

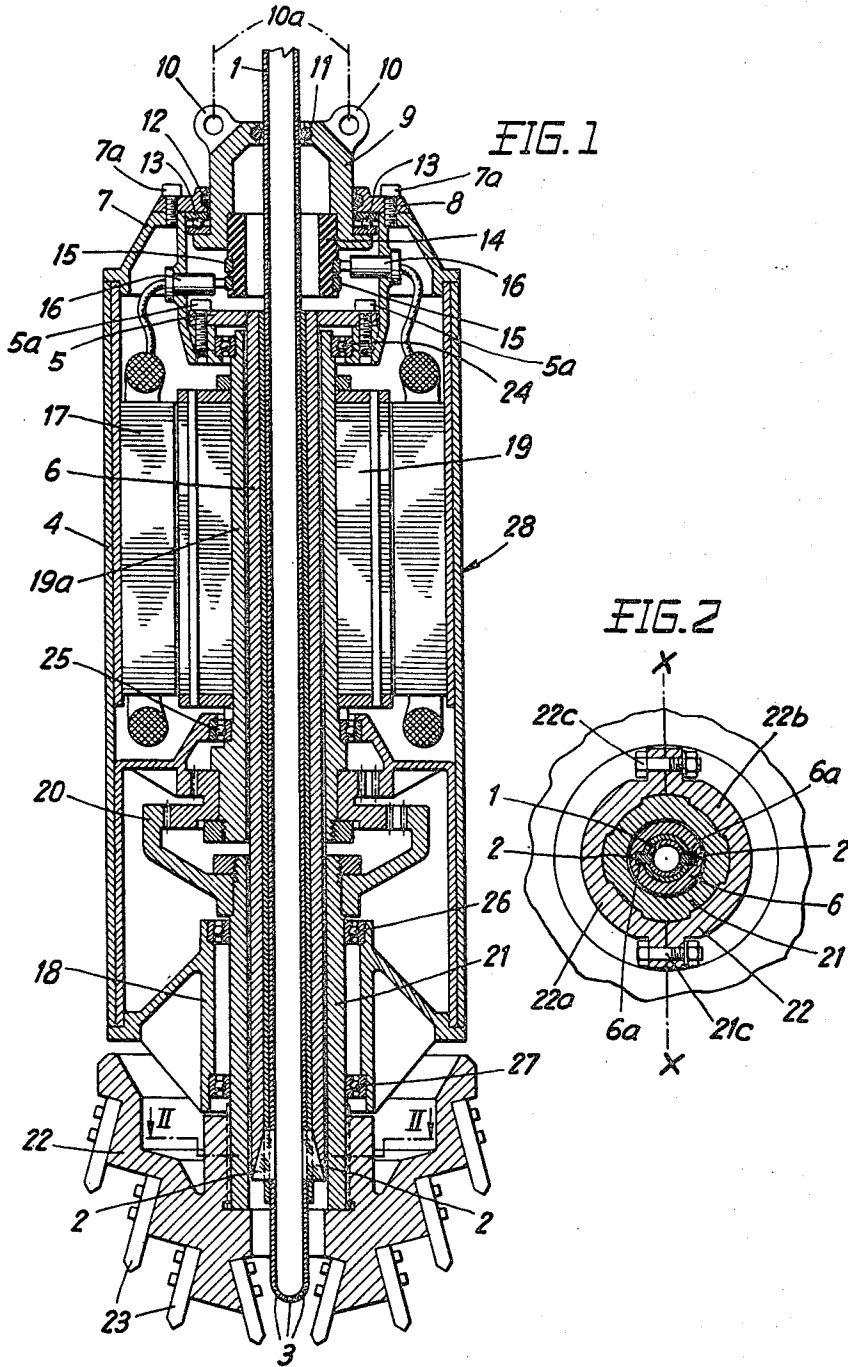
June 25, 1968

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DEEP-BORING APPARATUS INCORPORATING
AN ELECTRICAL BORING UNIT

3,389,758

Filed Oct. 20, 1965

2 Sheets-Sheet 1



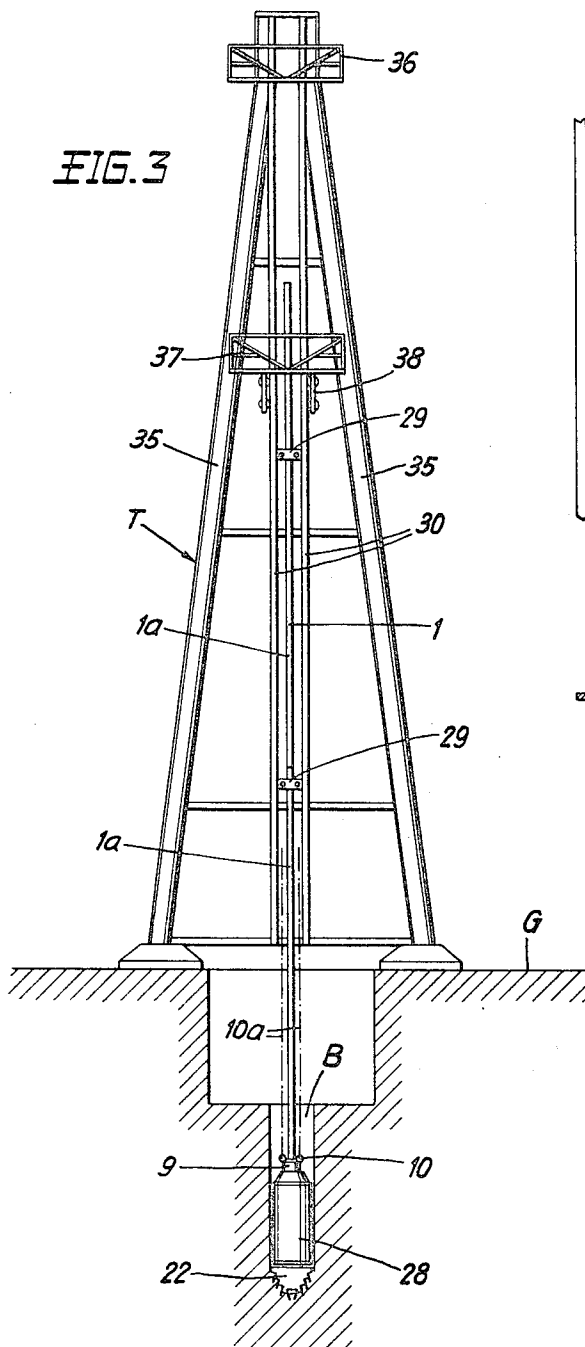
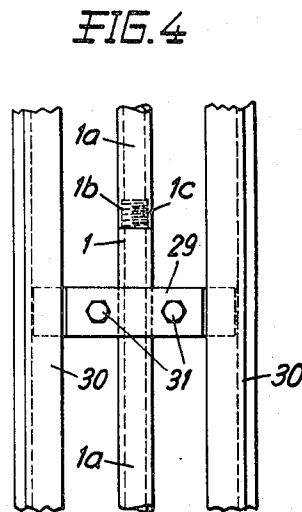
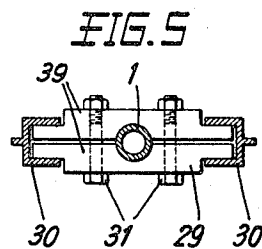
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DEEP-BORING APPARATUS INCORPORATING AN ELECTRICAL BORING UNIT

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1 Claim. (Cl. 175-104)

ABSTRACT OF THE DISCLOSURE

Deep-boring apparatus comprising bore hole tubing means secured against rotation and an electrical boring unit, wherein the electrical boring unit can be raised to the surface for the purpose of changing the boring head without removing the tubing means. The electrical boring unit is removably mounted upon the tubing means and is provided with eyelets to which are attached tension cable means for raising the electrical boring unit when desired.

The present invention has reference to an improved boring apparatus of the type incorporating borehole tubing means and an electrical boring unit having a non-rotatable housing with stator and rotor means and an exchangeable boring head.

With known deep-boring apparatus it is necessary to dismantle the borehole tubing in order to exchange the boring head, in other words, to dismount the boring unit which is fixedly connected with the bore rods or tubing.

Now, the present invention, however, contemplates the provision of a deep-boring apparatus wherein the electrical boring unit can be raised to the surface out of the bore hole for the purpose of changing the boring head without having to remove from the bore hole the bore hole tubing means which can be appropriately lengthened, in other words, without previously having to dismantle such bore hole tubing means.

Only upon rupture of the tension cable at which the electrical boring unit is suspended, is it necessary to bring back to the surface the electrical boring unit located below the surface by dismantling the internally threaded hollow borehole tubing.

Accordingly, it is an important object of this invention to provide an improved construction of deep-boring apparatus wherein the electrical boring unit carrying the boring head can be withdrawn out of the borehole back to the surface of the earth without first having to dismantle the borehole tubing.

A further considerable object of this invention relates to an improved deep-boring apparatus constructed such that it is possible to quickly exchange the boring head with a minimum of effort and without having to remove the borehole tubing from the borehole.

Still another noteworthy object of this invention is to provide an improved construction of deep-boring apparatus wherein the borehole tubing is secured against rotation, the electrical boring unit carrying the boring head can be selectively coupled with the borehole tubing during the drilling or boring operation, and whenever it is desired to change the boring head such electrical boring unit can be easily uncoupled from the borehole tubing and returned to the surface of the earth independently of the borehole tubing.

In order to implement these and still further objects of the invention which will become apparent as the description proceeds, the inventive deep-boring apparatus comprises borehole tubing means constructed to provide a hollow guide shaft arrangement, means for securing said borehole tubing means against rotation, an electrical boring unit which is displaceable along said boring tubing means, and means for selectively releasably coupling said electrical boring unit with said borehole tubing means.

According to another facet of the invention, the boring head of the electrical boring unit is constructed as a bipartite assembly incorporating two portions which can be separated from one another along a plane passing through the lengthwise axis of the boring head.

Other features, objects and advantages of the invention will become apparent by reference to the following detailed description and drawings in which:

FIGURE 1 is a longitudinal sectional view through a preferred embodiment of electrical boring unit of the invention;

FIGURE 2 is a cross-sectional view of the electrical boring unit of FIGURE 1, taken through its bipartite boring head and along the line II—II of FIGURE 1;

FIGURE 3 schematically illustrates details of the associated derrick or boring tower, also depicting the electrical boring unit operating beneath ground level;

FIGURE 4 is a fragmentary view depicting details of the hollow borehole tubing means with the associated rail members carrying the securing plates cooperating with the borehole tubing means to prevent its rotation; and

FIGURE 5 is a cross-sectional view of the arrangement of FIGURE 4, taken just above the cooperating securing plates thereof.

Describing now the drawings, it will be understood that only enough of the physical structure of the inventive deep-boring apparatus will be described in detail as believed necessary to understand the underlying principles of the present invention. The schematic illustration in FIGURE 1, showing details of the construction of the electrical boring unit 28, incorporates the following non-rotating components: the non-rotating borehole tubing means 1 embodying a plurality of individual hollow tubular pipes 1a assembled together to provide a hollow guide shaft arrangement. These hollow pipe members 1a are provided with internal threading 1b (FIGURE 4) with which threadably engages a threaded nipple 1c of an adjacent, confronting pipe member 1a, so that in this manner all of the pipe members 1a can be detachably interconnected. Moreover, it will be understood that the outer dimensions of the borehole tubing means 1 remain constant throughout the entire length thereof. It should also be appreciated that such borehole tubing means 1 can be made longer or shorter, as desired, by merely adding or taking away individual pipe members 1a.

As also best seen in FIGURE 1, adjacent the lower end of the borehole tubing means 1 there is provided conical coupling elements 2, here shown to taper downwards to that they can be inserted from below into appropriate receiving slots or grooves 6a of a slidable sleeve 6 located within the housing 4 of the electrical boring unit 28. The lowermost end of the borehole tubing means 1 is provided with outlet nozzle means or holes 3 for pressurized water in order to clear the borehole B of mud and for cooling this electrical boring unit. During such time as the boring or drilling work is carried out, the slidable sleeve 6 is coupled with the borehole tubing means 1 by means of the coupling elements 2. Moreover, this slidable sleeve 6 is welded at its upper end to the flange means 5, thereby enabling rigid connection of such slidable sleeve 6 with the housing 4. An upper housing cover 7 is threadably connected, as shown, by threaded bolts 5a with the flange means 5. A support or retaining ring 8 is threaded onto this housing cover 7 by threaded bolts 7a and serves to hold a traction or tension plate 9 provided with the eyelets 10 for suitable pulling or tension cable means, schematically indicated at 10a. Other components which are non-rotatable are: the sealing means 11 and 12, the balancing ball bearing 13, the insulation sleeve 14 with the current collector

rings 15, the cooperating brushes 16 for the stator components provided with stator winding 17 and secured to the inner wall of the housing 4, as well as the lower housing cover 18 which is connected with the housing 4.

The rotating components of the aforescribed arrangement are the rotor unit 19 incorporating the rotor shaft 19a to which there is operatively coupled a suitable, known speed-reduction transmission or gearing 20, e.g., planetary gearing, having a hollow output shaft 21, at the lower end of which there is detachably connected a bipartite boring head 22 having exchangeable boring bits 23. By referring to FIGURE 2, it will be recognized that the bipartite boring head 22 incorporates the two portions 22a and 22b which can be interconnected with one another by threaded bolt means 22c or equivalent fastening expedients, and the line of separation is advantageously along a longitudinal plane X—X passing through the lengthwise axis of the boring head 22. It will also be recognized that the rotor shaft 19a of the rotor 19 is mounted at its upper end in a ball bearing 24 accommodated at the upper cover member 7 and at its lower end in a ball bearing 25 of the therewith connected speed-reduction transmission 20. The previously mentioned hollow output shaft 21 of the speed-reduction transmission 20 is mounted in two ball bearings 26 and 27 accommodated at the lower housing cover member 18.

FIGURE 2 also shows in cross-section details of the borehole tubing means 1 constructed as a hollow shaft arrangement and provided with the thereat rigidly connected coupling elements 2, the displaceable or slidable sleeve 6, and the hollow output shaft 21 of the speed-reduction transmission 20 to which there is operably connected the boring head 22.

The schematic representation in FIGURE 3 depicts the general arrangement of the deep-boring apparatus, with the substantially cartridge-shaped electrical boring unit 28 thereof lowered into the vertical borehole B during the boring or drilling operation, at which time the hollow borehole tubing means 1 is releasably coupled by the coupling elements 2 with the slidable sleeve 6. It will also be noticed that above ground level G there is located the derrick or boring tower T incorporating two illustrated vertically extending legs 35 which approach one another at their upper end and a third inclined leg (not shown) having an inner staircase or step arrangement (not shown). The details of the construction of the derrick or boring tower T are not necessary for understanding the invention and can be of any well known construction. It further incorporates the work platforms 36 and 37, work platform 37 having associated therewith elevator or lift means, schematically indicated at 38, for elevationally displacing such work platform 37 vertically along the derrick T. This derrick or boring tower T is also usually weighted in known manner, so as to provide the necessary stability, as for instance by the use of a water ballast charge. It will also be recognized that the derrick T supports a pair of spaced, confronting, substantially U-shaped guide rails 30 engaging with the securing means 29 for preventing the borehole tubing means 1 from carrying out rotational movement. Two such securing means 29 are shown, and each comprises a pair of cooperating clamping or securing plates 39 between which there is fixedly clamped the borehole tubing means 1. These clamping plates 39 are held together by suitable threaded bolts 31 or equivalent fastening expedients. It will also be noticed that the pulling or tension cables 10a engage with the eyelets 10 of the

tension plate 9, so that the electrical boring unit 28 can be raised out of the borehole B independent of the borehole tubing means 1.

FIGURE 4 shows in fragmentary view both guide rails 30 with the securing plates 39 operably connected with the borehole tubing means 1 via the connecting bolts 31 in order to prevent rotation of such tubing means 1. FIGURE 5 is a cross-sectional view taken above these securing plates 39 and through the guide rails 30 and the hollow borehole tubing means 1, specifically depicting the manner in which these securing plates 39 are interconnected by means of the threaded fastening bolts or screws 31.

The foregoing description should make it apparent that during the boring operation the electrical boring unit 28 is detachably coupled by means of the coupling elements 2 with the borehole tubing means 1. In the event that it is desired to change the boring head 22, it is merely necessary to raise this electrical boring unit 28 independent of the borehole tubing means 1 by means of the pulling cables 10a, whereby the described coupling engagement between the coupling elements 2 and the slidable sleeve 6 is interrupted. As a result, this electrical boring unit 28 can be raised back to the surface along and relative to the borehole tubing means 1. Then, by merely releasing the fastening bolts or screws 22c the boring head 22 can be dismantled from the output shaft 21 and a new boring head attached thereto. Thereafter, the electrical boring unit 28 is again lowered into the borehole B and again coupled via the coupling elements 2 with the borehole tubing means 1.

While there is shown and described a present preferred embodiment of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

What is claimed is:

1. Deep-boring apparatus comprising bore hole tubing means constructed to provide a hollow guide shaft arrangement which comprises individual hollow pipe members, said hollow pipe members incorporating internal threading enabling interconnection of said hollow pipe members with one another to thereby enable selective altering of the length of said bore hole tubing means, said bore hole tubing means possessing the same external dimensions substantially throughout its external length; means for securing said bore hole tubing means against rotation which comprises at least one pair of cooperating plate members for fixedly clamping said bore hole tubing means therebetween; an electrical boring unit displaceably mounted upon said bore hole tubing means and incorporating a bipartite boring head which can be separated along a plane passing substantially through the lengthwise axis of said boring head; and means for releasably coupling said electrical boring unit with said bore hole tubing means.

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