

June 28, 1927.

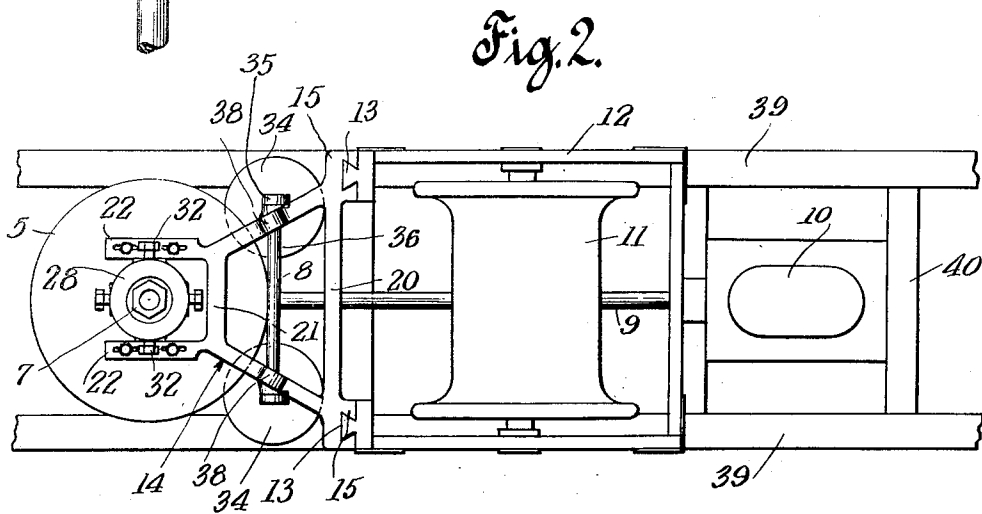
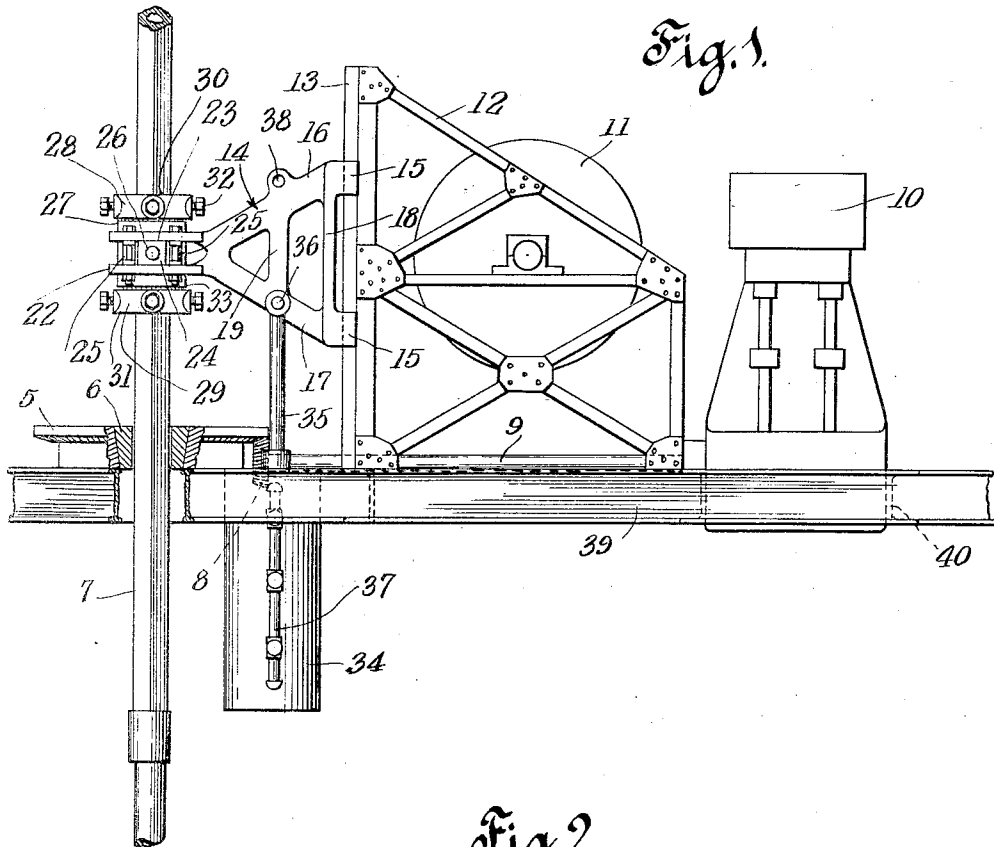
1,634,087

W. SHELDON

DRILLING APPARATUS

Filed Aug. 4, 1923

2 Sheets-Sheet 1



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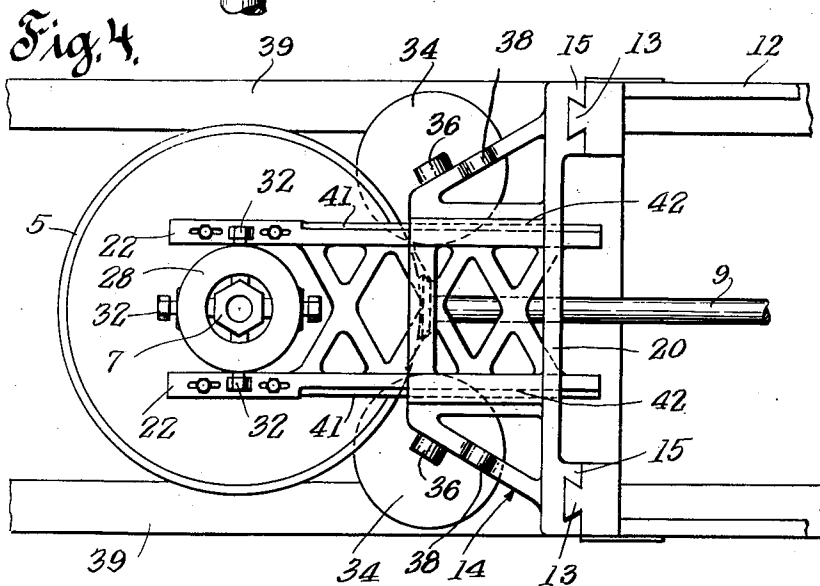
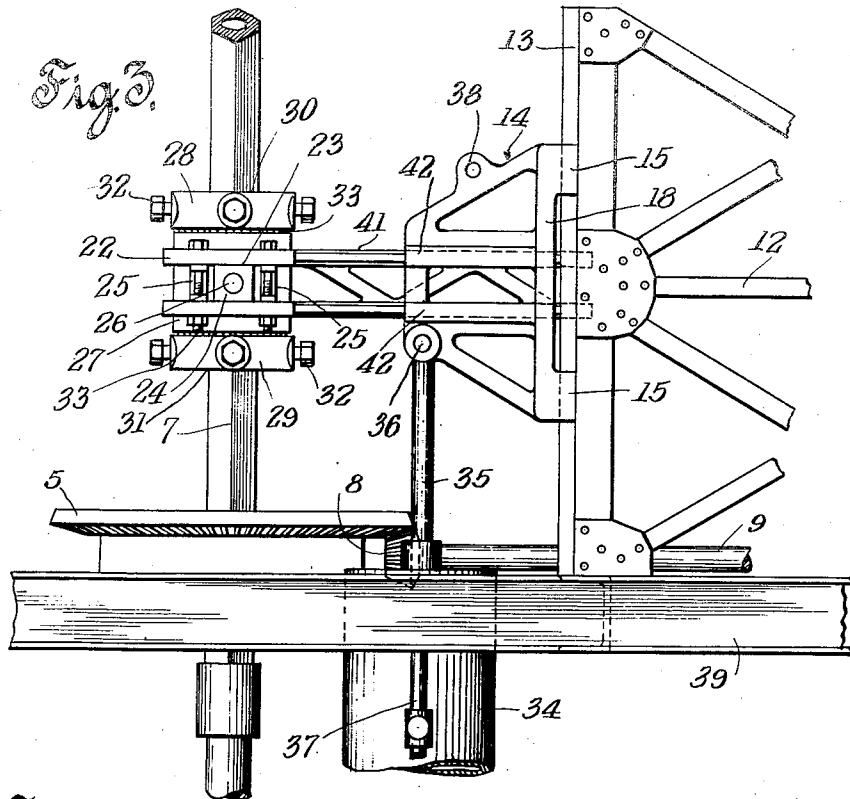
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UNITED STATES PATENT OFFICE.

WALDO SHELDON, OF GREENWICH, CONNECTICUT.

DRILLING APPARATUS.

Application filed August 4, 1923. Serial No. 655,742.

The present invention relates particularly to well drilling apparatus of the "rotary" type.

Special objects of the invention are to provide simple, powerful and accurately controlled means for raising and lowering the drill and for maintaining a desired pressure on the drill bit; to provide such mechanism in compact form and so that it may be combined with the usual rotary drilling rig without interfering with the proper operation of the same, and further, to so construct the apparatus that it may be advantageously combined with the motive power necessary for the rotary drilling operations.

The foregoing and other objects are attained in the embodiments of the invention illustrated in the accompanying drawings, but as such illustration is primarily for purposes of disclosure it is to be understood that the structure may be modified without departure from the broad spirit and scope of the invention as hereinafter defined and claimed.

Figure 1 is a side elevation, with parts shown in section of a form of the invention designed particularly for drilling deep oil wells.

Figure 2 is a general plan view of the same, also with certain parts broken away for purposes of better illustration.

Figures 3 and 4 are side and plan views respectively, illustrative of certain modifications.

The rotary table 5 is shown as provided at its center with a bushing 6 having a sliding driving fit with the angular drill stem 7 and is itself shown as driven by a bevel pinion 8 on the end of a shaft 9 which is operated by a steam engine 10 or other suitable motor.

At 11 there is illustrated in a general way a hoist such as is usually employed in drilling operations and both this hoist and the motor are shown mounted in a frame or bed 12 which, at its end nearest the table, carries a pair of spaced upright guides 13.

The guides 13 are shown as spaced a short distance away from the rim of the table and at substantially equal distances to opposite sides of a line intersecting the center of the table so as to constitute with the drill stem, the outlines for a substantially equal sided triangle. Slidingly engaged with the guides is a frame 14 which in plan is of generally

triangular shape with boxes 15 at the base corners of the triangle in sliding engagement with the guides. The engagement between the sliding frame and guides may be of the interlocking variety, such as the dovetail construction illustrated.

The sliding frame is shown as of substantially triangular formation in side elevation with convergent upper and lower bars 16, 17, connected at their bases by an upright 18, and each carrying one of the sliding boxes 15. The convergent bars 16, 17 forming the sides of the frame are also shown as connected intermediate their ends by the struts 19. The sides of the generally triangular frame are shown connected at the base by cross bars 20 and at the convergent end by a web or cross bar 21. This construction provides a rigid, well braced frame which is strong for its weight and which will slide readily over the guides without binding.

At the peak of the frame the sides are shown as extended in substantially parallel projections 22, reaching past opposite sides of the drill stem and forked at 23 to receive rectangular bearing blocks 24. These bearing blocks are shown as confined in definite position within the forks by the adjustable positioning blocks 25 and are shown as accommodating journals or studs 26 projecting from opposite sides of the chuck sleeve 27, which latter is rotatably confined between the upper and lower thrust shoulders 28, 29 on the chuck body 30, as illustrated more in detail in my co-pending application, Serial #642,182, filed May 29th, 1923. The chuck body is shown as secured in readily adjusted position upon the drill rod or drive stem by clamps 31 actuated by the screws 32. A pressure applying engagement is thus provided between the sliding frame and drill which is effective regardless of the rotary motion imparted to the drill by the rotary table. Cone bearings 33 or the like are usually provided to reduce friction between the thrust transmitting sleeve 27 and the thrust flanges 28 on the chuck body.

The power for operating the slide is provided in the present disclosure by a pair of hydraulic cylinders 34 located one beneath each of the sides of the substantially triangular or pyramidal slide and enclosing pistons having projecting rods 35 connected with the sides of the frame at points substantially in line with the intermediate

struts 19. The connection of the piston rods with the frame is shown as made by a pin or rod 36 which passes through seats provided therefor in the sides of the frame and heads on the ends of the piston rods and which can be withdrawn longitudinally to quickly disconnect the slide from both the power pistons.

Suitable valve mechanism such as indicated in a general way at 37 is provided for controlling the pressure at opposite sides of the piston in the power cylinder, such valve mechanism being ordinarily located within convenient reach of the operator and being of such a character as to enable accurate and fine control of the drilling pressure and both feeding and retractive movements of the drive stem or drill rod.

The construction disclosed makes it possible to locate the power cylinders below the derrick floor, thus lowering the center of gravity and placing them where they are entirely out of the way. Upon disconnecting the slide frame from the power pistons the latter will sink down out of the way and the frame may be removed by simply disengaging it from the chuck and lifting it clear of the guides. For such elevating purposes the frame is shown as provided with suitably located rings or eyes 38 for engagement by hoisting hooks. In such hoisting operations the chuck clamps may be loosened to release the chuck from the drill stem or the slide may be disconnected from the chuck and the chuck be allowed to remain with the drill stem. With the construction shown the disengagement of the slide from the chuck may be effected by simply removing the positioning blocks 25 and then partly rotating the thrust sleeve to carry the bearing blocks and journals 26 clear of the forks 23.

The power devices, through the medium of the slide, exert a direct straight-line push or pull on the drill so that full force can be applied without any tendency toward bending or binding the drill stem or other parts and this with a very compact construction which takes up no room on the derrick floor and adds no height to the drilling apparatus. The construction disclosed also makes it possible to mount the entire apparatus, including the motor, the hoist, the pressure-fed mechanism and the rotary table, all on a single base which may be made up as in the illustration, of a pair of channels or I-beams 39, forming part of the derrick floor frame and connected at suitable intervals by cross braces 40. The slide can be made relatively short since the piston rods of the power cylinders need only clear the rim of the table and this, coupled with the fact that the power is applied at a point between the ends of the slide and the slide has a relatively wide base, causes the slide to operate practically as a balanced "cross head".

In the form of the invention illustrated in Figures 3 and 4 the thrust of the power slide is transmitted to the drill stem chuck by means of a horizontally extending arm 41 supported for horizontal sliding movement in guides 42 in the body of the main slide. This construction provides a self-adjusting connection between the slide or cross head and the chuck and enables disconnection of the cross head from the chuck by simply removing the caps or blocks which hold the bearing blocks in place within the forks of the horizontally extending arm and then retracting the arm clear of the chuck. If the arm is drawn back far enough to clear the edge of the table, then the cross head may be lowered to the floor of the derrick where it will be entirely out of the way. This possibility is particularly advantageous in cases where it is desired to discontinue the pressure feed and proceed in the customary manner of rotary drilling, with only the weight of the pipe line as the vertical driving force. This method of operation also avoids any need for disconnecting the piston rod from the cross head, because with the cross head lowered out of the way, the piston may be left connected ready for use at any time.

The power cylinders are so located in this invention that they may be designed for a fairly long stroke so that a considerable feed or lift may be imparted to the drill stem with one setting of the chuck. By using two or a number of power cylinders the cylinders may be made smaller and lighter than if only a single cylinder were used and the effect of a number of cylinders is to distribute and balance the force applied to the cross head.

What I claim is:

1. In combination, a rotary table having means for driving a drill stem, a guide at one side of the table in substantial parallelism with the line of feed of the drill stem, a cross head slidably engaged with the guide at one end and having means at its opposite end for connection with the drill stem and a power cylinder mounted intermediate the table and guide and having a piston rod connected with the cross head at a point intermediate the ends of the same.

2. A structure as in claim 1 in which the power cylinder is mounted below the table and in which the connection with the cross head is readily detachable to enable removal of the cross head.

3. A structure as in claim 1 in which the connection with the drill stem is provided by a chuck having means for adjustable engagement with the drill stem and provided with bearing elements engaging in forked portions of the cross head.

4. In well drilling apparatus, a sliding cross head for applying pressure to the drill stem and a chuck having means for adjustably securing the same on the drill stem,

projecting bearing elements on the chuck and means on the cross head adjustably receiving said bearing elements.

5 5. In combination with a drill stem chuck having a thrust sleeve with projecting bearing elements, a power actuated thrust slide having seats for said bearing elements and adjustable means for positioning the bearing elements in said seats.

10 6. In combination with a drill stem chuck having a thrust sleeve with projecting bearing elements, a power actuated thrust slide having seats for said bearing elements and adjustable means for positioning the bearing elements in said seats, comprising positioning blocks secured in the seats at opposite sides of the bearing elements.

15 7. In a well drilling apparatus, a horizontally supported rotary table, a head guided for vertical movement in respect to said table, an arm mounted for horizontal movement in said head in relation to the center of the table, a drill stem chuck engaged by said arm and power mechanism for operating the vertically moving head.

20 8. In well drilling apparatus, substantially vertical guide posts, a power transmitting arm having a relatively wide base slidably engaged with said posts and convergent sides, power means for actuating said arm and a drill stem chuck engaged by the convergent side portions of the arm, said power means comprising power cylinders having piston connections with the convergent sides of the arm.

25 9. In well drilling apparatus, a rotary table having means for driving a drill stem, power cylinders supported in spaced relation adjacent the edge of the table and having pistons with upwardly projecting piston rods, a power transmitting arm overstanding the table and actuated by said piston rods and a drill stem chuck engaged by said arm.

30 10. In well drilling apparatus, a rotary table having means for driving a drill stem, power mechanism at the side of the table and having power transmitting connections rising in spaced relation at the side of the table, a power transmitting arm overstanding the table and actuated by said spaced connections and a drill stem chuck engaged by said power transmitting arm.

35 11. In well drilling apparatus, a frame, a rotary table journaled on said frame at one end of the same, a motor mounted on the opposite end of the frame, hoist mechanism mounted on the frame between the rotary table and motor, line shafting extending from the motor beneath the hoist mechanism to the rotary table, a vertical guide on the hoist mechanism at the side adjacent the rotary table, a cross head engaged with said guide, a drill stem chuck engaged by said cross head and power means on the

frame beneath the table connected with said cross head.

12. In well drilling apparatus, a rotary table, well drilling mechanism at one side of said table and mounted in a frame having vertical guides on the side exposed to the table, a power transmitting arm slidably engaged with said guides and overstanding the table, power means for actuating said arm and a drill stem chuck engaged by the overstanding portion of the power arm.

13. In well drilling apparatus, a drill stem chuck, a cross head guided for movement in a direction corresponding to the feeding movement of the drill, power means for actuating said cross head and a cross slide mounted on the cross head and having detachable engagement with the drill stem chuck.

14. In well drilling apparatus, a rotary table, a drill stem slidably held thereby, a chuck adjustably engaged with said drill stem, a cross head guided for sliding movement in the direction of feed of the drill stem, said cross head being mounted at one side of the table and an arm extensible from the cross head over the table into detachable engagement with the chuck.

15. In well drilling, a derrick floor, a rotary table mounted thereon, a power cylinder supported below the floor at one side of the table and having a piston rod rising from the floor at the edge of the table, a vertical guide rising from the floor, a cross head engaged with said guide, a drill stem chuck and a retractable arm extending from the cross head into engagement with the drill stem chuck.

16. In well drilling, a derrick floor, a rotary table mounted thereon, a power cylinder supported below the floor at one side of the table and having a piston rod rising from the floor at the edge of the table, a vertical guide rising from the floor, a cross head engaged with said guide, a connection between the piston rod and cross head and a drill stem chuck, the cross head having a part projecting over the table into engagement with said chuck.

17. In well drilling apparatus, a head guided for vertical movement, an arm mounted for horizontal adjustment in said head and provided with means for applying pressure exerted thereby to a rotating drill stem and power mechanism for the vertically moving head.

18. In well drilling apparatus, a supporting frame, a rotary table journaled on said frame at one end of the same, a motor mounted on the opposite end of the frame, hoist mechanism mounted on the intermediate portion of the frame between the motor at one end and the rotary table at the opposite end, line shafting extending from the motor beneath the hoist mechanism to the

rotary table, power mechanism supported on the frame below the rotary table and clear of the shafting for driving the table and connections from said power mechanism for
5 applying regulated lifting and lowering force to a drill stem rotated by the rotary table.

19. In well drilling apparatus, a frame consisting of a pair of I-beams connected in
10 spaced relation by cross braces, a rotary table mounted on one end of said frame, a motor mounted on the opposite end of said frame, hoist mechanism mounted on the intermediate portion of the frame between the
15 motor at one end and the rotary table at the opposite end, drive shafting for the rotary table extending from the motor beneath the hoist mechanism to the table and means carried by the rotary table for rotating a
20 drill stem extending down through the table between the I-beams of the frame.

20. In well drilling apparatus, a rotary

table, a tubular member having a driven sliding engagement through said table, spaced upper and lower thrust shoulders 25 carried by said tubular member, a thrust transmitting sleeve interposed between said shoulders and provided with projections extending from opposite sides of the same, power cylinders located at different sides of 30 and below the rotary table, said power cylinders having pistons provided with piston rods projecting upwardly past the edges of the table and detachably connecting means between said piston rods and the projections 35 of the thrust sleeve, whereby the lifting and lowering force of the power cylinders may be applied to the tubular member irrespective of the driving of the same by the rotary 40 table.

In witness whereof, I have hereunto set my hand this 28th day of July, 1923.

WALDO SHELTON.