Jan. 7, 1930. A. L. ARMENTROUT 1,742,641

ROTARY CORE DRILL

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Fig.1.

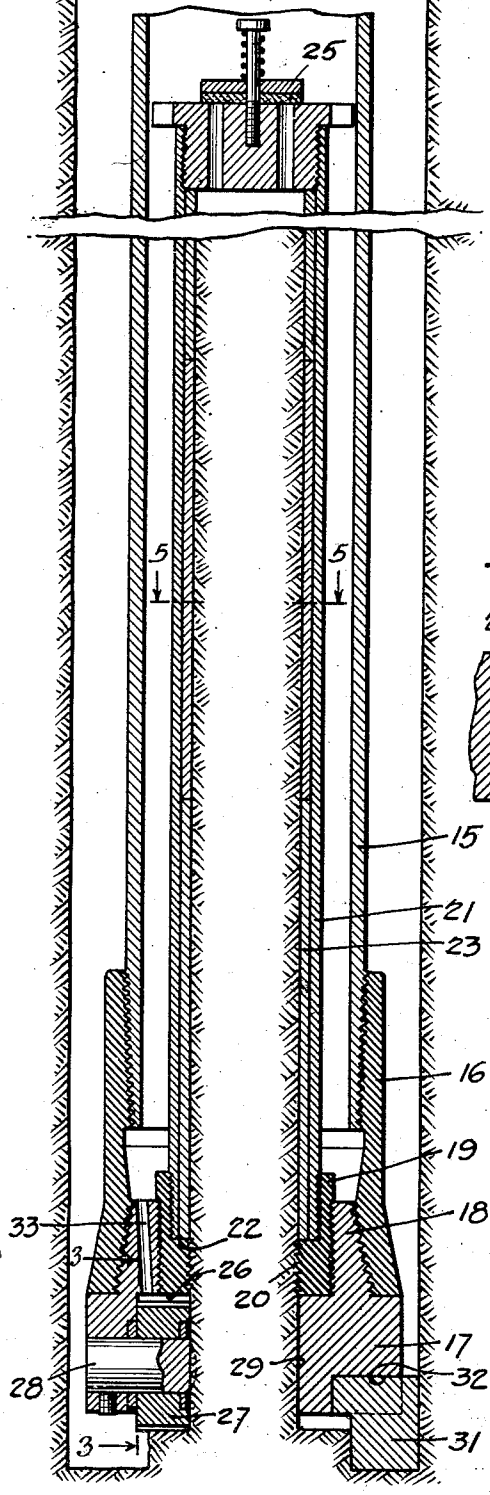


Fig.2.

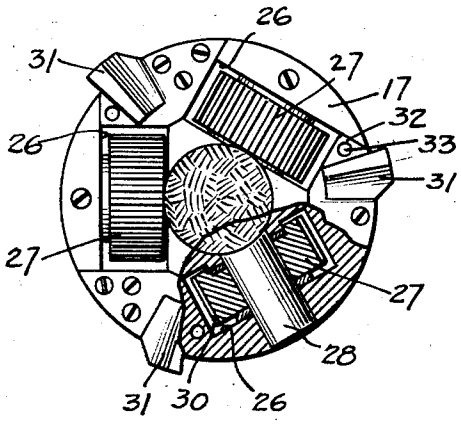


Fig.3.

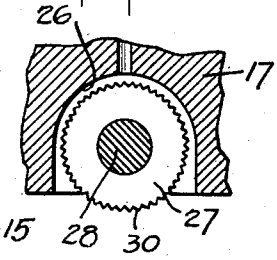


Fig.4.

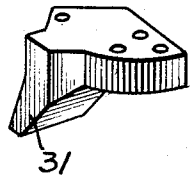


Fig.6.

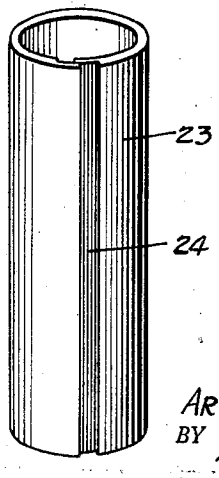
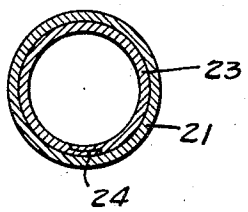


Fig.5.



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Fig. 7.

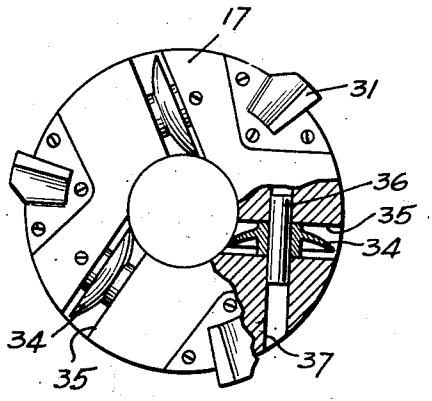
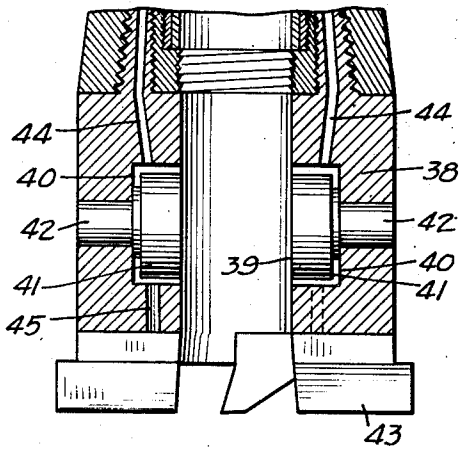


Fig. 8.



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ARTHUR LEON ARMENTROUT, OF LOS ANGELES, CALIFORNIA

ROTARY CORE DRILL

Application filed April 14, 1925. Serial No. 23,113.

My invention relates to rotary core drills, particularly of the type by which a sample core is formed and extracted to determine the character of formation encountered.

It is a purpose of my invention to provide a core drill having core forming cutters which in operation are subjected to minimum wear so as to prevent the formation of a tapered core and to produce a core of uniform diameter thereby maintaining the strata of the core in their original relative positions so that the true character of the formation can be determined.

It is also a purpose of my invention to provide a core drill which greatly facilitates the removal of the core from the barrel and in such manner as to eliminate the breaking, disintegration or in any way injuring the core when extracting the latter from the barrel.

A further purpose of my invention is the provision of a core drill which operates to trim the core to a uniform diameter for free passage into the core barrel so that irrespective of any irregularity in the formation of the core due to wearing of the cutters, a core of uniform diameter with the strata thereof maintained in their original positions is insured.

I will describe only three forms of rotary core drills embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings

Figure 1 is a view showing in vertical section one form of core drill embodying my invention in applied position within a well.

Figure 2 is a bottom plan view of the core drill shown in Figure 1 and with a portion thereof broken away.

Figure 3 is a vertical sectional view taken on the line 3—3 of Figure 1.

Figure 4 is a detail perspective view of one of the boring bits.

Figure 5 is a transverse sectional view taken on the line 5—5 of Figure 1.

Figure 6 is a detail perspective view of the split sleeve embodied in the core drill shown in Figure 1.

Figure 7 is a view similar to Figure 2 showing another form of core drill embodying my invention.

Figure 8 is a fragmentary vertical sectional view of a third form of core drill embodying my invention.

Similar reference characters refer to similar parts in each of the several views.

Referring specifically to the drawings and particularly to Figure 1, my invention in its present embodiment comprises a tubular shank 15 which may be of any desired length and following the usual practice may be considered as made up of several sections of drill pipe for connection of a string of drill tubing in the usual manner. Through the medium of a connecting sleeve 16, a tool head 17 is detachably connected to the lower end of the tubular shank 15, such head being provided with an annular collar 18 exteriorly threaded for engagement with the sleeve. The collar 18 is interiorly threaded to receive and secure therein an annular member 19 provided internally with upwardly extending buttress threads 20 provided for the purpose of preventing downward displacement of a core from the core barrel. The core barrel designated at 21 is received within the bore of the tubular shank 15 and is threaded at its lower end for connection with the annular member 19, the latter being provided with an annular shoulder 22 on which the lower end of the barrel rests. This shoulder 22 is sufficiently wide to also form a support for a core receiving sleeve 23 mounted in the barrel 21. This sleeve is made up of a plurality of sections each of which is split longitudinally as indicated at 24 in Figure 6 and formed of a material having the requisite degree of resiliency to permit of its being expanded and contracted for a purpose which will be hereinafter described.

The upper end of the core barrel 21 is provided with a check valve 25 which permits water in the barrel to be expelled into the shank as the core moves into the barrel which prevents the flushing water entering the upper end of the barrel.

As illustrated to advantage in Figure 2, the tool head 17 is provided with a plurality of pockets or chambers 26 spaced circumfer-

entially of the head and arranged at tangents with respect to the axis thereof. These chambers 26 are accessible from the bottom of the tool head, and as shown in Figure 3 each chamber contains a rotary cutter 27 rotatable on a stub axle 28 mounted in and disposed radially of the tool head as shown in Figure 2. The tool head is provided with a central bore 29 in vertical alinement with the core barrel 21 and annular member 19, and as shown in Figure 1 the cutters 27 are disposed so that their confronting sides are in tangential relation to such bore. The inner ends of the stub axle 28 are concave as shown in Figure 2 in order that they will not gouge the core during rotation of the drill.

In the present instance I have shown the tool head provided with three rotary cutters 27, and each cutter in the present instance is in the form of a relatively thick wheel having its periphery provided with transversely extending ribs 30 which function as teeth for boring the earth in the formation of the core. As illustrated in Figures 1 and 3, the mounting of the cutters 27 in the tool head is such that portions of their peripheries at all times project from the bottom of the tool head so that the ribs 30 thereof may have boring engagement with the earth as the drill is rotated to form the core.

Between and in surrounding relation to the cutters 27 are boring bits 31 having relatively broad bases suitably secured in recesses 32 in the bottom of the tool head and with their blades extending downwardly and outwardly beyond the periphery of the tool head so that in the rotary movement of the drill they will function to bore the hole. The blades of the bits extend in a counter-clockwise direction as when viewed in Figure 2 so that they co-operate in effecting a drilling of the hole as will be understood.

In operation, the bits 31 and the cutters 27 under rotary movement of the drill co-operate in effecting a drilling of the hole, the bits operating to drill the wall of the hole and a portion of the bottom and the cutters drilling a portion of the bottom and in such manner as to form a core between the cutters. As the drill proceeds downwardly the core continues to be formed in this manner and directly beneath the bore of the tool head so that the core is free to pass upwardly into the bore and ultimately into the sleeve 23 of the core barrel 21. It is to be noted that the confronting sides of the cutters 27 operate in conjunction with the peripheries thereof in forming a core of uniform diameter and in such manner that the cutters are subjected to a minmum amount of wear. It will be therefore manifest that the original arrangement of strata forming the core is preserved during the passage of the core through the tool head and into the sleeve so that the true character of the earth formation can be subsequently determined.

After the sleeve 23 has been completely filled with a core, by elevating the drill from the well, the sleeve with the core can be readily removed from the core barrel, it being understood that the sleeve has a sliding fit in the core barrel. Upon removal of the sleeve from the barrel it automatically expands by virtue of its split form thus releasing the core and permitting the ready removal of the latter in the exact form in which it was introduced into the sleeve. In this manner the true character of the earth formation is maintained during the formation and removal of the core from the drill.

In order that the rotary cutters 27 be properly flushed at all times during the operation of the drilling, the collar 18 is provided with ports 33 which provide communication between the shank and the core barrel and the several chambers or pockets 26 so that flushing water introduced into the shank will find ready access to the several chambers 26.

Referring now to Figure 7, I have here shown another form of core drill embodying my invention which is identical to the core drill first described with the exception that concavo-convex disks 34 are used in place of the rotary cutters 27. These disks have their cutting edges disposed tangentially of the bore 29 of the tool head and similarly to the cutters 27 they project from the bottom of the tool head for engagement with the earth in the formation of the core. The disks are disposed in pockets 35 and rotatably mounted on stub axles 36, the axles being insertable into the heads through openings 37 extending inwardly from the peripheries of the head. The mounting and arrangement of the several disks is such that they not only co-operate to form a core which ultimately passes upwardly into the sleeve of the core barrel but they operate to trim the core as it passes through the bore of the tool head whereby the formation of a core of uniform diameter is insured.

Referring now to Figure 8, I have here shown a third form of core drill embodying my invention which comprises a tool head 38 associated with the tubular shank and core barrel in the same manner as the other tool heads. The head 38 is formed with a central bore 39 in vertical alinement with the core barrel, and extending outwardly from the bore are pockets 40 in which trimming wheels 41 are rotatably mounted. These wheels 41 are mounted on stub axles 42 secured within the tool head, the wheels are arranged with their confronting sides flush with the bore 39 so as to have contact with the core as it passes upwardly through the bore.

In this embodiment of my invention, the bore is formed by a plurality of radially ar-

ranged bits 43 secured to and depending from the bottom of the tool head and also functioning to drill the hole in a manner similar to the boring bits 31 of the other forms of core drills. In a core drill of this character where the bits perform the double function of forming the core and drilling the hole, they are subjected to great wear and particularly at their inner ends or those ends which have actual contact with the core as it moves upwardly. As a result of this wear, a core of tapered form is produced or a form which exceeds in diameter that of the bore so that in entering the bore a constriction of the core is effected which operates to destroy the original positions of the strata forming the core so that the true character of the formation can not be subsequently determined. In order to overcome this difficulty and produce a core which can readily pass through the bore of the tool head without disturbing the original character of the formation, the wheels 41 are provided, and as shown these wheels are disposed above the bits 43 so that the confronting sides under the rotative movement of the drill will operate to trim the core to such diameter that it can pass freely through the bore into the core barrel.

In Figure 8, I have shown the tool head 38 provided with ports 44 through which a flushing water finds access to the pockets 40. Other ports 45 are formed in the tool head so that the water supplied to the pockets can find its way downwardly to points between the bits 43.

Although I have here shown and described only three forms of rotary core drills embodying my invention, it is to be understood that various changes and modifications may be made therein without departing from the spirit of the invention and the spirit and scope of the appended claims.

What I claim is:

1. A core drill comprising a tubular shank adapted to be connected to a rotary drill pipe, a sleeve connected to the lower end of the shank, a tool head having an annuluar externally threaded collar threaded into the sleeve and provided with an internally threaded portion, an annular member threaded into said portion and having an annular shoulder, a core barrel threaded into the annular member and engaging said shoulder, said barrel having a centrally disposed core receiving bore and provided around the bore with a plurality of downwardly opening pockets arranged tangentially with respect to the axis of the barrel, horizontal stub axles secured to the barrel extending radially into said pockets, relatively thick cutter wheels rotatably mounted on the axles and having peripheral transversely extending ribs to form teeth, said wheels projecting below the tool head so that their teeth are adapted for boring engagement with the earth to form a core, and a plurality of cutters having relatively broad bases secured to the head and the blades of which project below the rotary cutters and beyond the periphery of the tool head.

2. In a core drill, a tool head having a core receiving bore, boring cutters fixedly secured to the head for rotation therewith, and core trimming elements mounted to rotate about horizonal axes in the head above the fixed cutters and comprising wheels having their confronting side faces disposed at a tangent to a circle defining the circumference of the bore.

3. In a core drill, a tool head having a core receiving bore, a plurality of radially arranged cutters mounted for rotation in the head upon axes transversely disposed with respect to the length of the bore, said cutters comprising relatively thick wheels having their peripheries formed with transversely extending teeth, the cutters being arranged tangentially of the bore so that their confronting side faces are adapted to have contact with a core received in the bore, and a plurality of cutters fixed to the head in alternate relation to the rotary cutters and having cutting blades, the outer ends of which are disposed beyond a circle defined by the outer sides of the rotary cutters and the inner ends of which are disposed within said circle, the cutting blades of the last mentioned cutters being radially arranged and inclined downwardly and forwardly in the direction of rotation of the head, the blades presenting horizontal and vertical cutting edges.

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