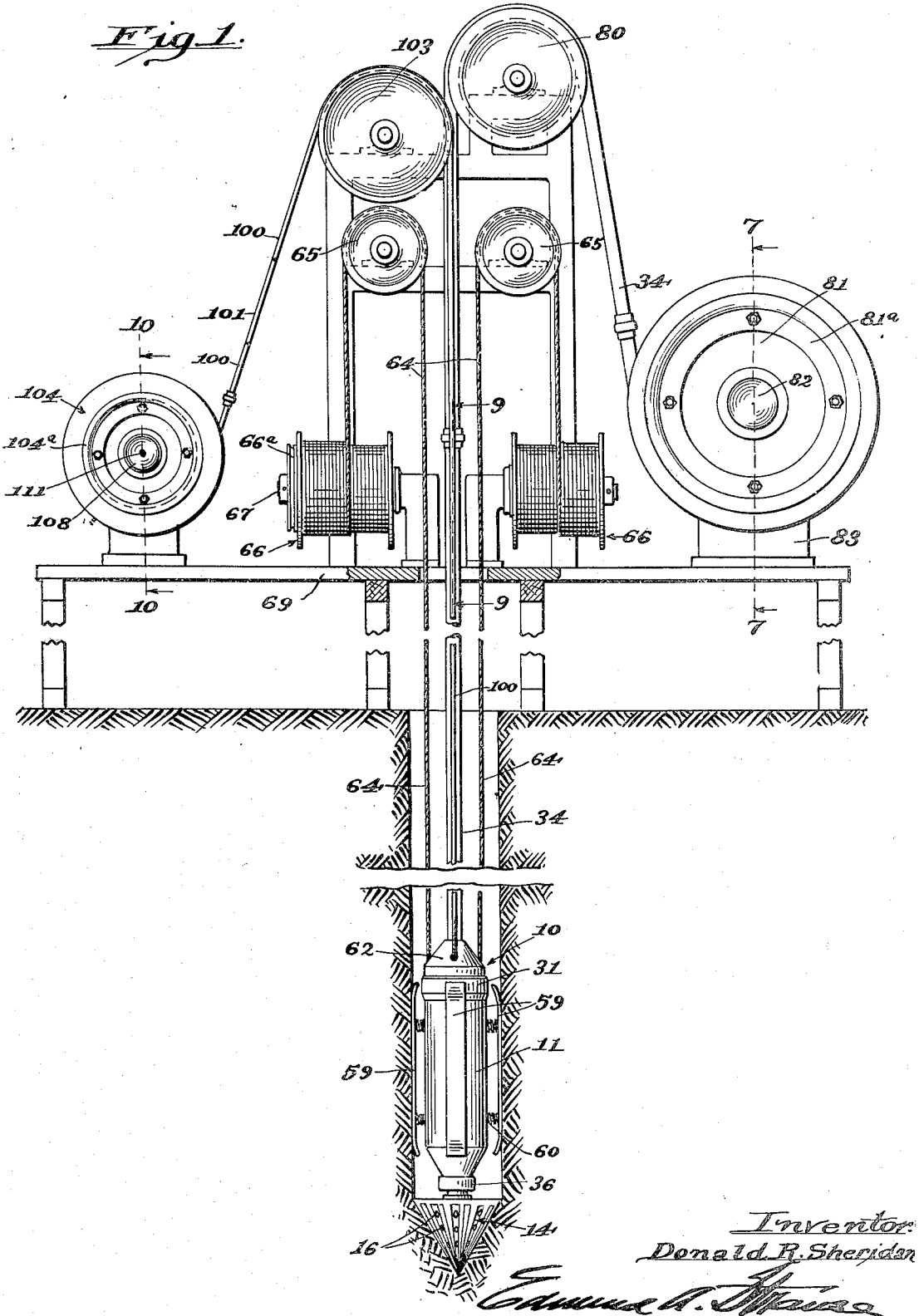
Sept. 3, 1935. D. R. SHERIDAN 2,013,070

OIL WELL DRILLING APPARATUS

Filed Oct. 2, 1934 4 Sheets-Sheet 1

Fig 1.



Inventor:
Donald R. Sheridan
Edmund A. Ofstein
Attorney.

Sept. 3, 1935. D. R. SHERIDAN 2,013,070

OIL WELL DRILLING APPARATUS

Filed Oct. 2, 1934 4 Sheets-Sheet 2

Fig. 2.

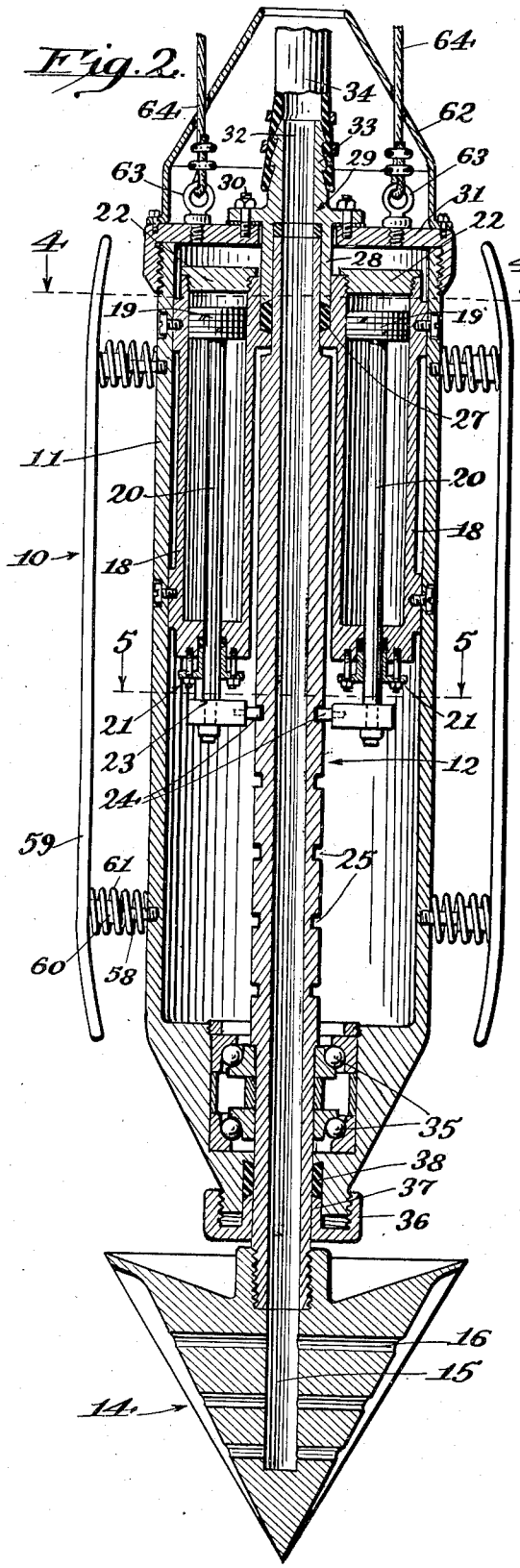
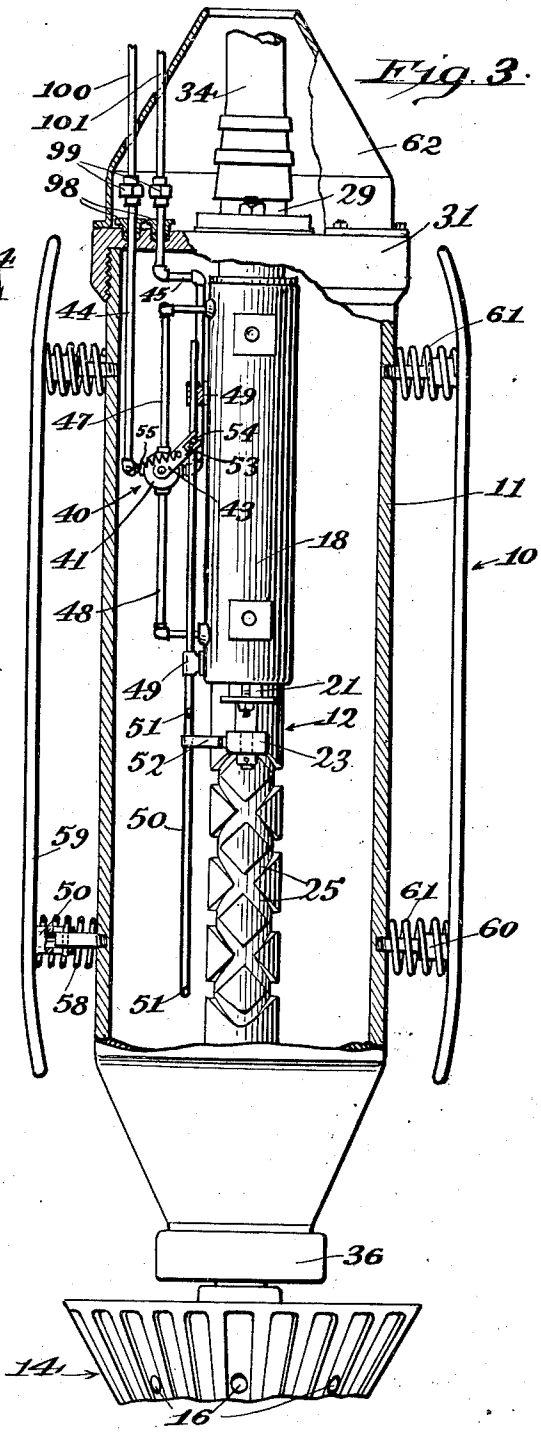


Fig. 3.



Inventor:
Donald R. Sheridan
Edmund A. Thurston
Attorney.

Sept. 3, 1935. D. R. SHERIDAN 2,013,070

OIL WELL DRILLING APPARATUS

Filed Oct. 2, 1934 4 Sheets-Sheet 3

Fig. 4.

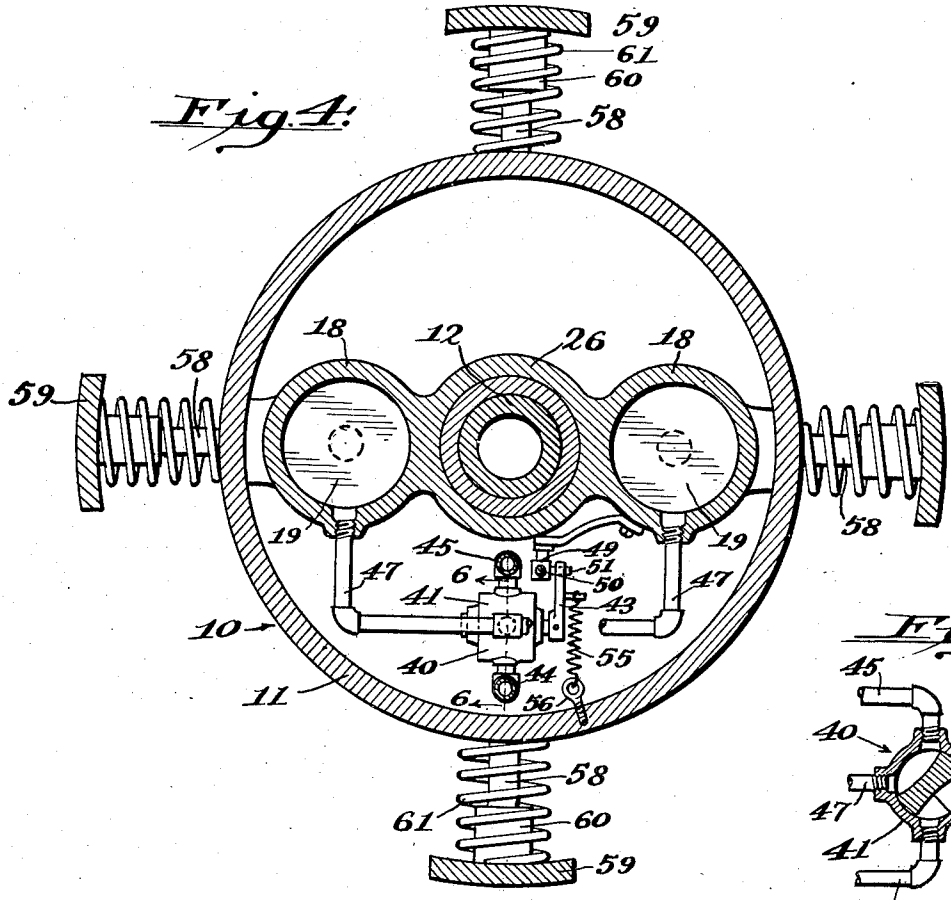
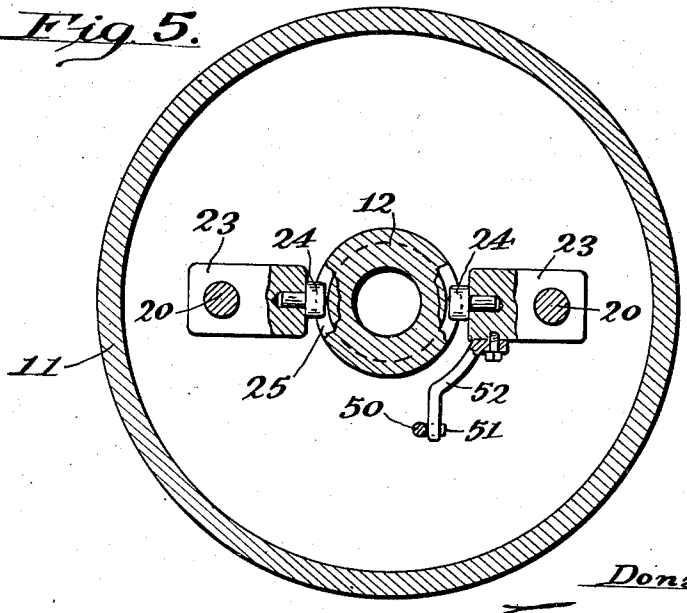


Fig. 6.

Fig. 5.



Inventor
Donald R. Sheridan
Edmund A. Strauss
Attorney.

Sept. 3, 1935. D. R. SHERIDAN 2,013,070

OIL WELL DRILLING APPARATUS

Filed Oct. 2, 1934 4 Sheets-Sheet 4

Fig. 7

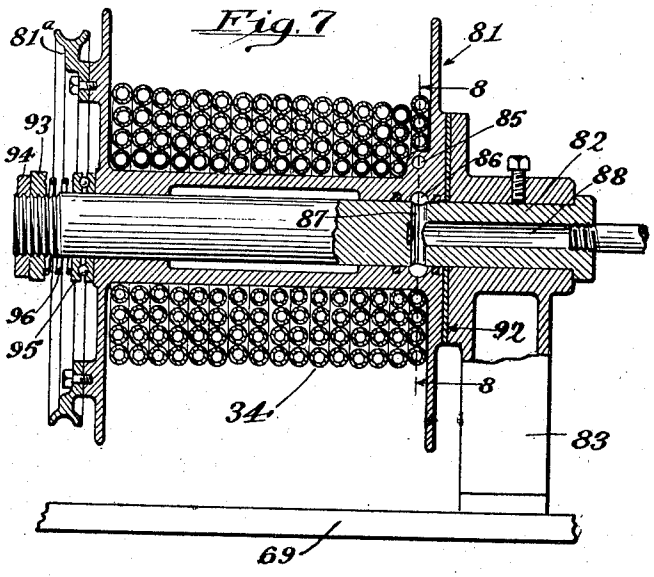


Fig. 8.

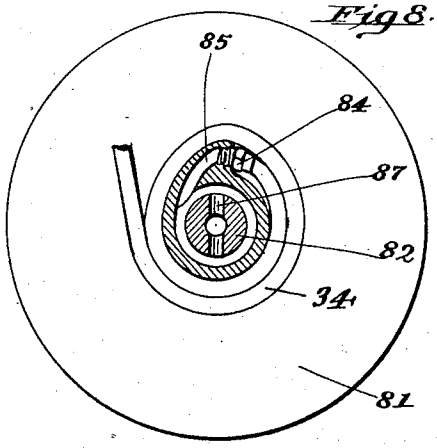


Fig. 9.

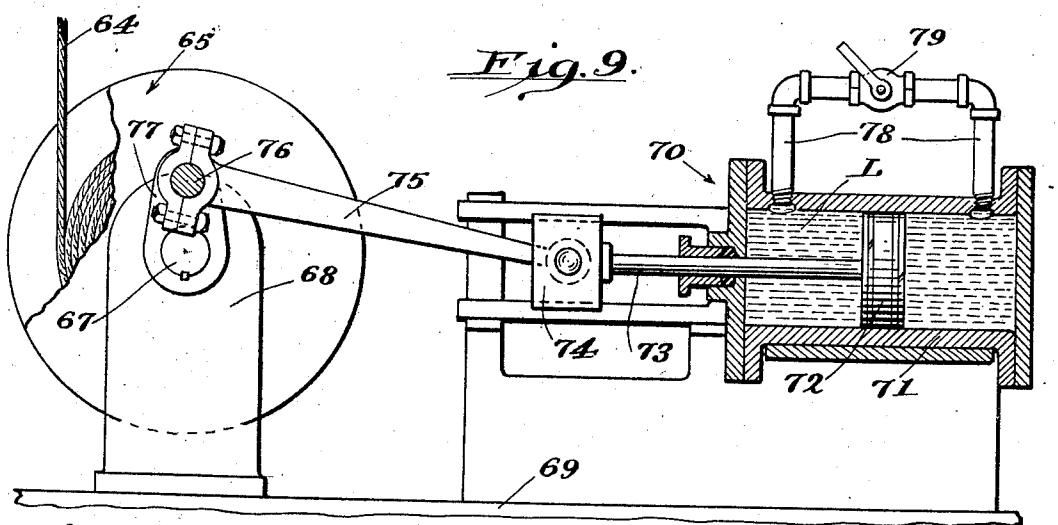
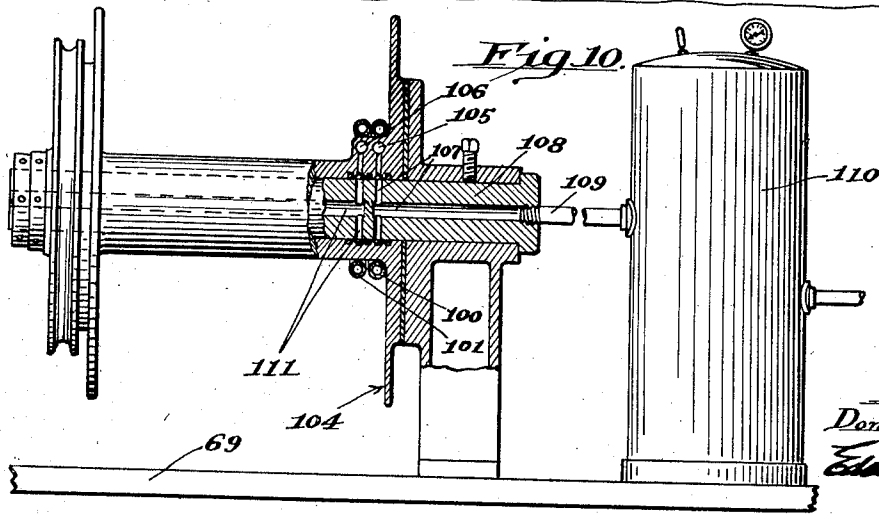


Fig. 10.



Inventor.
Donald R. Sheridan
Edmund A. Thum
Attorney.

Patented Sept. 3, 1935 2,013,070

UNITED STATES PATENT OFFICE

2,013,070

OIL WELL DRILLING APPARATUS

Donald R. Sheridan, Los Angeles, Calif.

Application October 2, 1934, Serial No. 746,525

8 Claims. (Cl. 255—4)

This invention relates to well drilling apparatus and is an improvement over the so-called rotary well drilling system.

In drilling a well with the rotary system it is not only necessary to stop drilling operations each time it becomes necessary to add another length or stand of drill pipe to that in the hole but the parts forming the apparatus are very heavy and expensive to operate especially so in drilling wells to great depth.

It is therefore an object of this invention to provide a well drilling apparatus wherein the drill bit is rotated by means arranged within a casing which is adapted to be lowered in well hole.

Another object is to provide a well drilling apparatus including a rotary member and a bit secured thereto and fluid operated reciprocating means associated therewith for imparting rotation to the bit.

Other objects and advantages will be apparent from the following description reference being had to the accompanying drawings in which:

Fig. 1 is a front elevation of the complete well drilling apparatus and a section taken through a well hole with the drilling mechanism disposed therein.

Fig. 2 is a vertical section taken through the drill bit rotating mechanism.

Fig. 3 is a side elevation of the mechanism shown in Fig. 2 parts being broken away and shown in section.

Fig. 4 is horizontal section taken on line 4—4 of Fig. 2.

Fig. 5 is horizontal section taken on line 5—5 of Fig. 2.

Fig. 6 is a section taken through the piston reverse valve as indicated by line 6—6 of Fig. 4.

Fig. 7 is a section taken through the drum and hose for conveying the circulating mud or water to the bit as indicated by line 7—7 of Fig. 1.

Fig. 8 is a detail section taken on line 8—8 of Fig. 7.

Fig. 9 is a section taken on line 9—9 of Fig. 1 showing the weight regulating mechanism.

Fig. 10 is a section taken on line 10—10 of Fig. 1.

Referring more specifically to the drawings 10 generally designates the actual drilling or bit rotating mechanism. Mechanism 10 comprises a hollow cylindrical casing 11 through which extends and is rotatably mounted a tubular member 12 to which is removably secured at its lower end a drill bit 14.

The drill bit is preferably of conical shape having a duct 15 therein communicating with the bore 16 in the member 12 and branch ducts 17 through which the circulating water or mud is discharged while drilling. It will be understood however that any of the usual types of bits employed in the rotary well drilling system may be employed in lieu of the bit shown if desired.

Arranged within the casing 11 is a pair of cylinders 18 in which are operatable pistons 19 having rods 20 that extend through usual stuffing boxes 21 on the lower ends of said cylinders, the upper ends of the cylinders being closed by heads 22.

Secured to the lower ends of piston rods 20 are blocks 23 that carry pivotally mounted tongues 24 which slidably engage spiral cross grooves 25 formed in the face of member 12, rotary movement being imparted to the member 12 and bit 14 (through the tongues 24) during reciprocation of the pistons 19.

Cylinders 18 are preferably cast integral at their upper ends as shown in Figs. 2 and 4, the portion 26 joining the same having an annular recess therein for the reception of packing 27 that is compressed by a gland 28 formed on a fitting 29.

Fitting 29 is secured by screws or the like 30 to a cap 31 that is removably connected to the upper end of the casing 11, said fitting having a bore 32 therein communicating with the bore of member 12.

Connected to the projecting portion 33 of fitting 29 is a flexible conduct or hose 34 through which the circulating fluid is conveyed to the drill bit.

Member 12 is journaled in anti-friction bearings 35 mounted in a recess formed in lower portion of the casing 11.

Casing 11 is tapered at its lower end and terminates in a screw threaded portion upon which is threaded a fitting 36 having a gland 37 thereon that enters and compresses packing 38 disposed in a recess formed in said casing.

Packing 38 prevents mud or water in the well hole from entering the casing while the packing 27 prevents water passing through member 12 from entering it.

Disposed in the casing is a four way valve 40 that serves to alternately admit fluid under pressure to each end of the cylinders for imparting reciprocatory movement to the pistons 19 therein.

Valve 40 consists of a housing 41 and a valve member 42 rotatably mounted therein provided

with a stem to which is secured an operating arm or lever 43.

Formed in the valve housing 41 are ports (see Fig. 6) from which extend inlet and outlet pipes 44 and 45 respectively, while in a like manner pipe lines 47 and 48 extend from the housing to the opposite ends of the cylinders.

Slidably mounted in bearings 49 secured to one of the cylinder walls is a rod 50 having stops or abutments 51 thereon that are engaged by an arm 52 rigidly connected to one of the blocks 23.

Projecting from rod 50 into a slot 53 in the valve operating arm 42 is a pin 54 which serves to actuate the valve member 41 during movement of said rod.

One end of a retractile coil spring 55 is connected to arm 43 while its opposite end is connected to an eye bolt 56 threaded in the wall of casing 11 as shown in Fig. 4. Spring 55 is provided to impart a quick movement to the valve member 52 as the pistons 19 approach the limit of each stroke or effect a reversal of the valve member when the inlet and outlet ports in valve body are closed.

Projecting from the wall of casing 11 are radially disposed studs 58 which carry a plurality of shoes 59 that engage the walls of the well hole and serve to prevent rotation of the casing.

Secured to shoes 59 adjacent each end thereof are sleeves 60 that slidably engage studs 58 and encircling the sleeves and studs are expansion coil springs 61 that urge said shoes into engagement with the wall of the well hole as shown in Fig. 1

Mounted on closure cap 31 is a guard member 62 preferably of frusto-conical shape which is provided to prevent damage to the parts in the event that portions of the formation should become dislodged and drop down the well hole during drilling operations.

Secured to the closure cap 31 is a pair of diametrical disposed eye bolts 63 to which are connected cables 64.

Referring to Fig. 1, the cables 64 extend upwardly through the well hole over sheaves 65 and are wound upon drums 66 that are removably secured to shafts 67 journaled in bearings 68 mounted on the platform 69.

Cables 64 serve to suspend the drilling mechanism 10 so that its dead weight will not bear directly upon or be transmitted to the bit 14 also to remove said mechanism from the well hole after completing a drilling operation.

Downward movement of the drilling mechanism is adapted to be controlled by any suitable means such as the fluid operated apparatus designated at 70 in Fig. 9.

Apparatus 70 consists of a cylinder 71 in which is operable a piston 72 having a rod 73 that is inter-connected through a cross head 74 and connecting rod 75 to the pin 76 of cranks 77 secured to the inner ends of the cable drum shafts 67.

Communicating with interior of cylinder 71 adjacent each end thereof are pipes 78 that are connected to a valve 79 through which liquid in the cylinder flows back and forth during each stroke of the piston.

From the above it will be apparent that by manipulating valve 79 the rate of rotation of the cable drum and downward movement of mechanism 10 may be regulated at will due to checking or retarding the flow of liquid through the valve.

Conduct 34 extends upwardly through the well hole over a sheave 80 and is wound upon a drum 81, said drum 81 being removably and rotatably mounted on a spindle 82 which in turn is held against rotation in a standard 83 mounted on the platform 69.

The inner or dead end of conduct 34 is removably connected to a fitting 84 (see Fig. 8) that enters a duct 85 formed in a drum 81. The duct 85 communicates with an annular recess 86 which in turn communicates with ducts 87 and 88 formed in spindle 82. Duct 88 communicates with a pipe 89 that is adapted to be connected to the discharge end of a circulating pump not shown.

Packing rings 90 disposed in grooves formed in bore of drum 81 serve to prevent escape of the circulating mud or water around the spindle during drilling operations.

As cables 64 serve to suspend the drilling mechanism 10 in the well hole all tensile strain on the conduct 34, is relieved as far as suspending the weight of said mechanism is concerned.

It is however desirable to hold the conduct 34 sufficiently taut to prevent it from swaying or rubbing against the walls of the well hole.

To this end a friction disk 92 is positioned between the opposite end faces of the drum 81 and standard 83. Threaded on the outer end of spindle 82 is a ring 93 and lock nut 94. Encircling the spindle and disposed between ring 93 and an anti-friction bearing 95 is an expansion coil spring 96 that serves to transmit pressure to the friction disk 92. By adjusting ring 93 more or less tension may be applied to the conduct for the purpose above referred to.

Referring to Fig. 3 the inlet and outlet pipes leading to reverse valve 40 extend through packing glands 98 threaded in the closure cap 31 and are connected through suitable couplings 99 to flexible conducts 100 and 101 respectively.

Conducts 100 and 101 extend through the well hole around sheaves 103 and are wound on a drum 104, the dead ends of the cables being connected to fittings (not shown) that communicate with ducts 105 and 106 formed in the drum 104.

Duct 105 enters an annular recess 106 (formed in drum 104) which in turn communicates with ports 107 formed in a spindle 108 upon which the drum is rotatably mounted. Communicating with ports 107 is a pipe 109 which leads to a receiver 110 which in turn is adapted to be interconnected with an air compressor not shown.

Conduit 101 in a like manner communicates with ports 111 formed in the spindle through which the exhaust air from the cylinder 18 may escape to atmosphere.

Drum 104 is mounted on the spindle 108 in the same manner as drum 81 in order that tension may be applied to the conduits 100 and 101.

Secured to drums 66, 81 and 104 are sheaves or pulleys 66*a* and 81*a* and 104*a* respectively which are adapted to receive endless belts or the like passing over sheaves on shafts (not shown) whereby the drilling mechanism 10 may be removed from the well hole.

Operation:—Drilling mechanism 10 is lowered into a shallow hole, compressed air is then admitted to cylinders 18 through conduct 100 and water to the bit 14 through conduct 34. Admission of compressed air to the cylinders through valve 40 imparts reciprocatory movement to pistons 19 the action of which through engagement of tongues 24 with the grooves 25 in member 12 will result in rotation of bit 14. During rotation of bit 14 water passing through member 12 will flow through ducts 16 into the well hole and induce an upward current therethrough which will carry

the cuttings of the bit to the surface in the form of mud in a similar manner to the usual rotary well drilling system.

Drilling of the hole may be carried on until cables 64 and conducts 34, 100, and 101 have been unwound from their respective drums. Thereafter if it is necessary to drill to greater depth the drums above referred to are adapted to be removed from the spindles, the conducts disconnected therefrom and other drums wound with conducts thereon placed on the spindles and the conducts connected to those previously removed from the drums. The above procedure may be repeated until the oil or water bearing strata has been penetrated.

I claim:

1. A well drilling apparatus comprising a casing, a tubular member having spiral cross grooves formed therein extending through said casing, a drill bit secured to said tubular member, cylinders mounted in said casing, pistons operable in said cylinders and having rods projecting therefrom, tongues pivotally mounted on the piston rods and slidably engaging the grooves in said tubular member for imparting rotation thereto and valve operated means for alternately admitting fluid under pressure to each end of said cylinders for effecting reciprocation of the pistons therein.

2. A well drilling apparatus comprising a casing, a tubular member having spiral cross grooves formed therein extending through said casing, a drill bit secured to said tubular member, cylinders mounted in said casing, pistons operable in said cylinders and having rods projecting therefrom, tongues pivotally mounted on the piston rods and slidably engaging the grooves in said tubular member for imparting rotation thereto, valve operated means for alternately admitting fluid under pressure to each end of said cylinders for effecting reciprocation of the pistons means including a plurality of shoes connected to said casing for centering and holding the same against rotation in a well hole.

3. A well drilling apparatus comprising a casing, a tubular member having spiral cross grooves formed therein extending through said casing, a drill bit secured to said tubular member, cylinders mounted in said casing, pistons operable in said cylinders and having rods projecting therefrom, tongues pivotally mounted on the piston rods and slidably engaging the grooves in said tubular member for imparting rotation thereto, a four way reverse valve including a housing and a valve member rotatably mounted therein disposed in said casing, pipes leading from the valve housing to the opposite ends of said cylinders and means operable by the piston rods for actuating said valve member whereby to effect reciprocation of said pistons and impart rotation to said tubular member and drill bit.

4. A well drilling apparatus comprising a casing, a tubular member having spiral cross grooves formed therein extending through said casing, a drill bit secured to said tubular member, cylinders mounted in said casing, pistons operable in said cylinders and having rods projecting therefrom, tongues pivotally mounted on the piston rods and slidably engaging the grooves in said tubular member for imparting rotation thereto, valve operated means for alternately admitting fluid under pressure to each end of said cylinders for effecting reciprocation of the pistons means including a plurality of shoes connected to said casing for centering and holding the same against rotation in a well hole, and means for suspending and controlling the downward movement of said casing in the well hole.

5. A well drilling apparatus comprising a casing, a tubular member having spiral cross grooves formed therein extending through said casing, a drill bit secured to said tubular member cylinders mounted in said casing, pistons operable in said cylinders and having rods projecting therefrom, tongues pivotally mounted on the piston rods and slidably engaging the grooves in said tubular member for imparting rotation thereto, valve operated means for alternately admitting fluid under pressure to each end of said cylinders, means including a plurality of shoes connected to said casing for centering and holding the same against rotation in a well hole, means for suspending and controlling the downward movement of said casing in the well hole, flexible conduits for admitting and discharging fluid under pressure to said valve operated means and a flexible conduit for supplying water through said tubular member and drill bit.

6. A well drilling apparatus comprising a casing, a tubular member having spiral grooves therein rotatably mounted in said casing, cylinders mounted in said casing and having pistons therein, means interconnecting the pistons with the grooves in said tubular member, and valve operated means for alternally admitting fluid under pressure to each end of said cylinders for effecting rotation of said tubular member.

7. A well drilling apparatus comprising a casing, a tubular member having spiral grooves therein rotatably mounted in said casing, cylinders mounted in said casing and having pistons therein, means interconnecting the pistons with the grooves in said tubular member, valve operated means for alternally admitting fluid under pressure to each end of said cylinders for effecting rotation of said tubular member, and means carried by said casing for centering and holding said casing against rotation in a well hole.

8. A well drilling apparatus comprising a casing, a tubular member having spiral cross grooves formed in its outer face extending through and rotatably mounted in said casing, a drill bit secured to and having ducts therein communicating with the bore of said tubular member, a pair of cylinders mounted in and held against movement in said casing, pistons operable in said cylinders and having rods projecting therefrom, a tongue pivotally connected to the projecting end of each piston rod and slidably engaging the grooves in said tubular member, a four way reverse valve including a housing, a valve member rotatably mounted therein having a stem and an arm secured thereto, a slide rod interconnected with the arm of said valve member and having abutments adjacent each end thereof, an arm secured to one of said piston rods and arranged to alternally engage the abutments on said slide rod to actuate the valve member, whereby to effect reciprocation of the pistons and impart rotation to said tubular member and drill bit.

DONALD R. SHERIDAN.