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DIRECTIONAL DRILLING DEVICE

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Fig. 1

Fig. 3

Fig. 4

Fig. 5

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DIRECTIONAL DRILLING DEVICE

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7 Claims. (Cl. 255—1.6)

1. This invention relates to new and useful improvements in drilling apparatus and the primary object of the present invention is to provide a drilling device so constructed as to permit vertically and circumferentially spaced horizontal holes to be drilled from a main vertical hole in which the drilling device is disposed.

Another important object of the present invention is to provide a drilling apparatus consisting of a horizontally extensible drilling member correlated with a gyroscope, whereby the direction of horizontal branch holes from a main vertical hole may be readily and conveniently predetermined.

Yet another object of the present invention is to provide a drilling device including a pair of power driven flexible and tubular shafts disposed one within the other and a fluid impeller connected to the inner shaft to remove well drillings from concentric drill bits attached to the shafts.

A further object of the present invention is to provide a directional drilling device including a perforated basket member adapted to rest against the bottom of a vertical hole and which is connected by hydraulically actuated means to a casing that rotatably supports a flexible drilling member that is extendable through an arcuate opening in a guide attached to the basket member as the casing is lowered relative to the basket member.

A still further aim of the present invention is to provide a drilling device of the aforementioned character that is simple and practical in construction, strong and reliable in use, efficient and durable in operation, inexpensive to manufacture, service and operate, and otherwise well adapted for the purposes for which the same is intended.

Other objects and advantages reside in the details of construction and operations as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming part thereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is an elevational view of the present invention lowered in a vertical hole;

Figure 2 is a longitudinal vertical sectional view of Figure 1;

Figure 3 is an enlarged horizontal sectional view taken substantially on the plane of section line 3—3 of Figure 2;

Figure 4 is an enlarged horizontal sectional view taken substantially on the plane of section line 4—4 of Figure 2;

Figure 5 is an enlarged horizontal sectional view taken substantially on the plane of section line 5—5 of Figure 2;

Figure 6 is an enlarged horizontal sectional view taken substantially on the plane of section line 6—6 of Figure 2;

Figure 7 is a horizontal sectional view taken substantially on the plane of section line 7—7 of Figure 2;

Figure 8 is an enlarged detail sectional view showing the drilling member and its inner and outer flexible tubular shafts and the drill bits carried thereby; and,

Figure 9 is a diagramatic view showing the drill guide extending means and its actuator.

Referring now to the drawings in detail, wherein for the purpose of illustration, there is disclosed a preferred embodiment of the present invention, the numeral 10 represents an elongated casing composed of upper and lower sections 12 and 14 that are connected together by a coupling 16, more specifically described in my copending application Serial No. 290,125, filed November 16, 1951.

A perforated basket member 18 is disposed below the casing 10 and has a guide 20 removably secured within its upper portion. The guide 20 is provided with an arcuate opening 22 including a vertical entrance 22a and a horizontal exit 22b. The exit 22b faces an opening 24 in the peripheral wall of the basket member 18. Bearing or anti-friction elements 25 are retained in the opening 26 by an internal shoulder 28 adjacent the exit and a retaining plate 30 at the entrance.

Means is provided for connecting the basket member 18 to the casing 10 and for adjusting the casing 10 longitudinally relative to the basket member. This means consists of a plurality of pneumatically actuated jacks 32 each of which includes an upper tubular member 34 and a lower piston rod 36 having a piston 38 at its upper end that is workable within the member 34. The lower ends of the rods 36 are suitably fixed to the guide and the members 34 are held on the outer periphery of the casing by brackets 40.

An electric motor 42 is held within the upper casing section 12 by a suitable mounting bracket attached to the inner periphery of section 12 and operates a fluid impeller or pump 44 supported on a bracket 46 within the section 12. The impeller blade 48 is operatively connected to the armature shaft of motor 42 to be driven thereby. The pump 44 includes outlets that are connected by conduits to the upper ends of the members 34 and the pump 44 also includes an inlet 50 that extends outwardly through the cas-
ing section 12 to receive fluid in the hole into which the device is placed.

Check valves 52 are in the conduits 54, between the outlets of the pump and the upper ends of the members 34. Relief valves 56 are incorporated in the upper ends of the members 34 to permit the relief of fluid pressure in the jacks 32, whereby the casing 10 may move vertically downward toward the basket member 18 and guide 20.

A drilling member 58 is rotatably supported by the casing 10 and includes inner and outer flexible tubular shafts 60 and 62. The lower end of shaft 62 carries a hollow diamond toothed drill bit 64 in which a second diamond toothed drill bit 66, attached to the lower end of shaft 60, is rotatable. A bearing 68 is held in the bit 64 about the bit 66 to permit relative rotation between the drill bits without undue friction.

The lower end of the section 12 rotatably supports a sleeve member or cylinder 70 through the medium of a bearing unit 72. The unit 72 is formed with a central opening that accommodates the depending hollow armature shaft 74 of an electric motor 76 that is suitably mounted with section 12. The lower end of shaft 74 supports a gear 78 that meshes with a pinion 80 on a bracket 82 journaled on the upper end of the attaching flange 83 of the shaft 62. An internally toothed ring gear 84 is secured to the inner periphery of the sleeve member 70 and meshes with the pinion 80.

The upper end of shaft 60 is coupled to the lower end of shaft 74 so that the primary shaft 60 will rotate with the shaft 74 and in a similar direction as shaft 74. Since the member 70 is connected to the flange 83 of shaft 60 and to the gear 78 by the pinion 80 and ring gear 84, shaft 62 will rotate opposite relative to shaft 60.

A second pump or fluid impeller 86 is suitably mounted in the casing section 14 and its impeller blade 88 is connected to the tubular upper portion 90 of shaft 74. Pump 86 is provided with an outlet 92 that is coupled to the upper end of portion 90 and pump 86 is also provided with an inlet 94 that extends outwardly through the section 14 to receive the fluid from the hole into which the casing is lowered.

A gyroscope 96 is supported by a bracket 98 secured within the upper casing section 12 and the gyroscope is correlated with the opening 22 to indicate the direction of the opening and more particularly the exit 28.

The upper and lower angulated ends 100 and 102 of a plurality of circumferentially spaced vertical centering tubes 104 are slidably over upper and lower horizontal lugs 106 and 108 on the casing sections 12 and 14. Spring means, as disclosed in my aforementioned pending application, urge the tubes 104 laterally outwardly from the casing.

The electric wires from the motor 76 extend upwardly through the hollow central portion of coupling 16 and outwardly from the casing to a suitable remote switch and the wires for motor 42 also extend to a switch remote from the casing.

In practical use of the present invention, the gyroscope is first set for the desired direction and the device lowered into a hole. When the device is raised the electric motor 76 of the casing 10 seats against the bottom of the hole. The electric motor 76 is then started to commence drilling operations.

Pump 86 will take in fluid through its intake 94 and will force the fluid downwardly through shaft 60 and from bit 66, which will wash the cuttings from the hole 24 and the bits. The length of the cutting catching basket member 18 may vary in order to retain the opening 24 spaced a predetermined distance about the bottom of the hole 24.

At the start of the drilling operation, the casing 10 is spaced at its maximum distance from the basket member with the bits 64 and 66 in a recess R in the guide. As the bits are rotated, the casing 10 descends due to its weight and the exhaust of fluid pressure from the relief valves 56. During downward movement of the casing 10, which is gradual, the shafts 60 and 62 will extend outwardly from opening 24 to permit drilling of a horizontal hole H.

After the hole or holes H have been drilled, the motor 42 is started which will force fluid into the members 34 past the check valves 52 and the casing 10 will again be extended vertically upwardly from the basket member 18. As the casing 10 is raised, the shafts 60 and 62 will be retracted and the bits again positioned in the recess R. The entire apparatus is then pulled outwardly from the hole H by any suitable lift means.

Having described the invention, what is claimed as new and particularly the combination of claim 1 and a power means in the casing, and means operatively connecting said power means to the shafts for rotating the shafts in relatively opposite directions.

3. A drilling apparatus comprising a basket member adapted to rest against the bottom of a hole, a guide attached to the basket member and having an arcuate opening therein with a horizontal exit, a vertical casing, means connecting the casing to the guide for moving the casing vertically toward and away from the guide, a power driven drilling member carried by the casing, said drilling member including inner and outer concentric flexible tubular shafts extending through the opening and concentric drilling bits movable outwardly from the guide, and power means in the casing and operatively connected to the shafts for rotating the latter in relatively opposite directions.

4. The combination of claim 3 and anti-friction means in the opening and slidably receiving the tubular shafts.

5. A drilling apparatus comprising a basket member adapted to rest against the bottom of a hole, a guide attached to the basket member and having an arcuate opening therein with a horizontal exit, a vertical casing, means connecting the casing to the guide for moving the casing vertically toward and away from the guide, and a power driven drilling member carried by the casing and slidably received in the opening, said drilling member being extended outwardly from the opening to drill a horizontal hole as the casing is moved toward the guide and the basket member, said means connecting the guide to the casing including pneumatically actuated jack.
means and a pump in the casing and operatively connected to the jack means.

6. A drilling apparatus comprising a basket member adapted to rest against the bottom of a hole, a guide attached to the basket member and having an arcuate opening therein with a horizontal exit, a vertical casing, means connecting the casing to the guide for moving the casing vertically toward and away from the guide, and a power driven drilling member carried by the casing and slidably received in the opening, said drilling member being extended outwardly from the opening to drill a horizontal hole as the casing is moved toward the guide and the basket member, said means connecting the guide to the casing including pneumatically actuated jack means and a pump in the casing and operatively connected to the jack means, check valves in the jack means and relief valves also in the jack means, said relief valves permitting relief of fluid pressure in the jack means, whereby the casing may lower itself toward the guide due to the weight of the casing.

7. A drilling apparatus comprising a guide holding member adapted to rest against the bottom of a hole, a guide carried by said member and having an arcuate opening therein with a horizontal exit, a vertical casing, means connecting the casing to the guide for moving the casing vertically toward and away from the guide, a power driven drilling member carried by the casing and including inner and outer concentric flexible shafts extending through the opening and concentric drilling bits movable outwardly from the guide, and power means operatively connected to the shafts for rotating the latter in relatively opposite directions.

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REFERENCES CITED

The following references are of record in the file of this patent:

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<table>
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