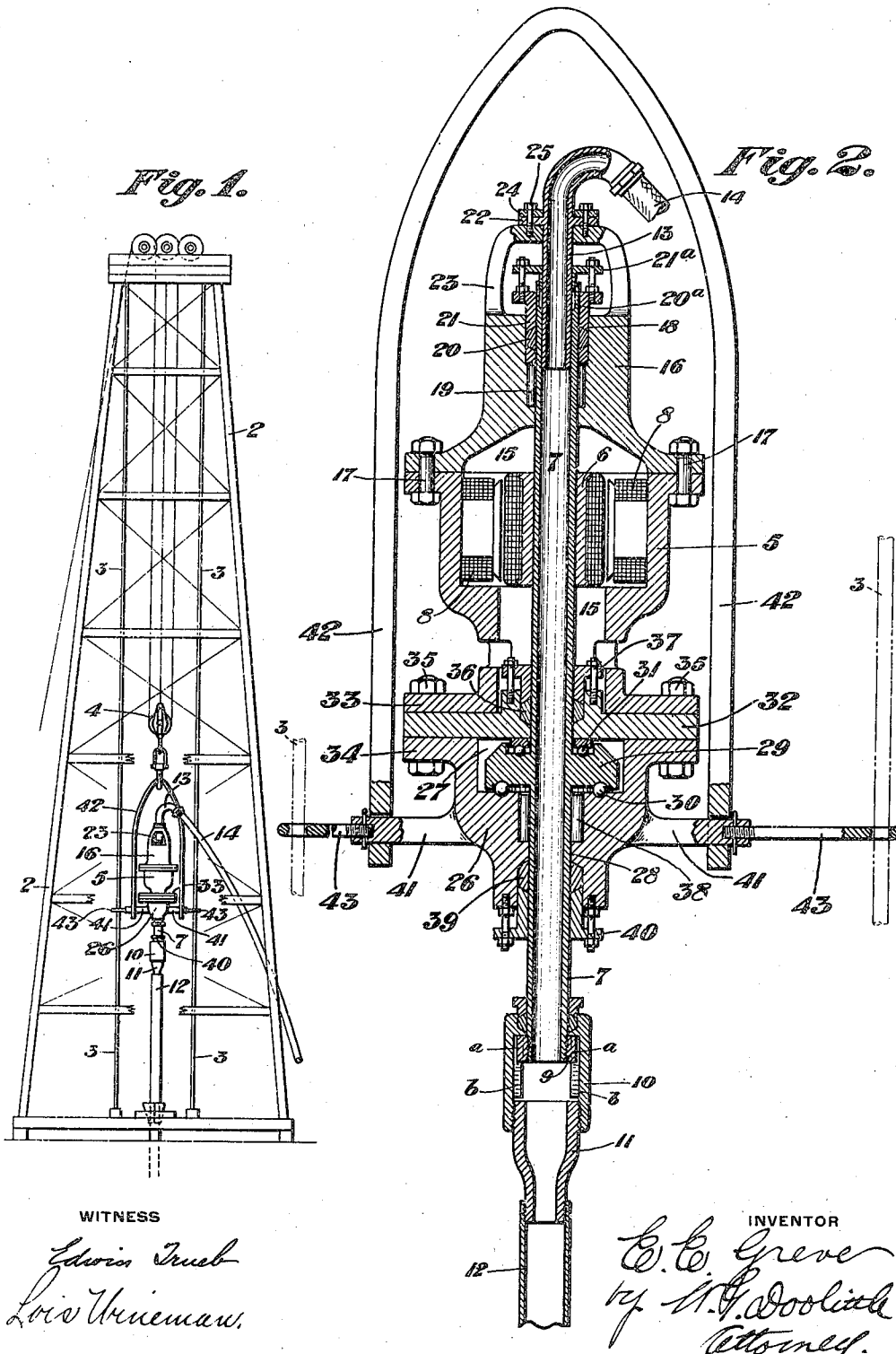


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 ROTARY WELL DRILLING APPARATUS.
 APPLICATION FILED DEC. 22, 1919.

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UNITED STATES PATENT OFFICE.

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Specification of Letters Patent.

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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 Well-Drilling Apparatus, of which the following is a specification.

My invention relates to improvements in well drilling apparatus, and more particularly to what is commonly and commercially known as hydraulic rotary well drilling apparatus. Apparatus of the character to which my invention relates is especially designed for drilling oil and gas wells, and as heretofore constructed, usually comprises a hollow sectional drill-stem or drill-pipe to which the drill tool is attached, a rotary table for rotating the drill-stem, connections between the table and drill-stem, means for rotating the table, a suspended hydraulic swivel, a pipe within the swivel, and a connection with a source of water and mud supply for furnishing a mixture of mud and water to the apparatus during the operation of drilling. The hydraulic swivel in practice carries the weight of the drill-stem and is suspended from a derrick in such a manner that it may be raised and lowered. Among the objects of the present invention are, to provide a new and improved drilling apparatus of the character described, of simple and efficient construction, and capable of being manufactured, installed and operated at considerably less cost than heretofore; apparatus in which the drill-stem driving and actuating means, such as the rotary table, means connecting the rotary table and drill-stem, and means for driving the rotary table, are entirely dispensed with.

In the embodiment of my invention shown by the drawings, I have provided a simple and efficient construction including a motor, a water-swivel, and connections between the drill-stem or drill-pipe and motor combined in a unitary structure; a structure capable of being suspended from the derrick and operable for effecting the required rotary and vertical movements of the drill-stem in a highly satisfactory manner.

In the form shown, I provide a combined electric motor and hydraulic swivel structure, and construct and arrange the driving shaft of the motor so that it may cooperate

in driving the drill-stem and be utilized for effecting a passage for water and mud through the combined motor and swivel structure.

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

Figure 1 is a side elevational view showing a derrick and my invention in connection therewith; and

Fig. 2 is a part elevational and a part vertical sectional view of a well drilling apparatus constructed in accordance with my invention.

Referring to the drawings, 2 designates a derrick of the usual and well known construction, and 3 rods or cables extending from the bottom of the derrick floor to the top of the derrick. The function of said rods or cables will be hereinafter described. Means are provided for raising and lowering the drilling apparatus and as illustrated include a block 4 suspended from the top of the derrick by means of ropes, in the usual manner.

In the preferred embodiment of my invention, and as illustrated, 5 designates the body or a portion of the casing of an electric motor of any suitable type; 6 revolving armatures; 7 the motor shaft; and 8 the fields or stators of the motor. Shaft 7 is formed hollow, and projects above and below the body portion 5 of the motor. As illustrated, the lower end of shaft 7 is threaded and provided with a collar 9 having driving lugs *a*. 10 designates a coupling member slidably mounted at the end of shaft 8. Member 10 is formed with vertically extending recesses *b* into which the driving lugs *a* of collar 9 are entered, said member being adapted to connect the shaft 8 through the collar 9 with a further coupling member 11, the latter being designed to be connected with a hollow drill-stem or drill-pipe section 12. It will be understood that the construction just described will permit a jumping action of the drill-stem to take place without in any manner affecting rotation of the motor shaft or the other working parts.

The upper end of hollow shaft 7 has a goose-neck 13 entered therein, which is of the usual construction, and is designed to communicate with a flexible pipe 14, the latter being in communication with a source of water and mud, constituting a drilling

mixture, whereby a supply of the mixture is introduced to the hollow shaft and the drill-stem or string of casing, as is usual in this class of rotary drilling apparatus.

5 The body 5 of the motor is formed with a chamber 15, and 16 designates a hood or cap secured to the upper end of the body by bolts 17. Hood 16 is formed with a central bore 18 adapted to receive the upper end of
10 the hollow motor shaft 7; said bore 18 is enlarged for a portion of its length to receive, in addition to the shaft 7, roller bearings 19, a packing 20, and a gland 21. As shown, goose-neck 13 is provided with a
15 flange 22 supported on the upper face of an openwork structure 23, the latter constituting the upper portion of the hood 16. Above the flange 22 is a cap plate 24, said plate and flange being securely attached to structure
20 23 by means of bolts 25. A packing 20^a and a gland 21^a are preferably employed at the upper end of hollow shaft 7.

The motor casing proper or the body 5 is designed to be mounted on and connected
25 with a hydraulic swivel casing 26, said casings and inclosed parts forming a combined motor and water swivel structure. Casing 26 is hollowed out to provide a chamber 27 and a depending communicating bore 28.
30 Shaft 7 extends downwardly through chamber 27 and bore 28, and is provided with a swivel head 29.

Swivel head 29, which is designed to carry the weight of the drill-stem, etc., is mounted
35 on anti-friction bearings 30, and 31 designates bearings interposed between the upper face of the swivel-head and an annular centrally apertured plate 32. Plate 32 separates chamber 27 of the swivel casing from chamber 15 of the motor casing, and is held in
40 position between a flanged portion 33 of casing 5 and a similar portion 34 of casing 26, said portions being connected together by bolts 35 passed through plate 32 and the
45 said flanged portions.

Chamber 27 preferably carries sufficient oil to maintain an oil bath for the swivel-head and its anti-friction bearings, and in order to prevent oil working up into the
50 motor casing or into the chamber 15 thereof, a packing 36 and a gland 37 are provided. 38 designates roller bearings for shaft 7, said bearings, as well as roller bearings 19, being designed to function as side thrust
55 bearings for the shaft 7 and the ball bearings 31 as end thrust bearings. A packing element 39 and a gland 40 are provided to prevent oil passing downwardly from the chamber 27.

60 The combined motor and swivel structure is designed to be suspended in the manner it is usual to suspend hydraulic swivels, and for this purpose, the body 26 is provided with trunnions 41, which connect with a bail
65 42, the latter in turn being suspended from

the hook and rope or cable of the rig. Projecting outwardly from each trunnion is a threaded and apertured member 43; these members 43 are designed to coöperate with the rods 3 for preventing the casings of the
70 combined motor and swivel structure from turning or rotating during the operation of drilling.

From the above description, it will be understood that a rotation of the motor shaft
75 will rotate the drill-stem and that in operation, water and mud constituting the drilling mixture are passed from the goose-neck 13 into the tubular shaft, and from thence into the hollow sectional drill-stem and discharged from the bottom section thereof.
80 Also, that the construction is such that it may be readily raised to permit the insertion of one or more sections of the drill-pipe or hollow sectional drill-stem, and then lowered into the desired operative position.
85

While I have shown an electric motor including revolving armatures for rotating the motor shaft, my invention is not limited to this particular type of motor, nor to an electric motor in combination with the swivel structure.
90

What I claim is:

1. In a rotary well drilling apparatus, the combination with a drill-pipe, of a combined motor and water-swivel structure
95 having a common rotative shaft, and means for connecting a drill-pipe section to the shaft including a slidable coupling-member.
2. In a rotary well drilling apparatus, the
100 combination with a drill-pipe, of a suspended combined motor and water swivel structure, said motor having a hollow rotative shaft, means for introducing a drilling mixture to the shaft and adjustable means
105 for connecting a drill-pipe section to the motor shaft.
3. In a rotary well drilling apparatus, the combination with a drill pipe, of a combined motor and water swivel structure
110 having a common rotative shaft, a swivel head on the shaft co-acting with the combined structure for supporting the weight of the drill pipe, means for suspending said structure, and mechanism including means
115 for permitting an independent vertical movement of the pipe section relatively to the shaft.
4. In a rotary drilling apparatus, the combination with a drill pipe, of a combined
120 motor and water swivel structure including a hollow rotative shaft, a swivel head co-acting with the combined structure for supporting the weight of the drill pipe, means attached to the swivel casing for suspending
125 said structure, and mechanism connecting a drill pipe section and the shaft, said mechanism including means for permitting an independent vertical movement of the pipe section relatively to the swivel head.
130

5. In a rotary drilling apparatus, the combination with a motor and a water swivel combined in unitary structure, means for suspending said structure including a bail attached to the swivel casing, and means for preventing rotation of said structure while suspended including an arm projecting from the swivel casing and adapted for engagement with a vertically extending member.

6. In a rotary drilling apparatus, the combination with a derrick having a vertically extending member, of a combined motor and swivel structure suspended from the derrick, and means projecting from the combined structure and engaging the said vertically extending member for preventing rotation of the structure while suspended.

7. In a rotary well drilling apparatus, the combination with a drill-pipe, of an electric motor having a hollow rotative shaft, means for introducing a drilling mixture to the upper end of the shaft, and an adjustable coupling for connecting a drill-pipe section to the lower end of said shaft.

8. In a rotary well drilling apparatus, the combination with a drill-pipe, of an electric motor having a hollow rotative shaft, means for introducing a drilling mixture to the shaft, a swivel-head carried by the shaft, and means for adjustably connecting a drill-pipe section to the lower end of said shaft.

9. In a rotary well drilling apparatus, the combination with a drill-pipe, of a suspended combined motor and water swivel structure having a common hollow rotative shaft, means for suspending the structure, a goose-neck entered in the upper end of the shaft, and an adjustable coupling connecting a drill-pipe section and the lower end of the shaft.

10. In a rotary drilling apparatus, the combination with a water swivel structure, of an electric motor having a hollow shaft projecting into the swivel structure and constituting the swivel-stem thereof.

11. In a rotary drilling apparatus, the combination with a water swivel structure, of an electric motor having a hollow shaft projecting into the swivel structure and constituting the swivel-stem thereof, said shaft carrying a swivel-head.

12. In a rotary drilling apparatus, the combination with a water swivel structure, of an electric motor having a hollow shaft projecting into the swivel structure and constituting the swivel-stem thereof, said shaft having a swivel-head formed integral therewith.

13. A rotary drilling apparatus including an electric motor having a rotative hollow shaft, a water swivel-head carried on said shaft, and a goose-neck entered in the upper end of the shaft.

14. In a rotary drilling apparatus, the

combination with an electric motor housing, of a water swivel housing, said housings combined in a unitary structure, a hollow motor shaft projecting through the housings, and a swivel head carried by said shaft.

15. In a rotary drilling apparatus, the combination with a drill-stem, of a motor having a hollow shaft and a swivel-head carried thereby, means for introducing a drilling mixture to the hollow shaft, and means connecting the drill-stem and shaft.

16. In a rotary drilling apparatus, the combination with a drill pipe, of a suspended combined motor and water swivel structure, and means for connecting a drill pipe section and permitting a vertical movement thereof relatively to the water swivel and motor.

17. In a rotary drilling apparatus, the combination with a drill pipe, of a suspended combined motor and water swivel structure including a swivel head, means for connecting a drill pipe section and permitting a vertical movement thereof independently of the combined structure and relatively to the swivel head, and means for preventing rotation of said structure while suspended.

18. A rotary drilling apparatus comprising a swivel including a stationary part and a rotating part, means on the rotating part for connection with a drill stem, a motor mounted on the stationary part, means on the stationary part for suspending the swivel, and means for introducing fluid into the rotating part of the swivel.

19. A rotary drilling device comprising a swivel including a stationary part and a rotatable part and a bearing between the parts, means on the rotatable part for connection with a drill stem, a motor mounted on the stationary part for driving the rotatable part, and means above the motor for introducing fluid into the rotating part.

20. In a rotary drilling apparatus, the combination with a drill pipe, a swivel including a motor driven shaft and a bearing for said shaft, and means for holding the shaft against endwise movement, a motor on the swivel for driving the shaft, and a connection on the shaft from which the drill pipe is suspended, said connection being movable vertically relatively to the swivel.

21. In a rotary drilling apparatus, the combination with a drill pipe, a swivel including a motor driven shaft, a bearing for said shaft, and means for holding the shaft against endwise movement, a motor on the swivel for driving the shaft, a connection on the shaft from which the drill pipe is suspended, said connection being movable vertically relatively to the swivel, and means for introducing water into the motor driven shaft.

22. A rotary drilling apparatus including

a swivel and motor in a unitary structure, said structure having means below the motor on the swivel by which it is suspended.

23. A rotary drilling apparatus comprising a swivel having relatively stationary and rotatable parts, means depending from the rotatable part for connection with a drill pipe, a motor on the upper side of the stationary part of the swivel, and means on the stationary part connected thereto below the motor by which the apparatus is suspended.

24. In a rotary drilling apparatus, the combination with a suspended combined mo-

tor, motor driven shaft and water swivel structure, of a drill pipe section and means on the lower end of the motor driven shaft from which the drill pipe section is suspended, said means permitting a vertical movement thereof independently of the combined structure.

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

EDGAR E. GREVE.

Witnesses:

J. M. GEOGHEGAN,
LOIS WINEMAN.