member.

19. In a rotary drilling rig, the combination with a turn-table, of a drive-ring having an elongated central vertical aperture adapted to permit the passage of a drill bit the opposite walls of said aperture of the drive ring being provided with means for engaging a clamp-member.

In witness that I claim the foregoing I have hereunto subscribed my name this 3rd day of June 1913.

RICHARD E. KLINE.

Witnesses:
JNO. T. HARRINGTON,
ELWOOD H. BARKELEW.