July 1, 1930. W. I. McLAUGHLIN 1,769,152

CORE BARREL

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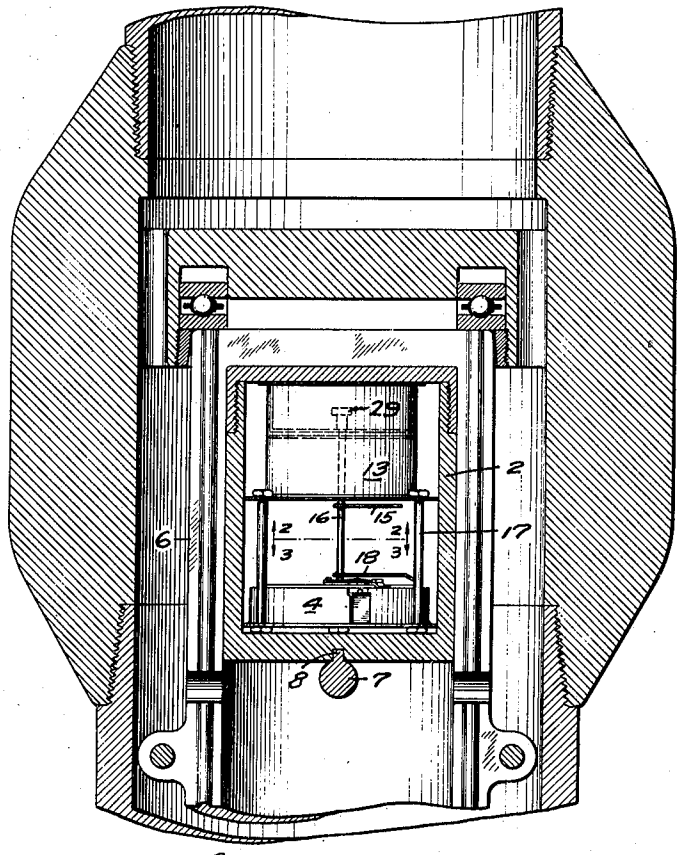


FIG. 1.

FIG. 2.

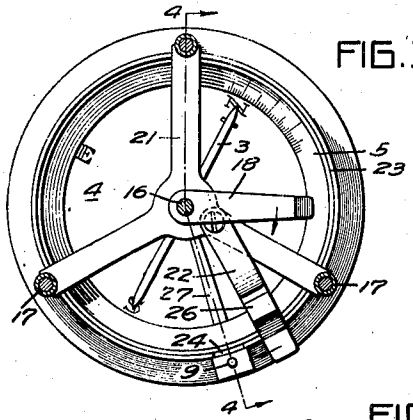
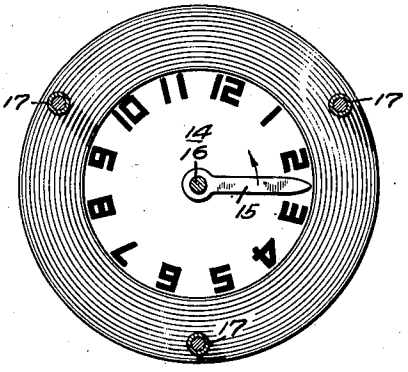


FIG. 3.



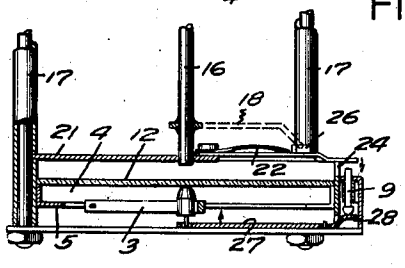


FIG. 4.

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CORE BARREL

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FIG. 5.

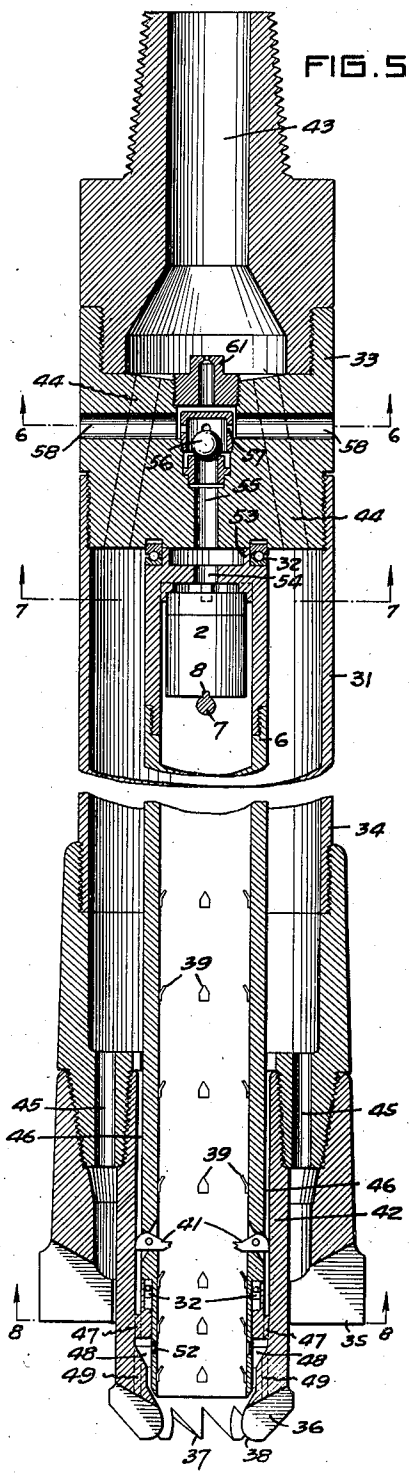


FIG. 6.

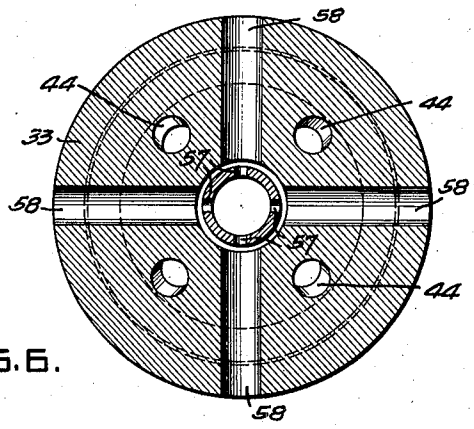


FIG. 7.

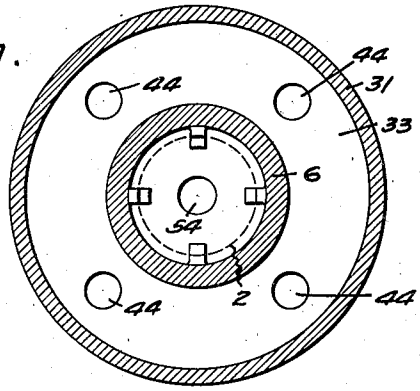
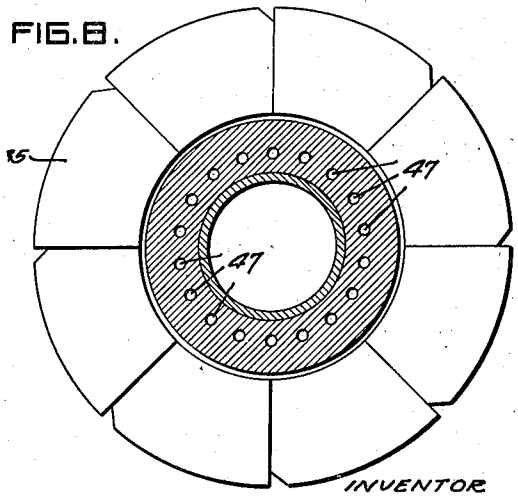


FIG. 8.



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CORE BARREL

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FIG. 9.

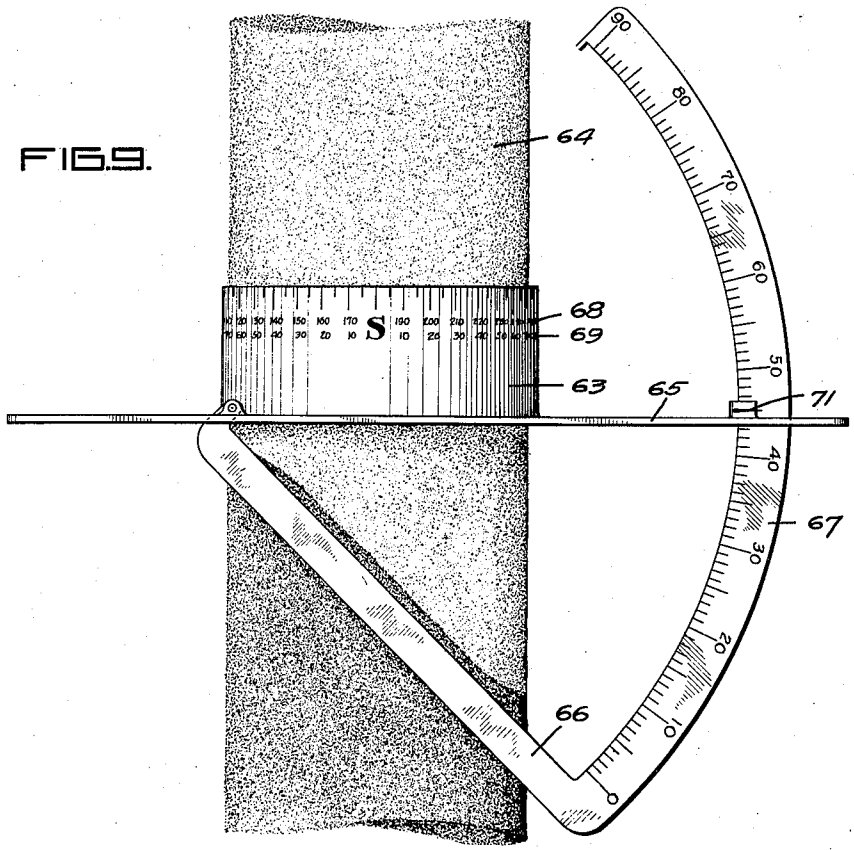
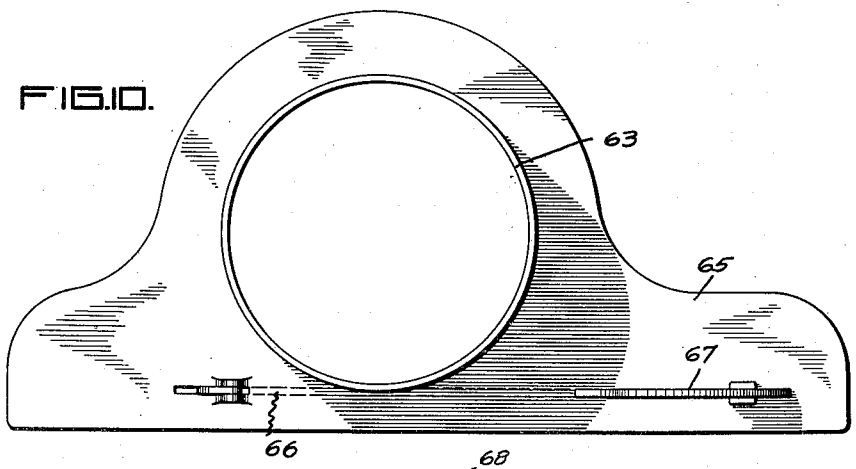


FIG. 10.



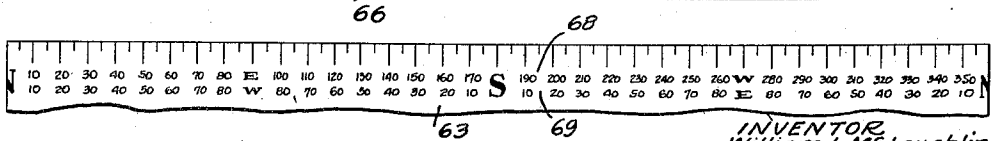


FIG. 11.

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UNITED STATES PATENT OFFICE

WILLIAM I. McLAUGHLIN, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO STANDARD OIL COMPANY OF CALIFORNIA, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF DELAWARE

CORE BARREL

Application filed May 20, 1924. Serial No. 714,668.

This invention relates generally to devices commonly known as core barrels, which are employed in earth drilling operations for taking core samples of subterranean strata.

It is a general object of the invention to improve upon core barrels of the prior art whereby breakage and loss of cores is minimized.

It is a further object of the invention to generally improve upon the construction of core barrels whereby lubricating mud is delivered more effectively to the cutting edges.

It is another object of the invention to devise improved means in a core barrel for engaging and severing a core.

The invention possess other advantageous features, some of which with the foregoing, will be set forth at length in the following description, where I shall outline in full that form of my invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. In said drawings I have shown one form of each of the devices of my invention, which cooperate to produce the desired final result, but it is to be understood that I do not limit myself to such forms of said devices, since the invention, as set forth in the claims, may be embodied in a plurality of other forms.

Referring to said drawings:

Figure 1 is a vertical section through one form of my invention, showing parts which may be associated with the upper end of the core retainer.

Figure 2 is a cross section taken on the line 2—2, Figure 1.

Figure 3 is a cross section taken on the line 3—3, Figure 1.

Figure 4 is a cross-section taken on the line 4—4, Figure 3.

Figure 5 is a vertical section through a desirable form of my core barrel.

Figure 6 is a cross section taken on the line 6—6, Figure 5.

Figure 7 is a cross section taken on the line 7—7, Figure 5.

Figure 8 is a cross section taken on the line 8—8, Figure 5.

Figure 9 is a side elevation of a device for indicating the strike and the dip of the formation composing the core.

Figure 10 is a top view of the device shown in Figure 9.

Figure 11 is a development of the circular scale of the device of Figure 9.

The complete device illustrated in the drawing can be used to indicate the oriented position of a core which is taken from the earth, so that after the core has been removed, its position while in the earth may be accurately determined. However the features as claimed are applicable to core barrels or core drills in general. The means disclosed for fixing the indicator in fixed position while the core is still attached to the formation, is preferably time controlled, so that the position of the core at any selected time may be determined. This indicator and its operating means, hereinafter referred to generally as an indicating device, comprises a housing 2 preferably made of paramagnetic material so that it will not interfere with the tendency of the magnetic needle to point to the true magnetic north. Arranged within the housing is a magnetic needle 3 which is pivotally mounted in the casing 4, so that it is normally free to swing to point to the magnetic north. Associated with the needle 3 is a dial 5 for indicating the position of the housing with respect to the needle. The housing 2 is rigidly secured to the core retainer 6 by a bolt 7 having an elongated projection 8 which seats in a groove in the housing.

The magnetic needle is provided with means for clamping it in fixed position in the casing 4, this means comprising a lever 27 disposed below the needle and having a raised end 28 disposed below the pin 9 arranged in the casing. Downward pressure on the pin 9 will raise the inner end of the lever 27 to lift the needle from its pivot and press it into contact with the glass covered plate 12, thus fixing the needle in position. Time controlled means are provided for depressing the pin 9 at the end of a predetermined time to fix the needle in position. Arranged adjacent and preferably above the needle casing 4 is a clock mechanism contained in the housing 13, the housing 13 being provided on its

under surface with a dial 14 having numbers indicating hours and movable over the dial 14, in the present instance in a counter-clockwise direction, is a hand 15 which is attached to a shaft 16 projecting from the clock mechanism housing 13. The shaft 16 is driven by the clock mechanism and preferably makes one rotation every 12 hours. The shaft 16 is manually movable to adjusted position by a thumb screw 29 on the end of the shaft so that the position of the hand 15 on the dial 14 may be readily set. The casing 13 is supported or connected to the casing 4 by bolts 17, which are made of paramagnetic material.

Secured to the shaft 16 is an arm 18 which, in the present instance, is disposed in parallel relation with the hand 15. The arm 18 moves in a clockwise direction with respect to the dial 5 and the hand 15 moves in a counter-clockwise direction with respect to the dial 14, this being caused by the fact that the two dials are opposed to each other. Pivoted to the frame 21, which is supported by the bolts 17, is a spring arm 22 which normally rides on a circumferential ridge 23 on the casing 4. The ridge 23 is provided at the position of the pin 9 with a notch or cut-out portion 24 into which the spring arm 22 falls when the arm is moved into registry with the notch. The end of the arm 22 overlies the pin 9 and when the arm 22 moves into the notch 24, the arm engages and depresses the pin 9, causing the magnetic needle to be fixed in position.

The arm 22 is moved by the arm 18, the arm 22 being provided on its upper surface with an abutment 26 with which the arm 18 moves into contact as it is rotated by the time mechanism. When the arm 22 springs into the notch 24, the abutment 26 is depressed below the end of the arm 18, so that the arm 18 may freely pass over the depressed abutment. The dial numeral 12 on the dial 14 lies directly over the notch 24 and constitutes the zero position of the hand 15. When it is desired to have the magnetic needle clamped in position at the end of two and a half hours, the hand 15 is moved to the position shown in Figure 2 and the spring arm 22 is lifted from the notch 24 and allowed to rest on the ridge 23 adjacent the notch. The time mechanism then drives the arm 15 toward the zero hour position, consequently moving the arm 18 toward the arm 22. The end of the arm 18 is brought into contact with the abutment 26 and thus moves the arm 22 to spring into the notch 24 and this will occur when the hand 15 reaches the zero hour position. The arm 22 will remain in the notch 24, holding the magnetic needle in fixed position with respect to the dial 5.

When the device as shown is used in connection with a core barrel which is taken a core from the bottom of a hole, the hand 15 is set at such position that the needle will be clamped in position after the core has been formed. Assuming that it will require approximately two hours to form the core, the time mechanism may be set to cause the needle to be clamped after a lapse of two and a half hours, so that after the core has been formed, the core barrel is permitted to remain stationary until after the selected time period has elapsed, so that when the core barrel is withdrawn from the hole, the exact position of the core retainer at the time that the needle was clamped, may be definitely and accurately determined.

The housing 2 is securely mounted within the core retainer 6, which is rotatably mounted in the core barrel 31 by the bearings 32, so that the retainer may be held against rotation during the rotation of the core barrel in forming the core. The core retainer 6 is provided with means for engaging the core after it has entered the retainer, for the purpose of preventing rotation of the retainer. The core remains fixed to the formation until it is completely formed, so that the core remains stationary and consequently by causing the retainer to engage the core and mounting the retainer so that it is freely rotatable with respect to the core barrel, the retainer remains stationary, or substantially stationary.

The core barrel comprises a head 33, a body portion 34 and a drill portion, comprising the outer drill bit 35 and the inner drill bit 36. These bits are formed of a plurality of teeth 37, so that as the core barrel is rotated the formation is cut to form the core. The drill bit 36 cuts the core from the formation and the drill bit 35 cuts the formation to permit the core barrel to descend in the hole. The teeth 37 of the drill bit 36 are formed with rounded edges 38 so that a flaring joint occurs between the formed core and the formation, thus strengthening the core at this point where it is subjected to its greatest fracturing strain. If the edges 38 were formed at a right angle, as are the edges of the teeth of the drill 35, a sharp line of demarkation would occur between the core and the formation, that is, the core would spring directly perpendicularly from the formation at a right angled corner. Should the drill bits or either of them strike a boulder which was eccentric to the hole, the core barrel would be shifted slightly to one side and this, in many instances, would fracture the core from the formation when the core joins the formation at a sharp angle. By flaring out the joint, however, the core is much stronger at its base and consequently more able to resist fracturing strain.

The core retainer 6 is disposed within and spaced from the core barrel and the lower end of the retainer is disposed adjacent the drill bit 36, so that the core passes directly into the retainer. The retainer is provided

throughout its length, with a plurality of inwardly inclined spring fingers 39 which engage the core as it enters the retainer and holds the retainer against rotation during the rotation of the core barrel. In the event that there is a slight rotation of the retainer with respect to the core, the pointed ends of the fingers will scratch marks on the face of the core and an inspection of the core after it is removed from the retainer, will indicate the amount of rotation of the retainer with respect to the core and thus permit the exact original position of the core with respect to the retainer to be determined. Since the direction indicator enclosed in the housing 2 is secured to the retainer, it is desirable to know the amount of rotation of the retainer with respect to the core. The retainer is split longitudinally into two parts, which are normally suitably held together and these parts are separated after the core barrel is withdrawn from the hole, for the purpose of removing the core from the retainer. The retainer is also provided with means for fracturing the core from the formation, when it is desired to lift the core barrel from the hole. These means comprise a plurality of toothed dogs 41, pivoted in the wall of the retainer and normally inclined upward, so that they do not interfere with the longitudinal movement of the core with respect to the retainer while the core is being formed. When it is desired to fracture the core from the formation, the core barrel is lifted and the teeth of the dogs 41 bite into the core and the dogs are forced downward to the position indicated in Figure 5 and during such downward movement they are forced into the core and fracture the core transversely, and also act to support the core in the retainer as the core barrel is being lifted. The dogs 41 are so formed that the rear surfaces thereof contact with the inner surface of the shank 42 of the inner drill bit, when the dogs lie in a horizontal position, to reinforce the dogs so that they will not be broken from their pivotal mounting.

During the operation of the core barrel, mud is fed downward through the drilling tube, for the purpose of lubricating the bits and carrying away the material cut by the bits. This mud passes downward through the passage 43 in the stem and thence through the passages 44 in the head 33 into the annular space between the retainer and the core barrel. From this annular space, some of the mud passes downward through the passages 45 in the core barrel and discharges between the outer drill bit 35 and the shank 42 of the inner drill bit and serves to lubricate the outer bit. A portion of the mud also passes downward through the annular passage 46 between the retainer and the shank of the inner drill bit 36 and passes through the passages 47 in the mounting of the lower ball bearing 32, into the annular chamber 48 formed between the retainer and the shank 42 of the inner drill. From the chamber 48, some of the mud passes through the passages 49 to the cutting edges of the drill 36 and some of the mud passes through the narrow annular passage between the lower end of the retainer and the shank of the drill 36 to lubricate the core and lubricate the inner cutting edges of the drill 36. This mud then passes upward through the hole on the outside of the core barrel. Provision is made for introducing a small quantity of mud into the retainer for the purpose of lubricating the core as it enters the retainer and, for this purpose, the retainer is provided adjacent its lower end with a plurality of small apertures 52 which communicate with the annular chamber 48.

Before the core enters the retainer, the retainer is full of mud and means are provided for permitting the discharge of this mud from the retainer as the core enters the retainer. For this purpose the housing 2 is preferably mounted on lugs 53 at the top of the retainer, to provide a passage around the housing for the mud. The retainer is provided in its upper end with a passage 54 and from this passage the mud passes through the passage 55 in the head, past the ball valve 56 and through the apertures in the cage 57 into the transverse passages 58 which open on the side of the head. Provision is also made for permitting a small amount of the mud introduced through the passage 43 to enter the passages 58 for the purpose of lubricating the sides of the core barrel. For this purpose, the head is provided with a nipple 61 through which a small amount of mud may pass to the chamber in which the cage 57 is disposed, this chamber being in communication with the passages 58. The ball 56 prevents this mud from passing downward into the retainer, but permits the mud in the retainer to be forced out.

After the core of the desired length has been formed, the core barrel is permitted to remain stationary until after the expiration of the predetermined time period for which the direction indicator was set, and then the core barrel is removed from the hole, the retainer removed from the barrel and the retainer opened to permit examination and removal of the core. Markings on the core which would indicate rotation of the core with respect to the retainer are noted and the position of the compass needle is also noted. A mark is placed on the core to indicate the position of the arrow of the magnetic needle and the reading of the needle is observed. In figures 9, 10 and 11, I have shown a device for indicating the dip and strike of the formation of the core. This device comprises a protractor adapted to be

applied to the core to definitely indicate the desired angles of direction. This device comprises a collar or cylinder 63, adapted to be slipped over the core 64. Secured to the cylinder is a plate 65 and pivoted to the plate is an arm 66, provided on its end with an arc 67, which passes through a slot in the plate. The arc swings in a vertical plane tangent to the cylinder 63 and preferably tangent to the cylinder at the south thereon. The cylinder is provided with two systems of graduations extending around its circumference, the first system of graduations 68 being used for laying off an angle with respect to a given point of direction. The second system of graduations 69 is used for measuring the angle between two given points of directions. The arc 67 is also graduated and is used for measuring the angle between any plane and the plane of the plate 65. A pointer 71 is arranged on the plate 65 to indicate the reading of the graduations on the arc. The readings taken around the circumference of the cylinder are considered as horizontal angles and the readings of the graduated arc are taken as the directions from the horizontal.

In using the protractor, the core is inserted through the cylinder 63 and the north point of the cylinder is placed on the reference line which has been scratched on the core. In case the core has been broken into a plurality of portions the marks on the core will indicate the relative rotation between the portions and they may be rotated relative to each other to take their original position which they occupied in the ground; in case the marks on the core show that rotation has taken place subsequent to the fixing of the needle the position of the mark on the core may be accordingly corrected. The protractor is then turned until a position will be found where the trace of the dipping strata in the core appears as a straight line. By placing the arm 66 of the vertical arc along this straight line, the degree of the steepest dip of the strata may be read on the vertical arc. Holding the protractor in this position, mark a point on the core at the north or south points on the graduations and this will indicate the line of steepest dip projected up to the horizontal plane. There is then present on the core two points, one point in the direction of north and one in the direction of the steepest dip. Turning the protractor around until the north point on the graduated cylinder corresponds to the north point marked on the core, direction of dip may be read directly on the graduations of the scale 69 at the point of the steepest dip scratched on the core.

I claim:

1. A core barrel comprising a barrel, a core retainer rotatably mounted within the barrel, pivoted dogs mounted in the wall of the retainer adapted to engage and fracture the core from the formation and extensions on the rear faces of the dogs adapted to bear against the barrel to firmly hold the dogs in position.

2. In a device of the class described, a core barrel, a hole cutting bit on the lower end of said barrel, a hollow core cutting bit secured to said barrel and extending below said hole cutting bit, a rotatable core retainer within said barrel, said retainer being journaled at its upper end to a head secured to said barrel and journaled within said core cutting drill at its lower end, means for allowing mud to circulate down between said hole and core cutting drills, and means for allowing mud to circulate down between said core retainer and core cutting drill.

3. A core barrel comprising a barrel enclosing a chamber adapted to receive mud, inner and outer annular drill bits on said barrel, conduits in said barrel for conveying mud to the outer drill bit and to the inner cutting edges of the inner drill bit, and separate conduits in the inner drill bit extending substantially to the lower end thereof for conveying mud to the bottom cutting edges of the inner drill bit.

4. In a device of the class described, a core barrel having a head, a hollow drill stem secured to said head thru which mud is to be circulated downwardly, a core retainer rotatably mounted within said barrel, the upper end of said retainer being journaled upon said head, a passage in the head communicating between said stem and core retainer, a check valve within said passage to prevent flow of mud into the retainer, and another passage within said head communicating between the exterior of the barrel and said first named passage at a point above said valve.

In testimony whereof, I have hereunto set my hand.

WILLIAM I. McLAUGHLIN.