

May 19, 1931.

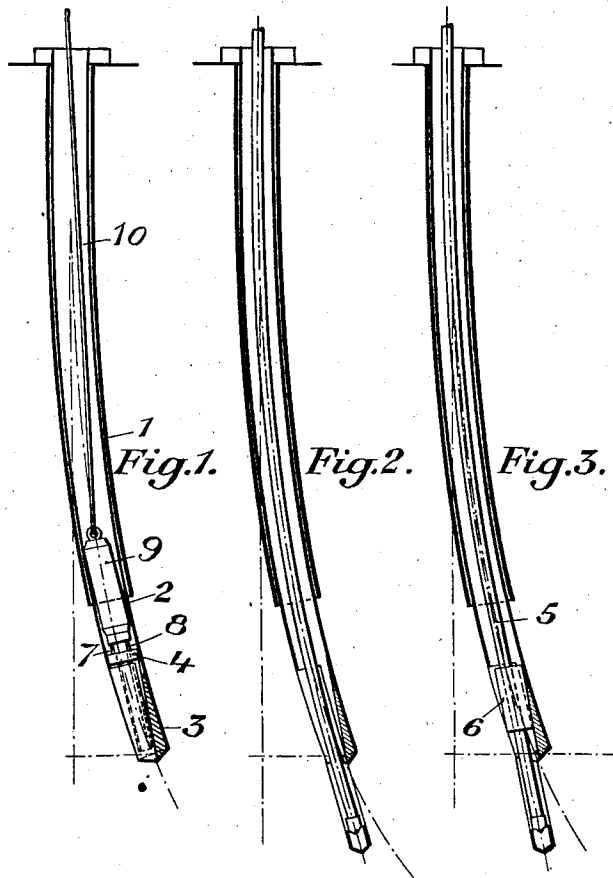
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1,806,509

METHOD OF ADJUSTING WELL HOLES

Filed Aug. 9, 1930

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FIG. 4.

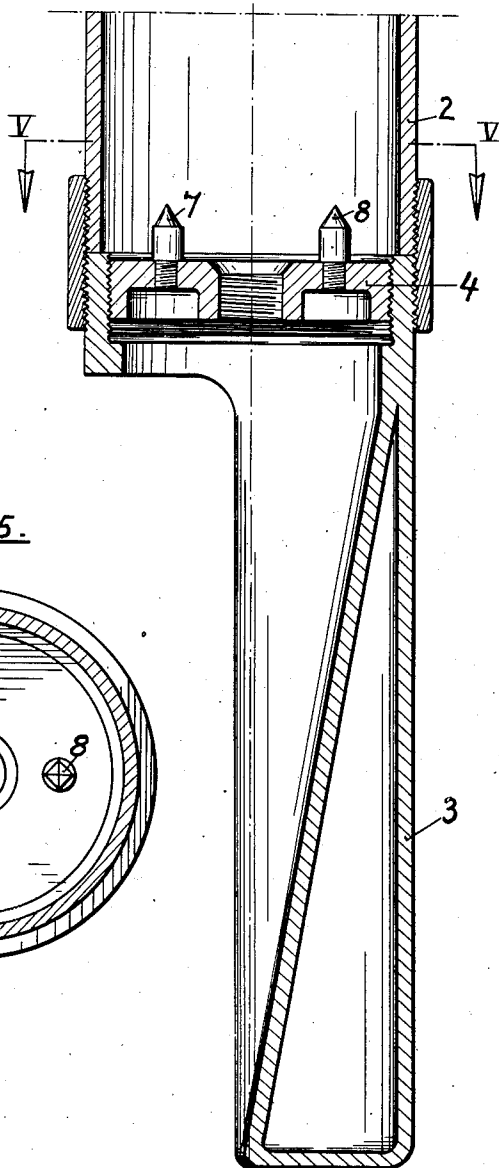
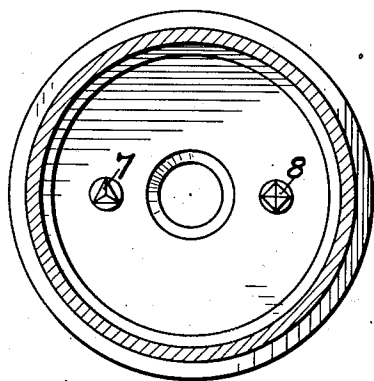


FIG. 5.



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# UNITED STATES PATENT OFFICE

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## METHOD OF ADJUSTING WELL HOLES

Application filed August 9, 1930, Serial No. 474,260, and in the Netherlands June 10, 1929.

This invention relates to a process and apparatus for straightening out bore-holes.

It is very important, especially when drilling deep bore-holes, e. g. when drilling for petroleum, that these holes coincide as nearly as possible with the vertical line. In practical application, however, the direction of the bore-holes generally deviates from this vertical and this invention provides a method and means whereby such a deviating hole can be brought back to the desired vertical direction.

It is known that by means of a whipstock a drill hole can be given a deviation from its original direction. There were, however, up to this date no practically useful method and means known to give this whipstock such a position as to force a slanting hole back into the normal or vertical line. Now this method and means are provided by the invention, which in principle consists in the orientation of a whipstock with regard to a clinometer. It is explained more fully with the help of the attached drawing, but is not at all restricted to the special form of embodiment here selected.

With these and other objects in view the invention consists in using the combination and arrangement of parts set forth below and shown in the drawings, in which

Figure 1 is a vertical cross-sectional view showing diagrammatically the parts in position for beginning the operation of straightening the drilled hole.

Figure 2 is a similar view showing the operation further advanced, and

Figure 3 shows a similar view with modified apparatus.

Figure 4 is a vertical cross-sectional view on an enlarged scale, showing some parts more in detail, and

Figure 5 is a horizontal cross-sectional view upon the line V—V in Figure 4 looking in the direction of the arrows.

In Figure 1, 1 represents a series of tubes constituting the casing of a bore hole, which it seems advisable to give another more vertical direction. There is inserted into this series of tubes another narrower, second series, to the lower end of which a whipstock 3 is at-

tached, preferably screwed thereto. It is not necessary to determine the position of this whipstock with regard to the points of the compass; the point is rather to give to its symmetrical plane such a direction that it coincides with the deviation plane of the drilled hole, which is the one over which the sectional view of Fig. 1 has been taken, in order to bring about a deviation of the bored hole in the desired direction. By deviation plane is meant a plane through the center line of the deviating bored hole at a certain place and the vertical line at such place. Furthermore, on the whipstock itself or by the aid of a separate element means are provided to orientate the whipstock with regard to a clinometer, e. g. an acid bottle. Since this orientation constitutes the essence of the invention, it will be explained herein more in detail.

In case the independent auxiliary element 4 shown in the drawing be employed, which afterwards may be pulled up separately by means of a gripping device, i. e. without the tube 2, and which is provided e. g. with one or several characteristic unevennesses 7, 8 or projections, which leave an impression on the lead bottom with which the mantle of the acid bottle is provided, the plane of symmetry of the whipstock can be determined in a relatively simple manner with regard to the plane of deviation, after which the position of the whipstock can eventually be corrected. For this determination it is necessary in the first place to know the position of the element 4 with regard to the whipstock. This position can be set when screwing or placing the whipstock and the auxiliary element on to the tube 2. Preferably this element is provided with two different marking elements 7, 8, which leave, each, a different impression (e. g. one element may be a triangularly shaped projecting part, the other one be a quadrangular projecting part) and which are arranged in a median line of the circular auxiliary element. This element may be screwed into the upper cylindrical extension of the whipstock by means of left-handed screw-thread, as shown in Fig. 4.

The median line of the element 4, provided with the marks 7, 8 is, when the apparatus is

mounted in the tube 2, made to coincide with the plane of symmetry through the whipstock, and a note is made as to which of the two projecting elements is nearest to the whipstock. Thereupon the tube 2 is inserted in tube 1 until the whipstock reaches the bottom; now the acid bottle 9 is let down into the bore-hole by means of a cable 10 until the bottom of the bottle strikes the marking elements 7, 8. These marking elements leave their impressions of triangular and quadrangular shape on said bottom, indicating a median line of this bottom, which is lying in the symmetrical plane of the whipstock. The acid within the bottle etches that part of the inner wall of it, which is situated beneath the liquid level, so that an elliptical line on this cylindrical inner wall between the etched and the non-etched part afterwards indicates the surface of the acid. As will be obvious, the longer axis of the ellipse will be situated in the deviation plane of the bore hole.

After the acid bottle has been pulled up to the ground surface, it clearly indicates the relative position of symmetrical plane of whipstock and deviation plane of bore hole, this position being the same as that of the median planes of the bottle over the marks and over the longer axis of the ellipse respectively. If the whipstock is well set, i. e. if its plane of symmetry coincides with the plane of deviation, the line running over the two impressions of the characteristic projecting parts and the longer axis of the ellipse, along which the surface of the acid is marked on the inner wall of the bottle between the etched and the non-etched part, lie in the same median plane of the acid bottle. Moreover the impression of the marking element situated nearest to the whipstock must be on that side of the longer axis of the ellipse which is nearest to the bottom of the acid bottle. If this is not the case, then the angle between the plane of symmetry and the plane of deviation is the angle between the median planes containing the marked center line and the longer axis of the ellipse respectively, so that the proper correction in the position of the whipstock can be made immediately by raising the tube 2 and displacing it by the desired angle. Then the auxiliary element is pulled up, which may be done by inserting a string of rods provided at its lower end with a screw-threaded head corresponding to the screw-threaded central hole of the element 4. After screwing the head into this hole, continued rotation of the string will unscrew the element 4 on account of its left-handed screw-thread, with which it is provided at its periphery. After taking away the auxiliary element a drilling chisel corresponding in size to the space between the whipstock and the opposite drill-hole wall is inserted and lowered. This chisel will assume a direction which differs from that of

the preceding drilling and especially will more nearly coincide with the vertical line than the former (Fig. 2). The bore-hole is then brought to the desired size in the customary way by means of a second drill or reamer, which follows the already drilled smaller hole. Generally the obtained change of direction will be small, which with regard to the introduction of the casing is desirable. By a periodical repetition of the described process the bore-hole can, after a certain depth has been drilled, be brought as near to the vertical line as may be desired, or may be made to coincide with it altogether.

The whipstock serves only for guiding a relatively small drill, whereby the same can be damaged only slightly.

It is evident that the described process may be altered in various ways without deviating from the principle of the invention. As has already been observed, any suitable clinometer may be used, provided it can be orientated according to the principle of the invention with regard to the whipstock. Also the method of orientation itself may vary considerably, and e. g. instead of the described auxiliary element 4 any other element may be used, which can serve for indicating the position of the plane of symmetry of the whipstock. The whipstock may even be orientated without the help of an intermediate element directly by the clinometer, although in practice the use of the same will be preferred, since all parts necessary for the orientation may then be easily removed from the drill-hole. Finally, after setting the whipstock it is possible to continue drilling in a different way without deviating from the principle on which the invention is based. As an example in Fig. 3 a method is represented where the chisel or drill is fastened to a special boring rod 5, which rotates in a cylindrical guide piece 6, which may become wedged between the whipstock and the wall of the drill hole, whereby the damages to the whipstock may be restricted to a minimum.

Finally also the method may be employed where with a slanting drill-hole having a casing the casing tube has to be drilled through at a certain place and the drilling has to be continued from here in a different direction.

I claim:

1. Process for orientating a whipstock in a slanting bore hole to be deflected into a vertical direction, which comprises inserting in the bore hole a series of tubes provided at its lower end with a whipstock, recording the position of the plane of symmetry of the whipstock with regard to the deviation plane of the bore hole by means of a clinometer device and shifting the position of the whipstock by displacing its tubes by the desired angle in accordance with the record obtained.

2. Apparatus for orientating a whipstock comprising a whipstock connected to the lower end of a series of tubes and provided with a removable element for indicating the plane of symmetry of the whipstock and adapted to make an indication mark upon a clinometer device.

3. Apparatus according to claim 2, in which the removable element of the whipstock is provided with two projecting parts situated in the plane of symmetry of the whipstock and in a line perpendicular to the axis of the tubes carrying the whipstock, said projections being adapted to make differently shaped impressions into a relatively soft surface, such as in the bottom of a clinometer device.

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

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