

Feb. 16, 1932.

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1,845,230

CORE DRILLING APPARATUS

Filed Dec. 13, 1930

2 Sheets-Sheet 1

Fig. 1

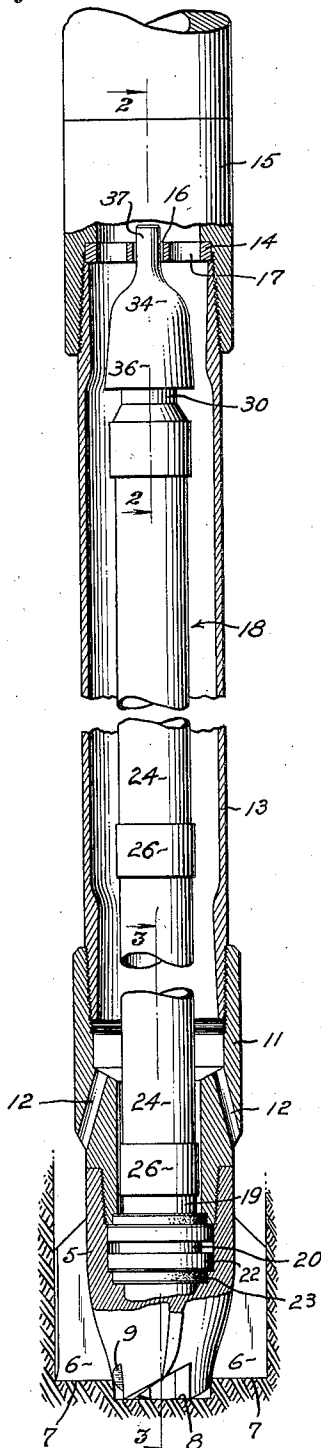


Fig. 2

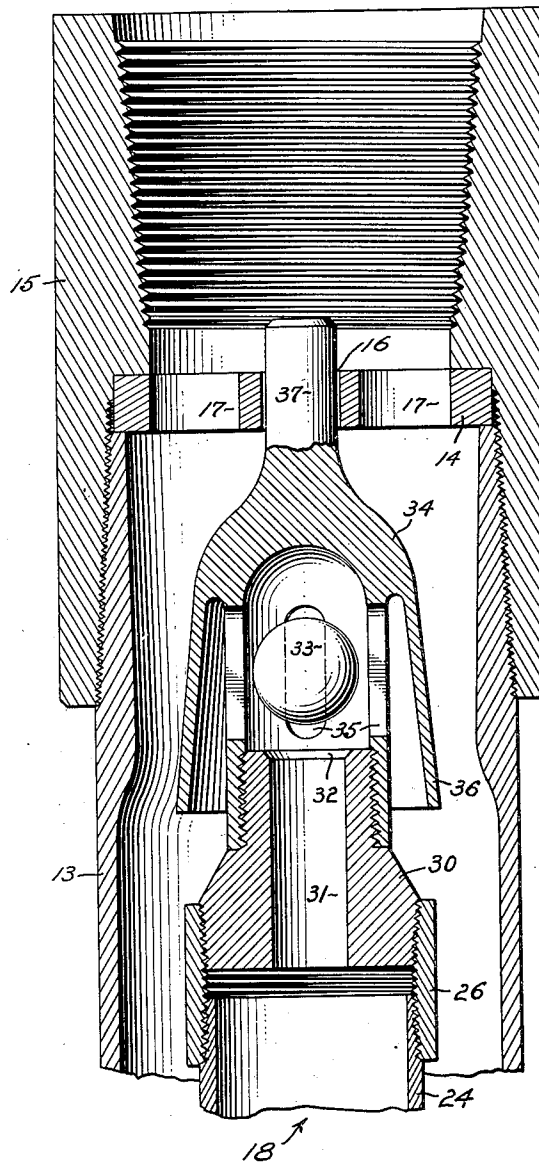
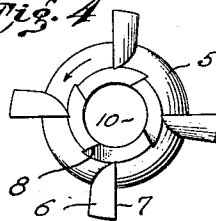


Fig. 4



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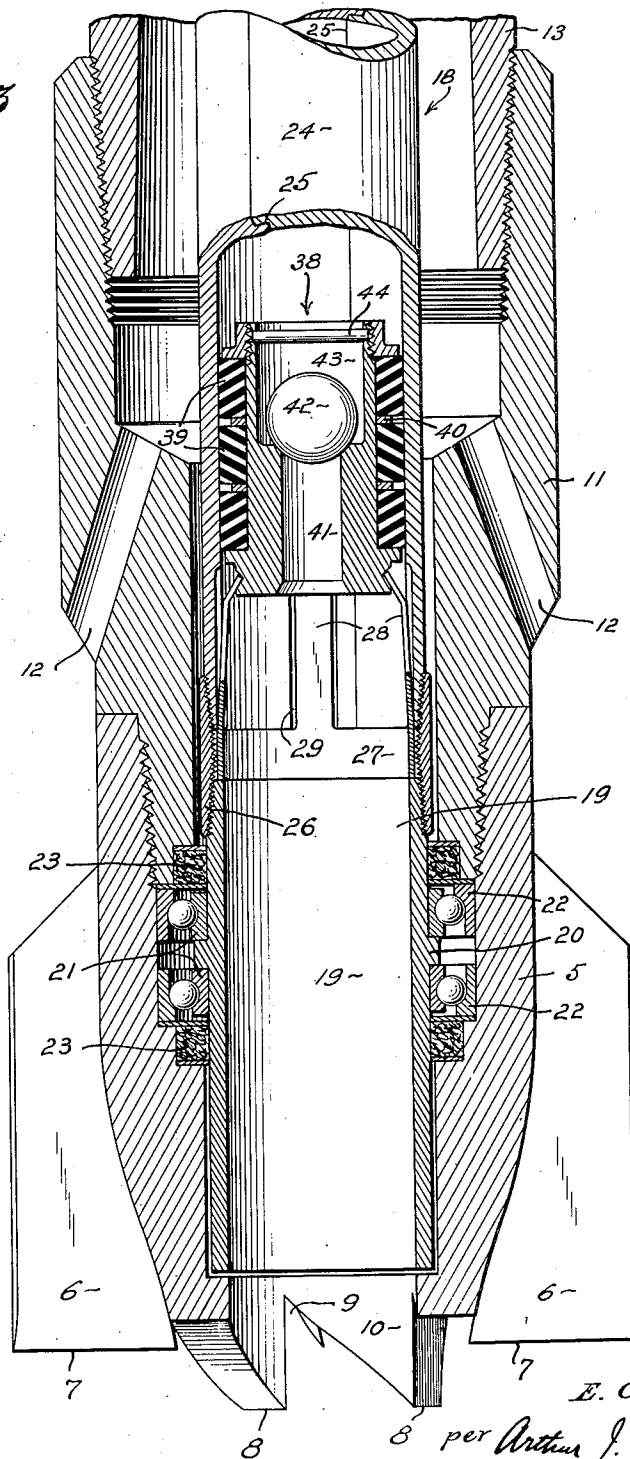
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Fig. 3



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CORE-DRILLING APPARATUS

Application filed December 13, 1930. Serial No. 502,092.

In this specification, and the accompanying drawings, I shall describe and show a preferred form of my invention, and specifically mention certain of its more important objects. I do not limit myself to the forms disclosed, since various changes and adaptations may be made therein without departing from the essence of my invention as hereinafter claimed; and objects and advantages, other than those specifically mentioned, are included within its scope.

My invention relates to core-drilling apparatus, and among its principal objects are: first, to provide means for co-operatively associating a rotatable core-drilling bit with an improved type of non-rotating axial core-barrel; second, to furnish superior means for protecting drill-cores against contamination from mud and other foreign substances, and from disintegration by water; third, to furnish facilities for securing substantially dry cores in wet earth drilling; and, fourth, to secure the above results by means of simple and relatively inexpensive apparatus.

My objects are attained in the manner illustrated in the accompanying drawings, in which:

Figure 1 is an elevation of my improved core-drilling apparatus within a drill hole produced thereby, certain portions of the apparatus being shown broken away and in central longitudinal section, and the associated core barrel being shown in elevation;

Figure 2 is a central longitudinal section of a portion of the above apparatus, taken on the line 2—2 of Fig. 1, illustrating internal details of the core-barrel in their relation to other elements of the construction;

Figure 3 is a central longitudinal section taken on the line 3—3 of Fig. 1, and illustrating the lower end of a core-drill and my improved core-barrel cooperatively associated therewith; and,

Figure 4 is a view of the bottom end of the

aforesaid core-bit, when looking upwardly thereat.

Figures 1 and 4 are drawn to approximately the same scale, and Figs. 2 and 3 are drawn to a greatly enlarged scale. Similar reference numerals refer to similar parts throughout the several views.

In order to obtain the utmost information regarding underground formations, it is essential to secure cores thereof that represent as nearly as possible the actual underground conditions at the points where they are taken. It therefore is of great importance to prevent the cores from becoming contaminated, as by fluid and mud in the well, or by the circulating fluid used therein. With this object in view, it is common practice to produce cores by means of narrow annular cuts that are more or less in advance of the main cutting blades of the bits used. The advanced annular cutting means for producing the core, if properly designed and proportioned, permit of securing substantially dry cores in wet wells. The cuttings produced by such means pass upwardly around the outside of the core-cutting portion of the tool, and make a surprisingly effective seal that prevents water from flowing downwardly into the core-barrel. When the core bit is inserted in a wet well however, it must first pass through whatever water and mud is at the bottom, before the drilling operations are started. Thus the core-barrel, as the art has been previously practiced, becomes filled with water or mud or both, before the coring operation starts. Such mud and water within the core-barrel, if permitted to remain therein, will contaminate the core that is subsequently produced, and partially obliterate or destroy the full significance of the information that it would otherwise be capable of affording. My apparatus embodies means for overcoming this difficulty.

In my improved construction, I employ a core bit that may have cutting elements of

any suitable and approved type. The form selected for illustration comprises a bit body 5 having four main blades 6 extending therefrom, adapted to produce the main portion of the drill hole. As the material dislodged by these blades is to be moved vertically upward, the cutting edges 7 may be radial. The bit is arranged for taking an annular pilot cut in advance of the main cutting edges. This annular cut is accomplished by means of cutting edges 8, and the material removed by these edges must pass both upwardly and outwardly with respect to bit body 5. Therefore, it is preferable to have edges 8 non-radial, and to give them a backward or trailing slant toward the outside, so as to enable them to take a shearing cut and move the dislodged material outwardly. This blade arrangement is indicated quite clearly in Fig. 4, which also indicates the direction of rotation of the tool, it being remembered that this is a bottom view looking upwardly. Material dislodged as the result of the annular cut taken by edges 8 is able to pass both upwardly and outwardly into the main bore of the drill hole, through the upper portions 9 of the notches between the cutting teeth, these upper portions being only slightly above main cutting edges 7. They thus allow the material that is removed by the annular pilot cut to escape into the main bore of the well, but this material quite effectively fills the notches and seals them against downward flow of water from the main well bore. The core produced by the described annular pilot cut, extends upwardly within axial bore 10 of the bit.

The above described core-cutting bit is attached to a suitable drilling head 11, the latter being provided with outwardly directed circulating passages 12, and being secured to the lower end of a tubular rotary drill string of which the lowermost member is illustrated at 13. At the upper end of member 13, I secure a transverse perforate plate 14, as by clamping it between the upper end of member 13 and the lower element 15 of the adjacent tool joint into which member 13 is screwed. Plate 14 has an axial bore at 16 for centering the upper end of a non-rotating core-barrel next to be described, and openings 17 for the passage of circulating fluid.

For receiving and securing a core, I employ a core-barrel 18 that is co-axial with the bit and tool string. The core barrel is supported by means of anti-friction bearings at the bottom, and by a loose guide bearing comprising hole 16 in perforate plate 14 at the top. The lower end of the core-barrel consists of a relatively short cylinder 19 having an intermediate peripheral flange 20 therearound, and on each side of this flange is a ball or roller bearing. The inner races 21 of these bearings fit the periphery of cylinder 19, and are positioned thereon by flange 20. The outer races

22 fit a co-operating bore in bit body 5. Before installation the bearings are completely filled with grease, and they are also installed with grease-impregnated felt packing rings 23 at the top and the bottom, as an extra means for preventing the entrance of mud and water. This construction enables bit body 5 to revolve freely about cylinder 19, and permits the latter to remain stationary for receiving the core as it is formed.

The other portions of the core-barrel consist of tubular sections 24 that are longitudinally split, and united by means of dovetailed or overlapping joints, as indicated at 25 in Fig. 3. These sections are assembled, and coupled to co-operating parts at the upper and lower ends thereof, by means of ordinary sleeve couplings 26. Unscrewing the couplings permits of separating the core-barrel sections, and of removing the core bodily therefrom.

Suitable core-catching means are installed in the core-barrel immediately above cylinder 19. A satisfactory device for this purpose is illustrated in Fig. 3. This consists of a continuous ring 27 having a number of resilient finger-springs 28 extending upwardly therefrom. Ring 27 is positioned by being gripped between the lower ends of sections 24 and the opposed upper end of cylinder 19, the coupling 26 being the means for accomplishing this gripping. Longitudinal grooves 29 are milled in the inner surfaces of sections 24, to permit retraction of finger-springs 28 therein.

At the upper end of the core-barrel is a fitting 30 having an axial bore 31 therethrough and providing a seat 32 for a ball valve 33 at its upper extremity. Fitting 30 also carries a cage fitting 34 that is adapted to retain the ball in position, and that is provided with orifices 35, through which fluid flowing upwardly through bore 31 may escape. A skirt 36 surrounds these orifices and directs the flow therefrom downwardly. Fitting 34 has an axial pin 37 extending upwardly through bore 16 in perforate plate 14, thus affording means for centering and guiding the upper end of the core-barrel.

The tubular sections of the core-barrel are of uniform internal diameter throughout, and provide a smooth and continuous cylindrical wall except for the gaps between opposed ends of the sections at the couplings. By bridging these gaps, it is possible for a piston to move from one end of the core-barrel to the other, and such a piston is provided and shown at 38. This has a plurality of packing rings 39 therearound, spaced from each other as by means of washers 40. These packing rings have axial lengths greater than any of the gaps between abutting sections of the core barrel, and thus are capable of bridging these gaps. There is an axial bore 41 through the piston, with a

seat for a ball valve 42 at its upper end, the ball being retained within a counter bore 43 in any convenient manner, as by a transverse pin 44.

Before being placed in operation, the apparatus is cleaned, the ball bearings are properly filled with grease, and the parts are assembled as indicated in the drawings. Piston 38 is placed at the lower end of the core barrel, slightly above cylinder 19, and is releasably retained in that position by finger springs 28, which then engage a peripheral groove at its lower end. As the instrument is lowered into the well, the mud and fluid at the bottom thereof will pass into the core-barrel, and flow upwardly therein past ball valves 42 and 33. As the core is formed, it will push upwardly, ahead of it, any mud and fluid that remains in the core-barrel after being lowered to the bottom of the well. When the core has grown to a height sufficient to contact with the lower end of piston 38, the mud and fluid that initially was within the lower portion of the core barrel will have been wholly displaced. Thereafter, as the core continues to grow, it will push the piston upwardly ahead of it. Mud and fluid in the core barrel above ball 42 cannot return to contaminate the forming core, and will escape past the ball valve 33, and flow downwardly with the current of circulating fluid that is supplied to the cutting bit through perforations 17 in plate 14. The flow of this circulating fluid will assist in pulling out the mud and fluid from the core-barrel, in accordance with well known principles.

In view of the above it will be apparent that, in operation; the mud and fluid that originally was in the core barrel will be displaced by the core as it is formed; no mud or fluid can flow downwardly upon the forming core; and no mud or fluid can enter at the bottom of the core barrel by reason of the advance cut made by the core-cutting portion of the bit, and the packing afforded by the cuttings therefrom. Thus it is possible by the use of my apparatus to obtain an uncontaminated core in wells that are wet.

Particular attention is called to the fact that the core barrel itself does not revolve in operation. It thus permits of obtaining unbroken cores of exceptional length, and obviates the possibility of twisting off the core-catching means.

Having thus fully described and illustrated my invention, in a manner that will make its construction and operation clearly apparent to those familiar with the art involved, I claim:

1. Construction of the character described, comprising; a rotary tubular tool string; a bit at the end of said string adapted to make an annular cut leaving an axial core; a core-barrel adapted to receive and retain said core, rotatably mounted within said tubular string

and spaced from the wall thereof to afford a passage for circulating fluid; and a longitudinally slidable piston within said core-barrel; said piston carrying means for permitting upward and preventing downward flow of fluid therethrough.

2. Construction of the character described, comprising; a rotary tubular tool string; a bit at the end of said string adapted to make an annular cut leaving an axial core; a core-barrel adapted to receive and retain said core, rotatably mounted within said tubular string and spaced from the wall thereof to afford a passage for circulating fluid to the bit; means at the upper end of the core-barrel for directing fluid escaping therefrom downwardly into said passage; and a longitudinally slidable piston within said core-barrel; said piston being provided with valvular means for permitting upward and preventing downward flow of fluid therethrough.

3. Construction of the character described, comprising; a rotary tubular tool string; a bit at the end of said string adapted to make an annular cut leaving an axial core; a core-barrel adapted to receive and retain said core, rotatably mounted at its respective ends within said tubular string and spaced from the wall thereof to afford a passage for circulating fluid to the bit; a deflector carried by the upper end of the core-barrel adapted to deflect downwardly into said passage fluid that escapes from said upper end; and a longitudinally slidable peripherally packed piston within said core-barrel; said piston being provided with valvular means for permitting upward and preventing downward flow of fluid therethrough.

4. Construction of the character described, comprising; a rotary tubular tool string; a bit at the end of said string adapted to make an annular cut leaving an axial core; a core-barrel adapted to receive and retain said core, rotatably mounted at its respective ends within said tubular string and spaced from the wall thereof to afford a passage for circulating fluid to the bit; a valve at the upper end of said core-barrel permitting upward flow therefrom and preventing downward flow thereinto; a deflector carried by said upper end adapted to deflect downwardly into said passage fluid that escapes through said valve; and a longitudinally slidable peripherally packed piston within said core-barrel; said piston being provided with valvular means for permitting upward and preventing downward flow of fluid therethrough.

5. Construction as set forth in claim 1 wherein the core-barrel is provided with internal core-catching means adjacent the lowermost position of said piston.

6. Construction as set forth in claim 1 wherein the core-barrel is provided with internal core-catching means adjacent the lowermost position of said piston; and wherein

said core-catching means are adapted for releasably engaging the piston.

7. Construction as set forth in claim 1 wherein the core-barrel comprises longitudinally split, separable, and opposed sections, assembled by circular couplings therearound.

8. Construction as set forth in claim 1 wherein the core-barrel comprises separable opposed sections, having closely engaged and substantially tight longitudinal joints, assembled by circular couplings therearound.

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