Feb. 14, 1933. A. G. H. STRAATMAN 1,897,871

APPARATUS FOR THE ORIENTATION OF DRILL CORES

Filed Jan. 19, 1928 2 Sheets-Sheet 1

FIG.1.

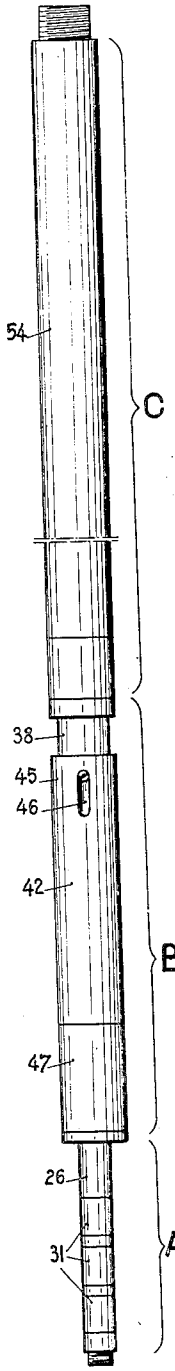


FIG.2.

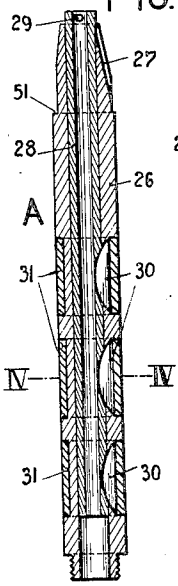


FIG.3

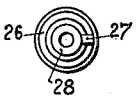


FIG.4.

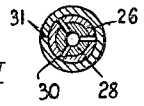


FIG.6.

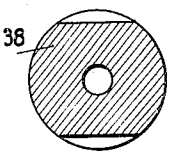


FIG.5.

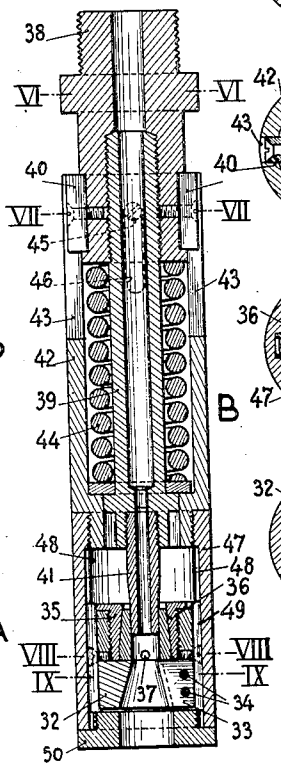


FIG.7.

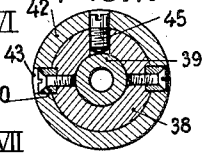


FIG.8.

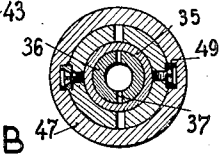
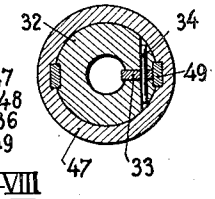


FIG.9.



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APPARATUS FOR THE ORIENTATION OF DRILL CORES

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FIG.10

FIG.11.

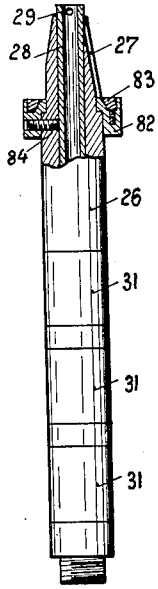


FIG.13.

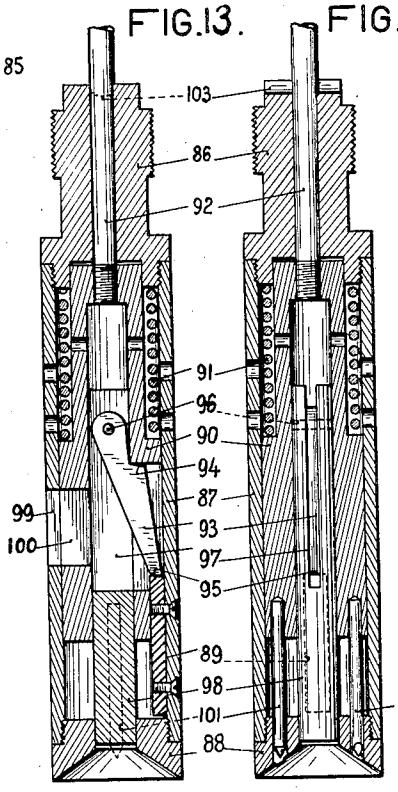


FIG.14.

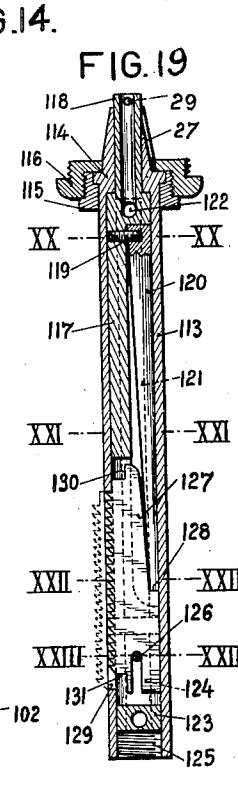


FIG.19

FIG.15.

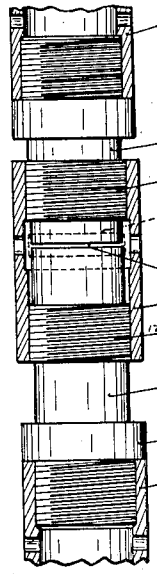


FIG.16.

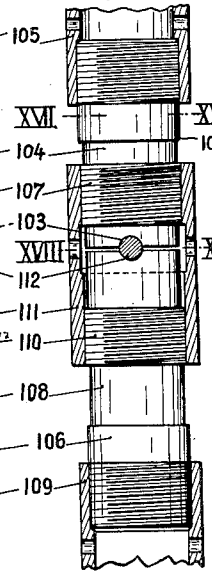


FIG.12. FIG.20 FIG.21.

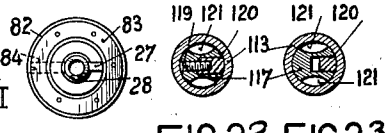


FIG.17.

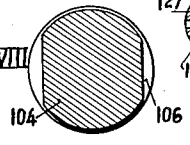


FIG.22. FIG.23.

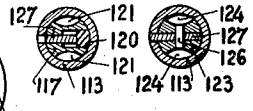


FIG.24.

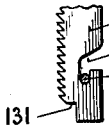
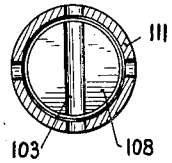


FIG.18.



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Attys.

Patented Feb. 14, 1933

1,897,871

UNITED STATES PATENT OFFICE

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APPARATUS FOR THE ORIENTATION OF DRILL CORES

Application filed January 19, 1928, Serial No. 247,992, and in the Netherlands February 14, 1927.

This invention relates to apparatus for the orientation of drill cores.

When drilling deep holes it is of importance to know the position of the strata in respect to the meridian, which would be done in a simple manner if it were possible to bring a drill-core up to the surface without rotating it about its axis. The string of drilling and fishing tools itself being subjected, however, to torsion as soon as it has to exert any appreciable force at the bottom and the string being generally of great length, this torsion makes the orientation of the core brought up most uncertain.

It has been suggested that marks be made on the top of the core before it is drilled out, showing a certain position in respect to the meridian, but there is a considerable element of uncertainty in such marking, because the rock has an irregular surface which is often covered with detritus and, therefore, not in contact with the marking device, or else it is broken while the core is being drilled out and so damaged that the marks are obliterated. Finally, even though rotatory forces at the bottom of the drilling string be avoided as much as possible, if the hole deviates from the perpendicular and is of considerable depth torsion may nevertheless occur, destroying all hopes of the observation being accurate.

The present invention aims at orientation of the drill-core with a great degree of certainty.

To this end the core is provided with indicating means that is not dependent upon the surface of the rock and which may consist of a distinctive mark made in a hole drilled in the core itself, for instance by making an incision, or it may consist of a drilling bit or an expansible plug, cylinder or such like object driven into a hole in the core and remaining there while the core is being drilled out and brought up to the surface.

There are various ways of orientating this distinctive indicating means. For instance in this invention the core can be orientated by means of a system of couplings and rods with locking means which are free from torsion and connected with the apparatus that is to make or has made an incision in the core. The indicating means driven into the core can also carry another object upon which an indication can be made (or which itself may make an indication), so that by means of a specially constructed string of drilling rods protected against torsion and run into the hole or well the orientation of the indicating means can be transmitted to the surface before the core is drilled out and brought up to the well mouth.

The invention will now be described with reference to the accompanying drawings, by way of example, in which:—

Figure 1 gives an outside view of three main parts which act together and are fixed to the bottom end of a special string of rods for orientation purposes.

Part A shows an indicating means for orientation which is driven into a hole in the core. A longitudinal section is given in Figure 2, a top view in Figure 3 and a cross section in Figure 4. It will have to carry a drill or bit at the bottom (not shown in the illustration).

Part B, the second part, is a holder for the indicating means and is shown in longitudinal section in Figure 5. Figures 6–9 incl. are cross sections of this holder.

Part C is a measuring and recording apparatus which, by means of photographic apparatus and a mercury level, indicates the direction in which the well deviates from the perpendicular in respect to the orientation marker (part A), which as long as it is coupled to parts B and C has a known position in respect to these two bodies. Part C is screwed onto a special string of rods for orientation purposes. After part A is driven into a hole in the core which is to be drilled out later, the deviation from the perpendicular in respect to this orientation marker is registered photographically. Part A is then disconnected from part B, the latter being pulled up with part C and replaced by the core-drill. This orientation can thus be made before the core is drilled. From the recordings then available a conclusion can be drawn as to the exact position of the strata.

Figure 10 is a ring which can be placed in the bottom of the holder shown in Figure 5, and Figures 11 and 12 illustrate an indicating means similar to that in Figure 2 but provided with an indicating disc which is temporarily covered by the ring in Figure 10 and upon which impressions are made later by a centre-punch by means of the apparatus shown in Figures 13 and 14 in longitudinal sections.

Figures 15–18 are couplings of orientation rods or tubes which have to carry down into the hole the centre-punch apparatus of Figures 13 and 14 or some other device for orientation. The position of this string of rods or tubes, which is calibrated for torsion, has to be orientated at the surface.

Figures 19 to 24 give respectively a longitudinal section, four cross sections and a detail of a tool which makes an incision in a hole in the core. This tool can be fixed to the instrument C in such a manner that its position is known, or directly to the special string of rods.

Referring now to Figures 1 to 4 these show the construction of an indicating means, in which: 26 is a thick tube with conical head in which a key-way 27 is cut; inside this tube is a loosely fitting inner pipe 28 with diametrically opposite holes 29 in the upper end protruding beyond the conical head of the outer tube. Nine segmental key-plates 30 lie in milled grooves cut into both the outer tube 26 and the inner tube 28. These key-plates are held in by rings 31 pressed into wide annular grooves on the outside of the outer tube 26. A drill or bit can be screwed into the bottom end of tube 26, and flush liquid can be passed through the inner tube 28. After the drill has made a hole in the rock which is to be drilled out later as a core, the inner tube 28 is forced downward, thereby causing the key-plates to bend and expand the rings 31 outward until they are jammed up tight against the wall of the hole, so that the whole device A (Figure 2) remains stuck in the core. The key-way 27 then serves for orientation.

When the hole is being drilled in the core, the indicating means A is joined to the holder B, for which purpose the latter has a conical hole in the slide 32 and a key-plate 33 which is fixed with two pins 34. A conical ring 36 is held in the slide by a screw 35 and has holes 37 corresponding to those 29 in the tube 28 of tool A. After the head of tool A has been inserted in the slide 32 of the holder B, a brass pin is passed through holes 29 and 37; further on it will be shown how this pin is broken in order to disconnect A and B.

The other parts of the holder B comprises: a hollow threaded coupling 38; in that coupling a threaded supporting tube 39; two guide-keys 40 screwed onto the coupling; a small tube 41 screwed into the bottom of the supporting tube 39 and acting as a drift; an outer slide 42 with grooves 43, by means of which it is passed over keys 40; a strong spring 44; an adjusting screw 45, used when placing the spring in the holder, and moving in a slot 46; an extension piece 47 of the outer slide, with key-ways 48 on the inside for keys 49, which are fastened on to the inner slide 32; finally the centring ring 50.

The holder B and the orientation indicating means A therefore have a continuous channel through their centre for the passage of flush-water to the drill. While drilling (with the drill attached to the bottom of A) care is taken that the spring 44 is not forced in; the rotatory force is transmitted by the keys 40 and 49, which also prevent the orientation of the key-way 27 of body A from being changed in respect to the other parts connected with the holder B, such as the apparatus C.

As soon as a hole has been drilled deep enough in the core that is to be drilled out later, the drill-pole is driven downward with great force. At the same time the cylindrical drift 41 forces down the inner tube 28 of tool A, breaking the pin which had been passed through the holes 29 and 37; the key-plates 30 are pressed outwards, and the metal rings 31 are jammed tightly against the rock. As the slide 32 continues to bear upon the cone and the centring ring 50 upon the shoulder 51 of part A, the spring 44 is compressed. The drift 41 enters the conical ring 36, into which it is jammed down tight. When the drill-pole is drawn up then the centring ring 50 at first continues to bear on the shoulder 51 owing to the force of the spring 44, but later the drift 41 fixed in the conical ring 36 takes that ring with it; this ring holds the drift still tighter because the screw 35 is also conical on the inner side, so that the slide 32 is forcibly carried upwards and freed from the conical head of the orientating device A. Finally also the pressure of ring 50 may be removed from A, which latter body remains fast in the future drill-core. The drill-pole can then be drawn up and fitted with a core-drill.

Before the connection is broken between A and B, the orientation and measuring instrument C is set in working for recording the inclination of the bore-hole.

Since the parts A, B and C affixed to the end of the drill-rods have a certain fixed position in respect to each other and no measurable error can arise through torsion, the orientation of the core in respect to the direction in which the well deviates from the perpendicular can be made absolutely accurately.

As already stated, the orinetation marker shown in Fig. 2 gives the desired indication of position by means of the key-way 27. Use is made of special orientation rods run into the hole, it then being known that the orientation of the bottom end of those rods corresponds to that of the visible end at the sur-

face. At the end of these rods an automatic punch too can be run down to make a certain orientation mark or marks on the object fixed in the core below.

For this purpose a tool similar to that in Fig. 2 is provided with a collar (82) (Figs. 11 and 12) in which is cast a soft metal ring 83; a screw (84) ensures its being held in the right position. The ring 50 at the bottom of the holder B is then replaced by a centering ring 85 (Fig. 10) which covers the leaden ring (83) in the collar of A and, when the connection between A and B is broken, transmits the pressure of the spring 44. The head of this tool (Fig. 11) and the expansible rings 31 correspond to those in Fig. 2. As will be understood, the use and purpose of the ring 85 are similar to those of the ring 50. The difference between the two rings 50 and 85 lies in the latter being provided with a recess at its lower end which is clearly shown in Fig. 10 and in which the upper end of the collar 82 fits, the soft metal ring 83 being thus better protected. Further the ring 85 in substantially the same way as the ring 50, centers the device shown in Fig. 11 in the lower end of the part B and presses the said device down by acting on the collar 82 under the influence of the spring 44 during the last stage of disconnecting A and B.

After the tool shown in Fig. 11 has been forced into the core, a round hole and a square centering hole are punched in the soft metal ring 83 by means of the tool shown in Figs. 13 and 14.

The coupling 86 (which will be described further in connection with Figs. 15–18) carries a tube (87) provided at the bottom with a centering cone (88). A guide (89) is screwed on the inside of this tube. The tube 87 also carries inside it a slide (90) upon which a spring (91) rests. This spring has a great tension owing to the slide 90 being drawn up by the draw-rod 92 before the apparatus is coupled to the rods shown in Figs. 15–18, whereupon pawl 93 is placed with its end 95 on guide 89. The draw-rod has to be unscrewed from slide 90 and put aside before the percussion tool is coupled to the rods of Figs. 15–18. When the draw-rod 92 is released, slide 90 engages in the tooth 94 of the pawl 93. This pawl turns on a pin (96) in a slot (97) cut in a central rod (98), and is accessible from the outside by means of the slots 99 and 100 cut in the tube 87 and slide 90 respectively. The slide 90 carries a center-punch (101) with a round cone-shaped point and another center-punch (102) with a square-faced conical point. These punches are diametrically opposite one another and their position is invariable in respect to the groove 103 at the top of coupling 86, which serves for the orientation of the apparatus with the measuring and percussion rod run into the well.

In the position shown in the drawings the bottom end (95) of the pawl 93 is resting against the guide 89, the pawl in turn supporting the slide 90 by means of its notch 94, thereby compressing the spring 91. When the apparatus is lowered into the hole until the central slide-rod 98 comes to rest upon the head of the orientation tool of Fig. 11, then this rod, carrying the pawl pin 96, takes up a higher position in the tube 87 and the end of the pawl (95) is released from the guide block 89. The notch in the pawl (94) is then no longer able to hold up the slide 90 because the position of that notch in respect to the axis 96 deprives the pawl of its stability. Thus, owing to the pressure of the spring, the pawl is forced into the slot 97 and the center-punches are knocked downward, making their marks in ring 83 of the apparatus in Fig. 12.

After the apparatus has been drawn up again it can be disconnected from the drill-rods. The draw-rod 92 is screwed into the slide 90, the latter drawn up and the pawl 93 again set in position as indicated in the drawings, after which the apparatus is ready for use again.

The complete couplings shown in Figs. 15–18 make it possible to orientate above ground an apparatus like that in Figs. 13 and 14 while it is in the well.

A coupling piece (104) is screwed permanently into tube 105. Wrench faces (106) serve also to check the proper coupling of two measuring rods (tubes) mutually. Part 104 has a rather coarse thread (107), say 10 threads per inch. The other coupling piece (108) is permanently screwed into measuring rod (or tube) 109 and is longer than 104. Part 108 has a finer thread (110), say 12 threads per inch. The two parts 104 and 108 are connected together by a collar (111) with corresponding threads; thus this collar works as a differential screw drawing the two couplings together when turned. The front face of each coupling has a cylindrical groove (103)—compare Figs. 13 and 14—in which a small cylindrical rod is placed which not only takes up to the pressure exerted by the collar but also provides particularly for the measuring tubes 105 and 109 being coupled together in such a way as to prevent any measurable error arising from a possible rotation of one tube in respect to the other. In this manner, therefore, an "orientating" coupling is obtained. When the coupling collars are unscrewed the two couplings are parted and the collar finally drops over the long neck of coupling 108, enabling the small rod (112) to be removed. Of course it is evident that every measuring tube has a coupling like 104 at one end and another like 108 at the other end, the latter coupling corresponding to that shown at 86 in Figs. 13 and 14.

The marking tool shown in Figs. 19–23

(Fig. 24 shows the toothed part of such an apparatus made in a different way) is similar to the tools of Figs. 2 and 11 in that from its top protrudes the end of a tube with holes (29) and a conical head with key-way (27), which head forms one whole with the tube 113 serving as casing for the mechanism. This apparatus can be suspended at the bottom of the holder B by means of the collar 114, nut 115 and the screw cap 116, which latter fits into the bottom of holder B. Into the bottom end of tube 113 a drill can be screwed. Inside tube 113 is a movable fork-like slide (117) with its top end at 118 cylindrical, in which the holes 29 already mentioned are made. This fork-like slide ends just below the cross section XXII in Fig. 19. A spring (120) is affixed to the forked slide by a screw (119). In the fork there are longitudinal grooves (121) and a diametrical hole (122) for the flush liquid, which passes down via another fork-shaped piece 123 (feed-piece) likewise provided with longitudinal grooves (124) and a T-shaped hole (125) conducting the flush liquid to the drill. The feed-piece (123) rests upon the drill-stem (not shown) and contains the pin 126 (breakable) which carries the saw-like instrument or incisor 127. In the back of this saw blade a notch (128) is made to engage the spring 120, which at first exerts pressure upon the saw. The saw edge is contained in the slot 129 of the tube 113 and has a notch at each extremity (130 and 131) to allow the toothed part to be forced out of the slot a certain distance only (the position indicated by the dotted lines).

When the cylindrical end 118 is knocked downward, in the manner described in connection with the corresponding tube 28 in part A, while the tube 113 is in the hole drilled in the core, then the slide 117 is also driven down, causing the spring 120 to push down the saw-blade, thereby breaking the pin 126. Finally the saw blade knocks against the bottom of the fork of the feed piece 123, while also the legs of the slide 117 knock against the forked end of the feed piece 123. At the same moment the saw blade has reached such a position that the notch 130 allows the spring 120 to force the toothed edge out of the slot 129. As soon as the saw is ready to make an incision in the core, its position is registered in the instrument C for orientation later. On the tube 113 being drawn up by the holder B, the teeth of the saw cut a groove in the core (in the wall of the hole drilled in the latter) which groove is not obliterated and is easily orientated. When the holder B is drawn up, the slide 32 disengages from the key-way 27 in the manner already described, consequently the saw edge can follow its course without being affected by rotary forces, whilst, moreover, its saw-like shape does not allow of its changing its direction once it has been forced outwards from the slot in the tube. This position of the saw in respect to the instrument C can be determined by means of the key-plate 33 in the holder B.

Fig. 24 is another type of saw (132) which has a hook-shaped notch (133) to engage the pin 134, which latter need not be broken but remains fixed in the feed-piece 123. As soon as this type of saw is forced down far enough, it disengages from the pin 134 and is forced outwards by the action of the spring 120.

A closer study of these methods of working, given here as examples, will show in the first place that several details can be altered. For instance the indicating means left in the core for orientation purposes may be different both as regards shape and construction (Figs. 2, 11), and the nature of the mark made in the core may also be different (incision made by the apparatus of Fig. 19 or by any other similar aparatus). Instead of using a marking disc as shown in Figs. 11 and 12 together with a centering apparatus (Figs. 13 and 14), the disc itself could have centering pins fitted into it with their points upward, upon which a leaden disc could be lowered at the end of rods as in Figs. 15 and 16. Thus it will always be possible to get reliable data for orientation without being dependent upon the surface features of the core, any deposit thereon, or any changes in that surface during the drilling of the core.

The manner in which an orientation body is fixed into the core may be varied, several constructions being possible according to the nature of the rock. Again instead of using a percussion rod to operate the outward-expanding parts, a draw-rod or wire may also be used. Also the rings (31) in Fig. 2 may be replaced by other pieces, e. g. claws or soft metal blocks.

Instead of the saw in Fig. 19, a sharp-edged roller might be substituted, or a number of such instruments making several marks in the rock may be used, provided their position is known at the time that the marks are made.

What I claim is:—

1. Apparatus for the orientation of drill cores comprising a system of couplings and rods with locking means which are free from torsion, and a saw-shaped cutting tool fixedly connected to the lower end of the rods and having its cutting edge substantially parallel with the longitudinal axis of the rods, for making an incision forming a mark in the wall of a hole concentric with the desired core, when the rods are moved in axial direction.

2. Apparatus for the orientation of drill cores comprising a system of couplings and rods with locking means, which are free from torsion, a hollow drill-holder connected to the lower end of the rods, a connection for a drill at the lower end of the drill holder, a

spring, a cutting-tool within the drill holder and adapted to emerge through an opening in the side wall of the said holder under the action of said spring, and a breakable element for maintaining the cutting-tool in its retracted position within the said holder.

In testimony whereof I have signed my name to this specification.

ALPHONS GERARD HUBERT STRAATMAN.