Jan. 2, 1951 L. C. MILLER 2,536,303

APPARATUS FOR TAKING ORIENTED CORES IN EARTH FORMATIONS

Filed Aug. 31, 1946 2 Sheets-Sheet 1

Fig. 1.

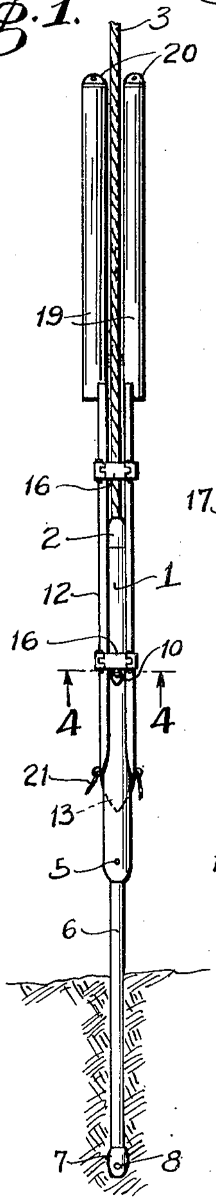

Fig. 2.

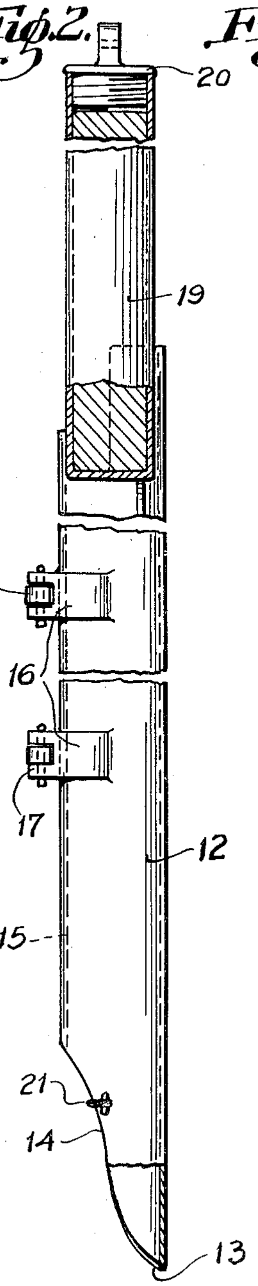

Fig. 3.

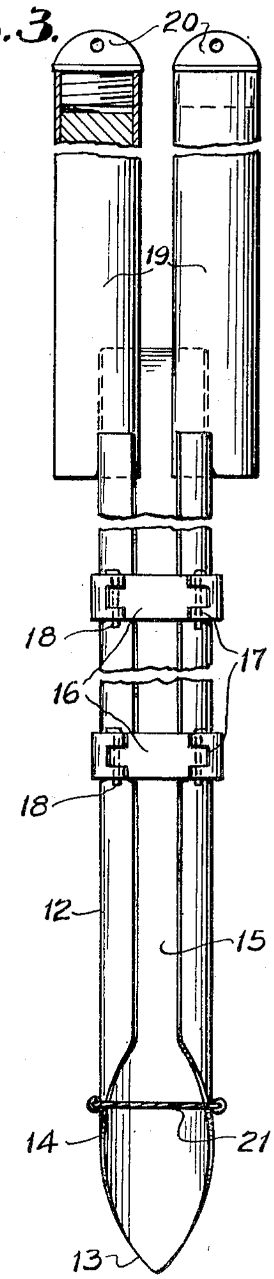

Fig. 4.

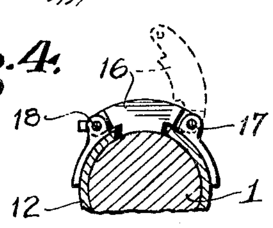

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Fig. 5.

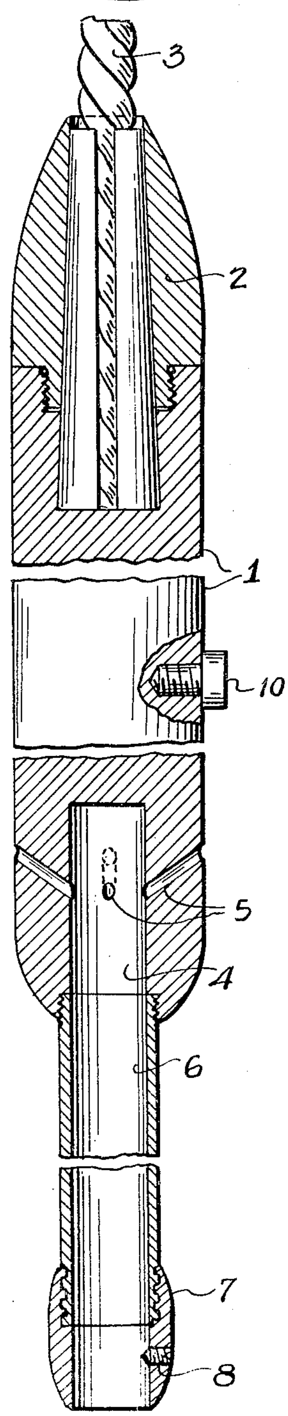


Fig. 6.

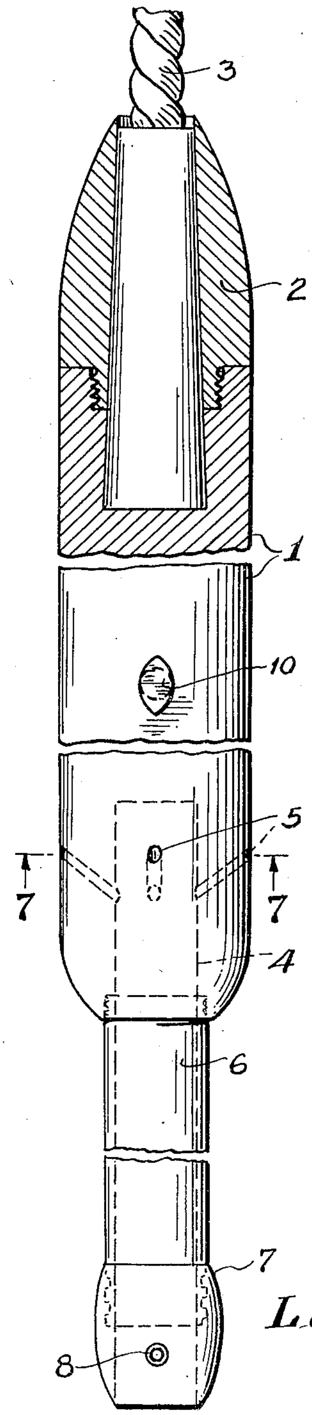


Fig. 7.

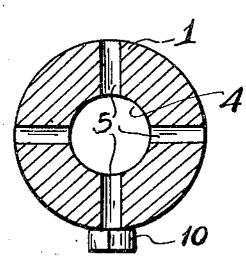
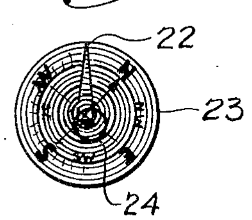


Fig. 8.



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APPARATUS FOR TAKING ORIENTED CORES IN EARTH FORMATIONS

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9 Claims. (Cl. 255—1.4)

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This invention relates to a device for obtaining oriented cores in the earth either in exposed formations at the surface of the earth or in submarine formations or in bore holes, and is particularly adapted for the taking of punch cores. However, the principle and device herein disclosed are also applicable to the taking of rotary cores in deep bores.

This invention relates generally to devices for taking cores so that they may be oriented, which methods and devices provide upon the core taker a mark or stylus which marks the core as it is taken and also records the vertical inclination of the axis of the core and at the same time records the azimuthal direction of the marker and therefore the mark formed on the core. Thus, when the core is recovered the mark on the core may be oriented azimuthally and also the axis of the core may be oriented vertically, thus setting the core into the position in which it was taken in the earth. The strata in the core are therefore oriented and the angle of the dip of the plane of the strata and the direction of the dip and strike of the strata may be determined.

It is an object of my invention to design an improved device employing such procedures.

It is a further object of my invention to devise simple and accurate apparatus for the taking of punch cores either in the earth formations or in submarine formations so that such cores may be simply taken and accurately oriented.

In my device a punch core bit is driven into the earth with sufficient force to drive a core into the core receiving chamber of the core bit. A marker or stylus upon the core taker makes a mark upon the core as it is taken. An orienting device is then slid over the core taker and axially aligned therewith. The orienting device records the vertical inclination of the axis of the core taker and also the deviation from north of the marker and therefore of the mark upon the core.

This invention will be further described in relation to the drawings, in which

Fig. 1 shows the position of the core cutter in the earth in core taking position with the recording device in place to orient the core;

Fig. 2 is a side view, partially in section, of the orienting sleeve;

Fig. 3 is a side view of Fig. 2;

Fig. 4 is a part section taken along the line 4—4 of Fig. 1;

Fig. 5 is a vertical part section through the core taking device;

Fig. 6 is a side view in part section;

Fig. 7 is a section taken along the line 7—7 of Fig. 6; and

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Fig. 8 is an illustration of the orienting picture taken by the orienting device shown in Figs. 2 and 3.

The core cutter shown in Figs. 5 and 6 is composed of a rod 1 of considerable weight carrying a central bore 4 and cross bores 5.

A core receiving tube 6 is screwed into the rod 1 to form a continuation of the bore 4. Tube 6 carries a core cutter head 7 which in turn carries a marking stylus formed of a pointed screw 8. Mounted upon the body of the rod 1 is an oval-shaped boss in the form of a screw head 10 so aligned that the axis of the oval is in line with the point of the screw thread 8 and said line is parallel to the axis of the core receiving tube 6. The upper end of the rod 1 carries a rope socket 2 into which is fitted rope 3. The orienting device shown in Figs. 2 and 3 is an overshot formed of a tubular section 12 of such diameter as to make a snug but easy sliding fit with the exterior of the rod 1. The tube carries a pointed or beveled end 13 formed with a curved section 14 and a slot 15 having a width only slightly more than the width of the minor axis of the oval headed screw 10, allowing for the passage of the screw 10 in the slot 15, but snug enough to hold the slot in proper position as is explained below.

The tubular section 12 carries gates 16 pivoted at 17 and latched at 18. At the upper end of the tube 12 are two cylindrical chambers 19 mounted so that their axes are parallel to the axis of the tube 12 and parallel to the center line of the slot 15. The chambers 19 are covered by covers 20. The chambers 19 are of identical construction and equal weight. One of the chambers 19 receives an orienting device such as commonly employed in oil well orienting practice, known generally in the art as "single shots." Such devices are essentially a means for determining the vertical and azimuthal variations of the axis of the bore and may generally be described as composed of a camera which takes a picture of a pendulum or inclinometer and of the azimuthal orientation of the plane of maximum inclination. The pendulum is in association with the compass card and enclosed in a chamber with a window. Upon taking any position the pendulum moves in the direction of plane of maximum inclination and when photographed through the window in relation to a compass chart the azimuthal deviation of the axis of the bore and its vertical inclination are determined. This is well known and understood in this art. Such devices are now commercially available and widely used.

Such a device is placed in one of the chambers 19 and the other chamber is weighted with a weight equal to the weight of the single shot so that the total weight of the chamber plus the single shot in one of the chambers is equal to the total weight of the other chamber plus the added weight in such other chamber. This produces an equally balanced structure.

To take an oriented core the rod 1 suspended on line 3 is allowed to descend in free-fall into the earth, thus driving itself into the earth. Instead of taking the core by free-fall, the coring device may be lowered on rods or pipe and driven into the formation by jars, such as cable tool jars. It may be lowered through pipe set in the formation or if the core is taken in submarine bottoms, a tube may be lowered from a boat, and if desired the sand and ooze swept away by means of a jet and the core taker driven into the formation through the tube.

The device may also be used in a similar manner in taking punch cores in bores made in dry land. In such case the device is lowered into the bore. It may be driven into the earth by gravity or by means of jars or by the weight of rods or tubing on which it is lowered.

The earth core enters through the core cutter 7 into the core receiving tube 6 and at the same time as it is driven up to the core receiving tube 6 the pointed screw 8 makes a mark which is parallel to the axis of the tube 6. Since the line connecting the core marking stylus 8 and the major axis of the oval screw 10 is parallel to the axis of the tube 6, the mark is therefore parallel to this line and to the axis of the tube 6 and rod 1.

The single shot is introduced into one of the chambers 19 and a line mark placed upon the window, which mark constitutes a radius line of the chamber 19 parallel to the radius of tubular section 12 passing through the center line of 15. Such a mark is indicated as 22 on Fig. 8 which shows a compass card 23. The gates 16 are opened, the rope or rods, as the case may be are passed through slot 15; the gates 16 are closed, and the latch 18 set, and the string 21 is tied in position, as shown in Figs. 2 and 3, so that the rope is held in place. The orienting device is then allowed to slide down the rope or rods and over rod 1, which thus telescopes inside the tube 12. The beveled portion 13 permits the orienting device to rotate as it passes over oval head 10 and this oval head cuts the string 21 and enters into the slot 15, and the orienting device comes to rest with the point of the oval head underneath the lower gate 16, as illustrated in Fig. 1.

Instead of the oval boss 10 being in line with the marker 8, as described above, it may be at any angular displacement therefrom so long as the angular displacement is known.

In this fashion the slot 15, since it makes a close but sliding fit over 10, is oriented in line with the mark formed upon the core or at a known angular displacement therefrom when it is taken as described above, since the center line of the slot 15 is parallel to the major axis of 10. The single shot takes a picture of the compass card. Such a picture is shown in Fig. 8. The whole device is retrieved by pulling up on the rope 3.

To remove the core, the core head 7 is unscrewed from the tube 6. The tube 6 is unscrewed from the rod 1 and the core removed. Upon development of the picture taken by the single shot the relationship of the slot 15 and therefore the mark upon the core to north and the vertical inclination of the slot 15 and therefore of the axis of the core 6 are given, since the slot 15, when in the position shown in Fig. 1, is parallel to the axis of 6. An illustration of such record is shown in Fig. 8, wherein the center of the circle 24, i. e., the pendulum, indicates that that the axis of the chamber 6 was oriented at a vertical inclination of 4° and azimuthally E. 10° S., and the slot and mark were azimuthally oriented N. 45° W.

In this fashion the core may be oriented by placing the axis of the core at the vertical inclination of 4° directing the axis E. 10° S., as shown by the single shot and rotating the axis of the core so that the mark worn by the stylus 8 has the azimuthal position shown by the single shot, i. e., N. 45° W. The plane of the strata may then be determined by measuring the dip and the strike in the strata in the core thus oriented.

While I have described a particular embodiment of my invention for the purpose of illustration, it should be understood that various modifications and adaptations thereof may be made within the spirit of the invention as set forth in the appended claims.

I claim:

1. A coring device for taking oriented earth cores, comprising a core cutter head, a core receiving tube, a marking means in said coring device for marking the core, an orienting device comprising a tube having an internal diameter greater than the external diameter of said core receiving tube adapted to slide over the coring receiving tube, means for axially aligning the orienting device parallel to the axis of said core receiving tube, and means for determining the azimuthal relationship of said marking means and a position on said orienting tube.

2. A coring device, means for attaching said coring device to a line for lowering the core cutter to core cutting position, a cutter head, a core receiving tube, a marking stylus on the core cutter head, a guide on said core cutter, said guide being axially aligned with the axis of said core receiving tube, an orienting tube, an orienting device mounted on said tube, said tube being of internal diameter sufficient to permit the core cutter to telescope in said orienting tube, a slot in said tube parallel to the axis of said tube, said slot being positioned to permit the entry of said guide in said slot to axially align said tube with said core receiving tube.

3. A coring device, means for attaching said coring device to a lowering line, a core cutter head, a core receiving tube associated with said cutter head, a core marker on said coring device, an oval boss on said core cutter so positioned on the core cutter that the axis of said oval boss and the marker are on a line parallel to the axis of said core receiving tube, a telescoping tubular overshot of internal diameter sufficient to permit the telescoping of the coring device inside the tubular overshot, a chamber positioned on said overshot to receive an orienting device, a slot in said tubular overshot parallel to the axis of said tubular overshot and of a width sufficient to permit the entry of the oval guide and to orient said tube with said core receiving tube.

4. A coring device, means for attaching said coring device to a lowering line, a core cutter head, a core receiving tube associated with said cutter head, a core marker on said coring device, an oval boss on said coring device so positioned on the core cutter that the axis of said oval boss and the marker are on a line parallel to the axis of said core receiving chamber, a telescoping

tubular overshot of internal diameter sufficient to permit the telescoping of the coring device inside said tubular overshot, a chamber positioned in said overshot to receive an orienting device, a slot in said tubular overshot parallel to the axis of said tubular overshot and of a width sufficient to permit the entry of the oval boss and to orient said tubular overshot coaxially with said core receiving tube, said tube being beveled and curved at its end so as to slide over said boss to rotate said tube and permit the entry of said boss into said slot.

5. A coring device comprising a core cutter head, a core receiving tube, a core marking means on said cutter head, means for lowering said core receiving tube and core cutter head to coring position, an overshot having an internal diameter greater than the diameter of said core receiving tube and said lowering means, said overshot being slidable over said lowering means and over said core receiving tube, an orienting device mounted on said overshot, and means engaging both overshot and tube to axially align said core cutter head and said tubular overshot and to orient said marking means.

6. A coring device comprising a core cutter head, a core receiving tube, a core marking means on said cutter head, a guide on said core receiving tube, means for lowering said core receiving tube and core cutter head to core cutting position, a tubular overshot adapted to slide over said lowering means and having an internal diameter greater than the external diameter of said core receiving tube and adapted to slide over said core receiving tube, a chamber mounted on said overshot to one side of the axis of said overshot, the axis of said chamber being parallel to the axis of said tubular overshot, said chamber being adapted to receive an orienting device.

7. A coring device comprising a core cutter head, a core receiving tube, a core marking means on said cutter head, a guide on said core receiving tube, means for lowering said core receiving tube and core cutter head to core cutting position, a tubular overshot adapted to slide over said lowering means and having an internal diameter greater than the external diameter of said core receiving tube and adapted to slide over said core receiving tube, a chamber mounted on said overshot to one side of the axis of said overshot, the axis of said chamber being parallel to the axis of said tubular overshot, said chamber being adapted to receive an orienting device, and a balancing chamber mounted on the opposite side of said axis.

8. A coring device, means for attaching said coring device to a lowering line, a core cutter head, a core receiving tube associated with said cutter head, a core marker on said coring device, a boss on said coring device so positioned on the core cutter head that a line connecting said boss and the marker is parallel to the axis of said core receiving chamber, a telescoping tubular overshot of an internal diameter sufficient to permit the telescoping of the coring device inside said tubular overshot, a chamber positioned on said overshot to one side of the axis of said overshot, a balancing chamber positioned on the other side of said axis, said first mentioned chamber adapted to receive an orienting device and said balancing chamber adapted to receive a balancing weight, and a slot in said tubular overshot parallel to the axis of said tubular overshot and of a width sufficient to permit the entry of said boss and to orient the tubular overshot coaxially with said core receiving tube, said tube being beveled and curved at its end so as to slide over said boss to rotate said tube and permit the entry of said boss into said slot.

9. A coring device, means for attaching said coring device to a lowering line, a core cutter head, a core receiving tube associated with said cutter head, a core marker on said coring device, a boss on said coring device so positioned on the core cutter head that a line connecting said boss and the marker is parallel to the axis of said core receiving chamber, a telescoping tubular overshot of an internal diameter sufficient to permit the telescoping of the coring device inside said tubular overshot, a chamber positioned on said overshot to one side of the axis of said overshot, a balancing chamber positioned on the other side of said axis, said first mentioned chamber adapted to receive an orienting device and said balancing chamber adapted to receive a balancing weight, and a slot in said tubular overshot parallel to the axis of said tubular overshot and of a width sufficient to permit the entry of the boss and to orient the tubular overshot coaxially with said core receiving tube, said slot extending throughout the length of said overshot and being sufficiently wide to pass over said lowering line, and a gate positioned on said overshot over said slot, said tube being beveled and curved at its end so as to slide over said boss to rotate said tube and permit the entry of said boss into said slot.

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