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PUNCH CORE ORIENTING DEVICE

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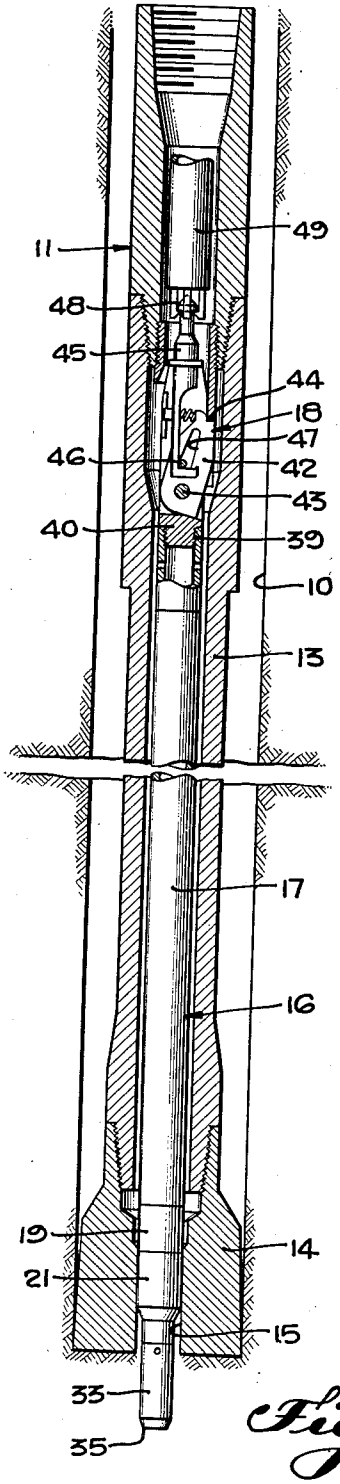


Fig. 1.

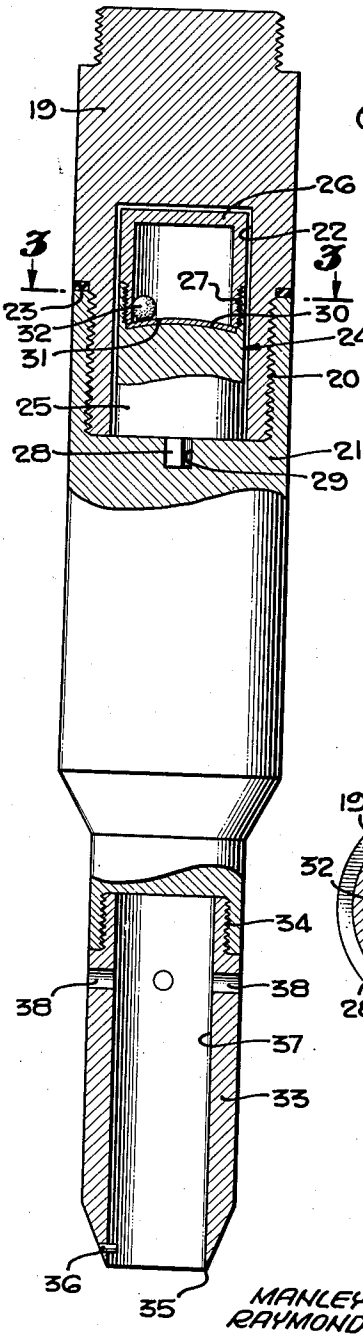


Fig. 2.

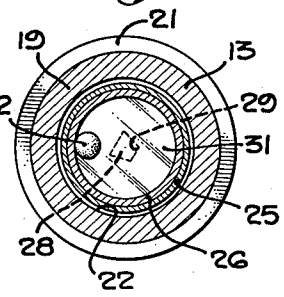


Fig. 3.

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PUNCH CORE ORIENTING DEVICE

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4 Claims. (Cl. 255—1.4)

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This invention relates to punch core orienting apparatus and constitutes an improvement over the device shown in our copending application, Serial No. 65,024, filed December 13, 1948, now Patent No. 2,600,125, issued June 10, 1952. In our copending application it is pointed out that conventional coring devices commonly employ a core bit with a hollow center which cuts away an annular ring into the formation, leaving the center of the hole uncut and forming a projection which extends upwardly into a core barrel extending downwardly into the hollow bit. When the desired length of core has been received within the core barrel, the core barrel, together with the formation sample or core, is withdrawn to the surface. The core barrel may be withdrawn on a wire line through the interior of the drill string, or the drill string itself may be withdrawn section by section to bring the core barrel to the surface. In either event, a problem of orienting the core arises in order to determine the azimuth of the dip of the well formation.

The present invention relates to an improved form of punch core apparatus which provides a means of determining the orientation of the core. The device is useful only in holes which deviate from the true vertical. In this device, the core barrel is provided with a cutting head and is moved longitudinally into the formation without rotary motion. The improvement to which the present invention relates lies in the use of a luminous ball which rolls on a light-sensitive surface. The ball and light-sensitive element are incorporated into a punch core apparatus and serve to furnish a record of the direction of inclination of the device at the time of taking the core from the formation. Since the amount and direction of inclination of the hole are known from a previously run survey, the record showing the "low side" of the hole with relation to the core enables the orientation of the core to be determined. The retractable device, together with the core, is then withdrawn from its position at the lower end of the drill string and is lifted through the interior of the drill string to the surface. The angular position of the core within the core barrel is then noted and the record of the inclination of the device is given by inspection of the light-sensitive element after standard photographic development procedures have taken place. From this information the orientation of the core with respect to the formation can readily be determined.

The indicator which constitutes the subject

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matter of the present invention records the "low side" of the retractable device so that by correlation with the known inclination and direction of the bore hole the orientation of the core may be determined.

In the drawings:

Figure 1 is a longitudinal sectional view showing a preferred embodiment of our invention.

Figure 2 is an enlarged sectional view showing the lower end of the retractable assembly shown in Figure 1.

Figure 3 is a transverse sectional view taken substantially on the lines 3—3 as shown in Figure 2.

Referring particularly to the detailed construction of a preferred embodiment of our present invention as shown in the drawings, the bore hole 10 receives the drill string generally designated 11 which may include a plurality of sections threaded end to end. The lowermost section, or sections, commonly has a heavier wall thickness and is known in the art as a drill collar 13. A bit 14 is connected to the lower end of the drill collar, and as shown in Figure 1 this bit is provided with an axial opening 15 through which the retractable core barrel assembly 16 may extend. This assembly 16 includes a support tube 17 which extends downward from a latching assembly generally designated 18. The lower end of the support tube is threadedly connected to the upper end of a sectional punch core head 19. The head 19 is connected by threads 20 to the body 21. A central recess 22 is provided in the head 19 which is accessible when the head 19 and body 21 are separated. A seal ring 23 normally acts to seal the recess 22 against entrance of fluids in the well bore.

In accordance with our invention a capsule 24 having a base 25 and a cover 26 connected by threads 27 is positioned within the recess 22. A noncircular key 28 on the base 25 is received within a correspondingly shaped recess 29 provided in the body 21 so that the angular position of the capsule 24 is fixed with relation to the body 21. An upwardly facing surface 30 which comprises a portion of a sphere is formed on the base 25, and a light-sensitive sheet, for example, a photographic film 31, is fixed on this surface 30. A ball 32 having a luminous coating rolls freely on the sheet 31. The ball 32 may conveniently be coated with luminous paint which will admit rays affecting the photographic-sheet 31, or the ball may be coated or formed of material having radio-active proper-

ties such as will affect the light-sensitive sheet 31.

The "speed" of the photographic sheet may be so chosen that the light or other rays emitted from the surface of the ball 32 affect it to an appreciable extent only after an elapse of considerable time. Accordingly, the ball 32 may be placed within the capsule 24, the capsule inserted within the recess 22 and the retractable device 16 as a whole run into the interior of the drill collar 13 on a wire line before the ball makes any permanent record on the sheet 31. The retractable assembly 16 assumes the inclination of the drill collar 13 within the bore hole, and this inclination and its direction are known from previously run surveys. Any appreciable inclination of the hole causes the ball 32 to roll to the "low side" of the sheet 31. The ball remains in that position while the punch core is being taken and sufficient additional time is allowed to elapse to insure that the ball shall leave a spot on the film which will show clearly after the film has been developed. The spot indicates the low side of the hole at the time the punch core was taken.

The core-receiving tube 33 is connected to the lower end of the body by means of threads 34 and is provided with a cylindrical cutter 35 at its lower end. A radially extending marking pin 36 is provided on the tube 33 near the cutter 35 so that a scratch mark is formed on the core as it enters the bore 37 of the tube 33. Relief openings 38 may be provided to permit escape of any fluids trapped in the interior of the tube when the core enters.

The upper end of the support tube 17 is threadedly connected at 39 to the latch body 40. A latching lug 42 is pivotally carried on the latch body at 43 and is adapted to extend under a shoulder 44 fixed relative to the drill string 11. A pull bar 45 is slidably mounted relative to the latch body 40 and carries a cross-pin 46 operable in an angularly disposed slot 47 provided in the latching lug 42. When the knob 48 on the upper end of the pull bar 45 is engaged by the overshot 49 and lifted vertically, the pull bar 45 moves upwardly relative to the latch body 40, causing the cross-pin 46 acting in the slot 47 to retract the latching lug 42 so that it no longer underlies the stationary shoulder 44. Continued upward movement of the overshot 49 serves to retract the entire device 16 through the drill string 11. The overshot 49 may be carried on the end of a wire line operated in a conventional manner.

In operation the retractable core barrel assembly 16 is latched into position at the lower end of the drill string with the punch core tube 33 projecting from the lower end of the bit 14. The drill string 11 is then lowered to bring the cylindrical cutter 35 into contact with the formation at the bottom of the well bore, and the weight of the drill string punches the core tube 33 into the formation, causing a core to be received within the bore 37 of the tube 33. The assembly is then unlatched from the drill string and withdrawn on a wire line as described above. The core is marked by means of the pin 36, and the spot on the film 31 left by the ball may then be used to calculate the orientation of the core. In order to be sure that the ball 32 has left a spot of adequate intensity on the sensitized film 31, it is only necessary to allow the required time interval to elapse before withdrawing the assembly 16 from the drill string 11.

Having fully described our invention, it is to be understood that we do not wish to be limited to the details herein set forth, but our invention is of the full scope of the appended claims.

We claim:

1. In a device insertable and retractable through a drill string for taking a punch core from a well bore and for indicating orientation of the core, the combination of a retrievable core barrel assembly adapted to be lowered from the surface through the drill string; means for latching the core barrel assembly relative to the drill string at a location near its lower end; means carried on the retrievable core barrel assembly for providing a record of the inclination of the core barrel assembly in latched position, said means comprising a ray-emitting ball adapted to roll upon a sensitized sheet fixed relative to said assembly; a core-receiving member on the core barrel assembly adapted to take a punch core upon lowering of the drill string; means in predetermined fixed circumferential relation to said sensitized sheet for marking said core and means for unlatching and withdrawing the core barrel assembly and core upwardly through the drill string.

2. In a device insertable and retractable through a drill string for taking a punch core from a well bore and for indicating orientation of the core, the combination of a retrievable core barrel assembly adapted to be lowered from the surface through the drill string; means for latching the core barrel assembly relative to the drill string at a location near its lower end; a capsule removably mounted on the retrievable core barrel assembly in fixed angular relation with respect thereto; the capsule providing a chamber; a ray-emitting ball in the chamber adapted to roll upon a sensitized sheet fixed on the capsule for providing a record of the inclination of the core barrel assembly in latched position; a core-receiving member on the core barrel assembly adapted to take a punch core upon lowering of the drill string; means in predetermined fixed circumferential relation to said sensitized sheet for marking said core and means for unlatching and withdrawing the core barrel assembly and core upwardly through the drill string.

3. In a device insertable through a drill string for taking a punch core from a well bore and for indicating orientation of the core, the combination of a retrievable core barrel assembly adapted to be lowered from the surface through the drill string; means for latching the core barrel assembly relative to the drill string at a location adjacent its lower end; means carried on the retrievable core barrel assembly for providing a record of the direction of inclination of the core barrel assembly in latched position, said means including a ray-emitting gravity responsive member adapted to roll upon a convex sensitized sheet fixed relative to said assembly; a tubular member on the core barrel assembly adapted to extend below the lower end of the drill string so that a punch core may be taken by the member upon lowering of the drill string; means in predetermined fixed circumferential relation to said sensitized sheet for marking said core and means for withdrawing the core barrel assembly and core upwardly through the drill string.

4. A capsule adapted to be removably secured to a retrievable core barrel assembly, comprising in combination: a housing having an aligning

element to be removably attached in fixed angular relation on the core barrel assembly, the housing providing a chamber, and a ray-emitting ball in the chamber rolling upon a sensitized sheet fixed in the housing.

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