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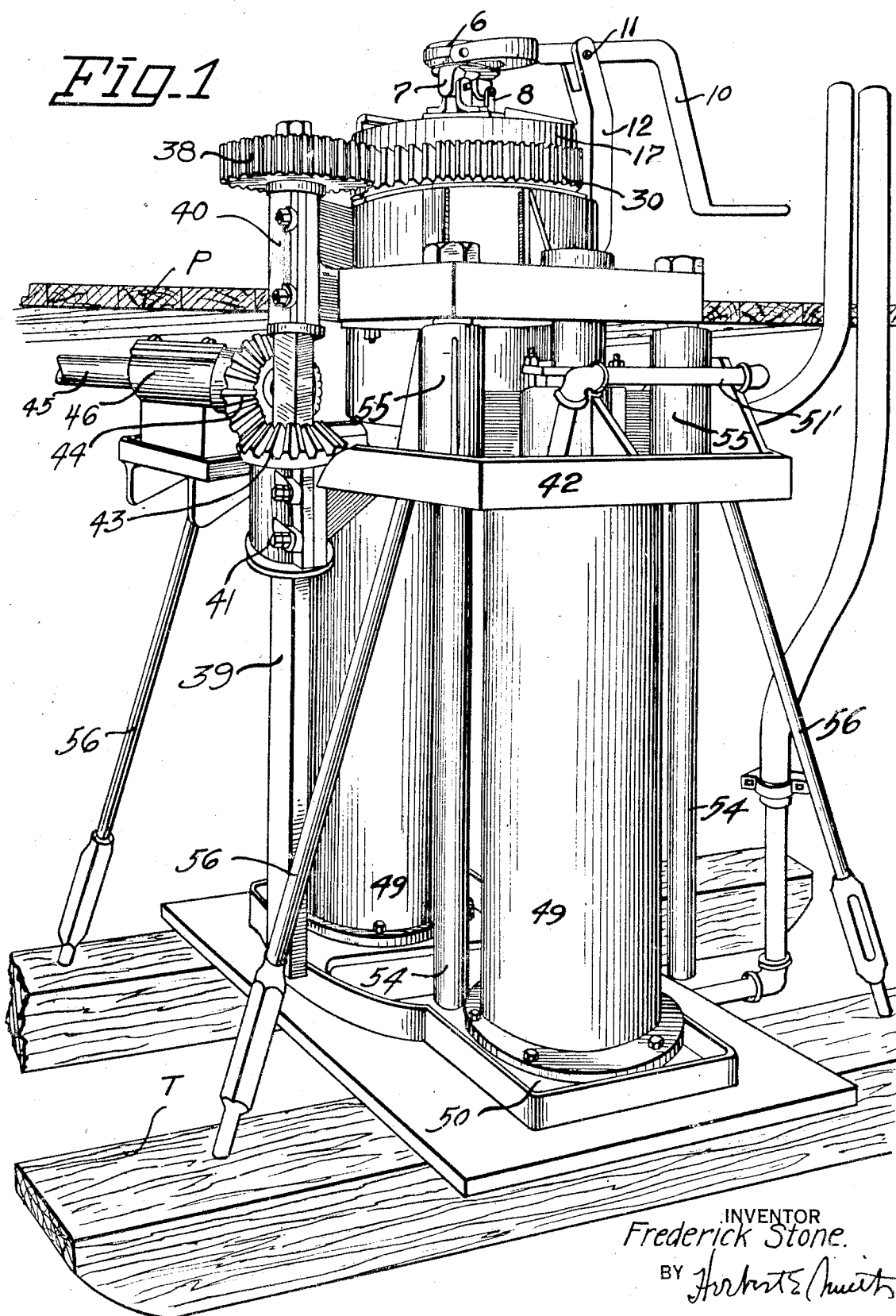
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F. STONE

EARTH BORING MACHINE

Filed Jan. 12, 1924

3. Sheets-Sheet 1



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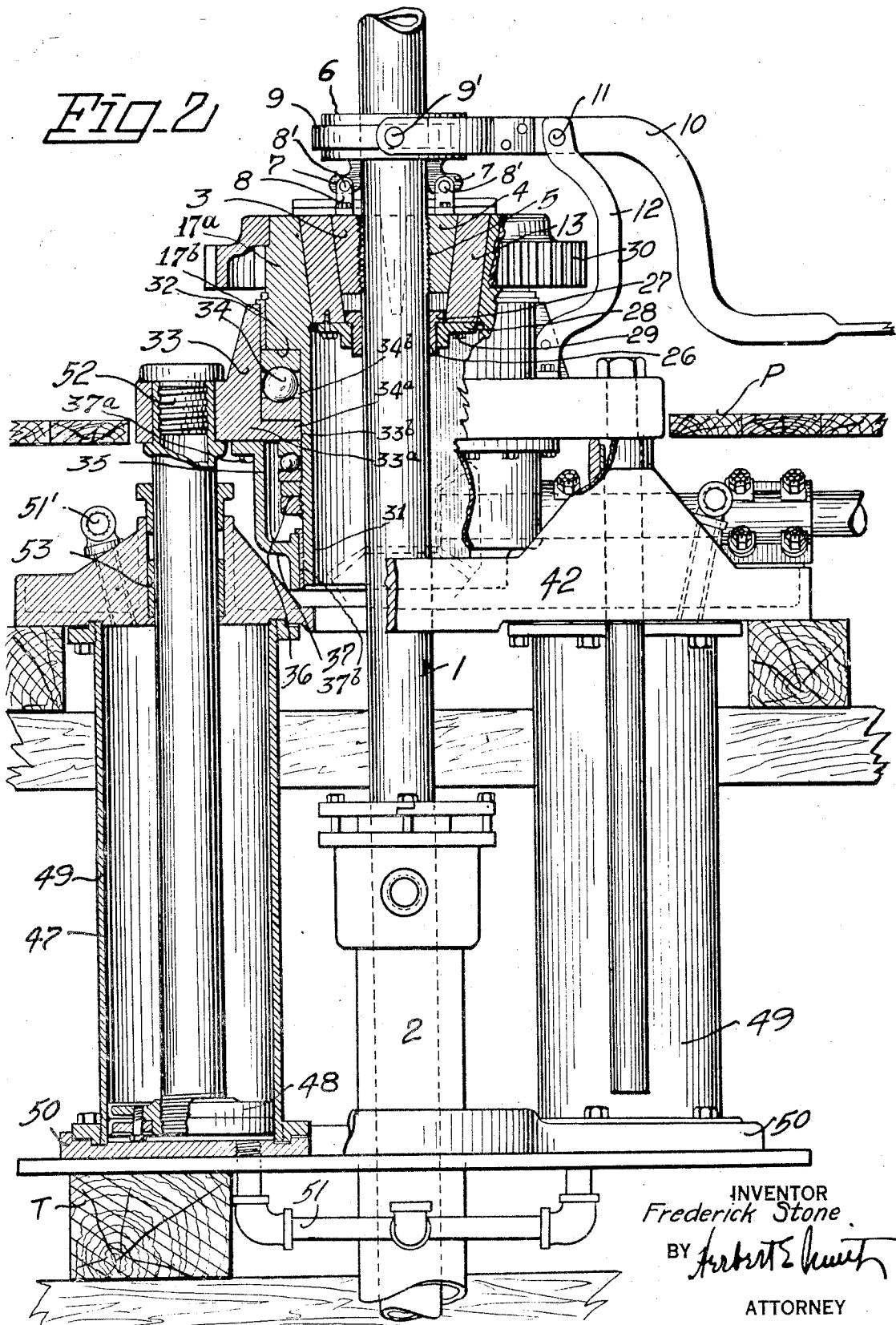
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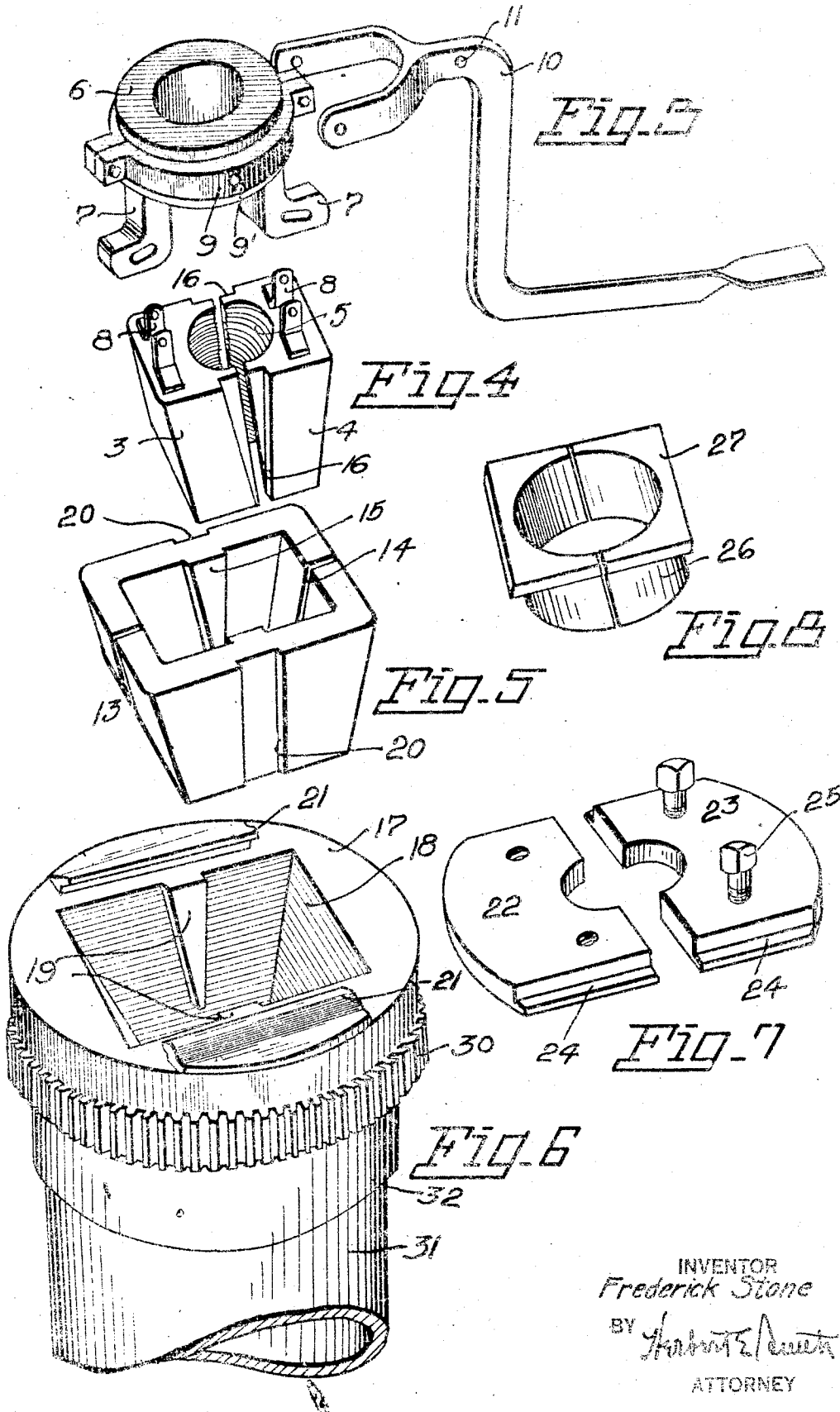
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

FREDERICK STONE, OF SPOKANE, WASHINGTON.

EARTH-BORING MACHINE.

Application filed January 12, 1924. Serial No. 685,744.

My present invention relates to improvements in earth boring machines of the rotary drill type, wherein the machine is preferably depressed or located below the surface of the ground to insure convenience and ready access to the attendants, and protection from accidents to the operating mechanism.

The machine, of my invention is designed for use in deep earth boring or drilling for oil, gas, artesian and other wells and the rotary drill head is supported for vertical movement when required upon hydraulic devices in such manner as to insure the proper load adjustment on the rotary drill for the proper performance of its functions. By means of the hydraulic devices downward pressure may also be imparted to the tool when required, and the drill rod may be elevated to withdraw the drilling tool from the well.

The primary object of the present invention is to improve the construction and operation of the rotary drill head in certain particulars whereby an effective grip between the drill head and drill rod may with facility be secured, and which may with equal convenience be released when required. The grip is effected in such manner as to retain the drill rod in its head in stable position against either wobbling or slipping with relation to the rod, and pedal actuated means are provided for releasing the head from the rod for the purpose of permitting lowering of the rod as the drilling progresses. By the utilization of the various features of my invention a combination and arrangement of parts in the rotary drill head is effected to secure simplicity in construction and operation of the machine. In the accompanying drawings I have illustrated one complete example of the physical embodiment of my invention wherein the parts are combined and arranged in accordance with the best mode I have thus far devised for the practical application of the principles of my invention.

Figure 1 is a perspective view in elevation with the machine in operative position and illustrating the power mechanism.

Figure 2 is a vertical sectional view of the assembled machine showing the chuck or grip device between the drill head and the drill rod, with the head in lowered position.

Figure 3 is a perspective view of the pedal

mechanism for releasing the chuck from the rotary drill head.

Figure 4 is a perspective view of the sectional chuck or gripping jaws for the drill rod.

Figure 5 is a perspective view of the changeable bushing of the chuck.

Figure 6 is a perspective view at the top of the rotary drill head showing the socket therein for the chuck bushing and means for locking the bushing in place.

Figure 7 is a detail perspective view of a pair of retaining plates of the chuck.

Figure 8 is a perspective view of the interchangeable thimble for aligning the drill rod.

In the accompanying drawings I have indicated as 1 the usual type of rotary drill rod and well casing 2 and the machinery of the drill head is indicated as supported on timbers T in a pit at the ground surface, planks P being indicated for covering the pit and enclosing the machinery. While the rotary drill head may be drivingly connected to the drill rod in any manner suitable to carry out the particular operation in hand (the general type of connection depending upon the particular operation, as is well understood), by way of illustration the drawings show an assembly wherein the drill head is directly connected to the drill rod by means of a pair of complementary jaws 3 and 4 to form a sectional gripping device with an interior cylindrical bore threaded or otherwise formed at 5 to secure a close grip on the exterior surface of the round drill rod. This gripping device or sectional chuck is rectangular in cross section and tapers from its top flat surface to its bottom flat surface and the two sections when in place surround the drill rod as shown. For releasing the grip of these jaws I employ a clutch collar or ring 6 having a slidable fit on the drill rod and located above the jaws at the top of the drill head. The clutch ring is fashioned with a pair of angular slotted lugs 7 depending therefrom, each of which fits between a pair of brackets 8 on the sectional chuck 3-4 and pins 8' are used to make loose pivotal connections between the lugs and brackets. A loose ring 9 is carried by the clutch ring, and this ring or collar 9 has laterally extending diametrically arranged pins 9' for the accommodation of the forked, angular pedal

lever 10 which is pivoted at 11 to fixed brackets 12 of the machine. It will be apparent that by exerting a downward pressure on the pedal level 10 it will be swung on its pivot 11 and the collar 9 and ring 6 will be caused to lift the sections 3 and 4 of the chuck to release these sections or jaws from the drill rod, when required.

When in operative position the sectional jaws 3, 4 are enclosed within a complementary, angular split bushing 13 which is tapered exteriorly and also has an interior socket 14 with tapering walls complementary to the exterior tapering faces of the jaws 3 and 4 that seat in the socket. At opposite sides of the socket 14 are fashioned tapering keys 15 which coact with the complementary grooves 16 of the jaws 3, 4 to guide the movement of the jaws to and from gripping position.

The bushing is supported within a rotary drill head 17 which has a tapering socket 18 therein for the reception of the bushing and which of course conforms to the exterior formation of the bushing. The socket 18 of the rotary drill head is also fashioned with tapering or wedge-shaped keys 19 on opposed faces, said keys being adapted to function as do keys 15, that is, keys 19 act as section guides when the bushing is removed so larger size chuck sections or slips, similar to sections 3 or 4, may be taken directly in socket 18. Bushing 13 has vertically extending clearance grooves 20 on opposite exterior faces thereof, so it may be lowered into socket 18 without interference from keys 19.

On the upper or top surface of the rotary drill head are provided a pair of complementary, horizontally disposed, grooved, flanges 21, 21 located near the edge of the head and adjacent to the socket 18. These grooved flanges are designed to receive the horizontally disposed retaining plates 22 and 23 which have lateral flanges 24 for a sliding fit beneath the flanges 21 of the head. The plates are cut out or formed with recesses to span the drill rod and are located on top of the bushing and gripping jaws to retain them in position in the drill head. By means of the four set screws or bolts 25 which pass through the plates and bear against the top surfaces of the chuck sections or jaws these tapering members may be forced down in the drill head to insure a tight grip of the jaws on the drill rod and retain the parts in the drill head. If the jaws are to be removed, these bolts are first loosened and then the plates are withdrawn in opposite directions by sliding them free of the drill head.

Within the bottom of the bushing 13 is located split alining thimble 26, which is formed with an upper exterior flange 27 fitting within the lower open end of the bush-

ing. The thimble encases the drill rod 1 and centers it within the drill head, and as the drill rods vary in diameter the equipment may include a number of these thimbles which also vary in diameter to fit the various rods, and of course the sectional jaws 3 and 4 are readily adapted for use with rods of different diameters within limits.

A retaining plate 28 is secured by bolts 29 to the bottom of the bushing, which plate surrounds the thimble and fits under the flange 27 thereof to hold the thimble in place.

On the exterior of the rotary drill head 17 is affixed a gear ring 30, secured to the head in suitable manner. The drill head embodies an upper portion 17^a of relatively large outside diameter and a depending bearing sleeve 31 of relatively small outside diameter, and cylindrical in shape and enclosing the drill rod as seen in Figure 2. At the junction of the larger and smaller portions an annular downwardly facing bearing shoulder 32 is formed, which shoulder engages the down-thrust main bearing 24, which is supported on the non-rotatable table 33^a about its axial opening 33^b, said table being supported for vertical movement, as will be described. Annular flange 33 extends upwardly from the table about bearing 34 (the flange and the table portion 34^a within the flange defining an upwardly opening recess 34^b), and providing at 17^b radial bearing for the head above bearing 34.

In addition to the main bearing 34 for supporting the load of the drilling tool, an auxiliary upthrust bearing 35 is located beneath the table 33^a for providing anti-friction means for the rotary drill head when an opposite pressure is being exerted. This auxiliary bearing is interposed between the under face of the table 33^a and is detachably held to sleeve 31 by bearing rings 36 threaded on the exterior of the said sleeve; and an enclosing cup 37 is fixed to the under face of the bearing head for shielding these elements of the auxiliary bearing as well as to form a bearing for the sleeve of the rotary drill head at the lower end of said sleeve.

Cup 37 may be considered as embodying a depending annular flange detachably secured to the table at 37^a, annularly spaced from sleeve 31 adjacent to the table, and providing at 37^b radial bearing for the sleeve at a point below bearing 35 and appreciably spaced below the table.

The rotary drill head is operated through the gear ring 30 by means of a driving gear or pinion 38 on the shaft 39, a bearing 40 being carried by the table 33^a for this shaft and suitable bearing sleeves being provided in the bearing to permit rotation of the shaft therein. The driving pinion and its shaft are vertically movable with the similarly

movable table 33^a to permit raising or lowering of the drill head and the rod gripped thereby.

A fixed bearing 41 for the angular shaft 5 is secured to the stationary, rectangular frame 42 of the machine, and suitable bearing sleeves are provided for journaling the shaft to revolve in this bearing also. A gear-couple 43, 44 in the form of bevel gears 10 is driven from the operating shaft 45 to revolve the vertical angular shaft 39, and suitable bearings as 46 are provided for this horizontally disposed shaft 45 which is driven from a usual source of power. Thus 15 while the bevel gears 34, 44 have stationary supports the rotary drill head and table with the gear 30 and pinion 38, as well as the shaft 39 are vertically movable as before described.

20 The rotary drill head through its table 33^a is supported for vertical movement on hydraulic devices including a pair of piston stems 47 having heads 48 at their lower ends and operative within complementary cylinders 25 49 supported on the base plate 50, the latter being supported in turn on the timbers T in the bottom of the pit.

Motive fluid is supplied to the lower end of the respective cylinders for lifting the 30 pistons through pipes 51, and outlet pipes 51' from the cylinders may be used to withdraw the fluid, or to provide pressure in the cylinders on top of the piston heads for forcing downwardly the drill rod.

35 At 52 the piston stems 47 are secured in suitable manner to the table 33^a, and these stems have slide bearings 53 in the stationary rectangular frame 42 for guiding the movement of the stems and holding them in true 40 position for operation.

In addition to the guides for the stems, the table is guided and held in stable position by means of four posts 54 bolted thereto and passing through guide sleeves 55 of the 45 stationary frame 42, which posts not only guide the table in vertical movement, but hold it in rigid stationary position. For bracing the frame 42 to hold it in rigid position stay bolts or braces 56 may be employed, which are anchored in the timbers T 50 with their upper ends in engagement with the frame.

It will be obvious that where a single standard size drill rod is to be employed the bushing 13, the bushing 26, and the retaining 55 plate 28 may be dispensed with as there will be no need in this event for interchangeable parts.

Having thus fully described my invention, what I claim as new and desire to secure by 60 Letters Patent is:—

In well drilling apparatus of the character described, a non-rotatable horizontal table supported for vertical reciprocation and having an axial opening therethrough, 65 an upstanding annular flange on the table about and annularly spaced from the axial opening, an anti-friction bearing seated on the table within the flange, a tubular, rotatable drill head adapted to take vertically 70 extending work through its bore and to hold said work against relative rotation and vertical movement with respect thereto, said head embodying an upper portion of relatively large diameter, and a lower sleeve 75 portion of relatively small diameter, there being a downwardly facing, annular shoulder formed at the junction of the portions, said upper portion being disposed within the upwardly opening socket defined at its 80 bottom by said bearing and annularly defined by said flange, said shoulder engaging the bearing and the flange having radial bearing with said upper portions, said sleeve 85 portion extending through the table bore to a point appreciably below the table, an upthrust bearing detachably held to the sleeve below the table and, in effect, coacting with the underside of the table to hold the head 90 against upward movement with relation thereto, said up-thrust bearing being spaced above the lower end of the sleeve, and a depending annular flange on the underside of the table and annularly spaced from the sleeve portion, said depending flange extending 95 downwardly about the up-thrust bearing and providing radial bearing for the sleeve portion at a point below said upthrust bearing, said depending flange forming a housing about said upthrust bearing. 100

In testimony whereof I affix my signature.

FREDERICK STONE.