

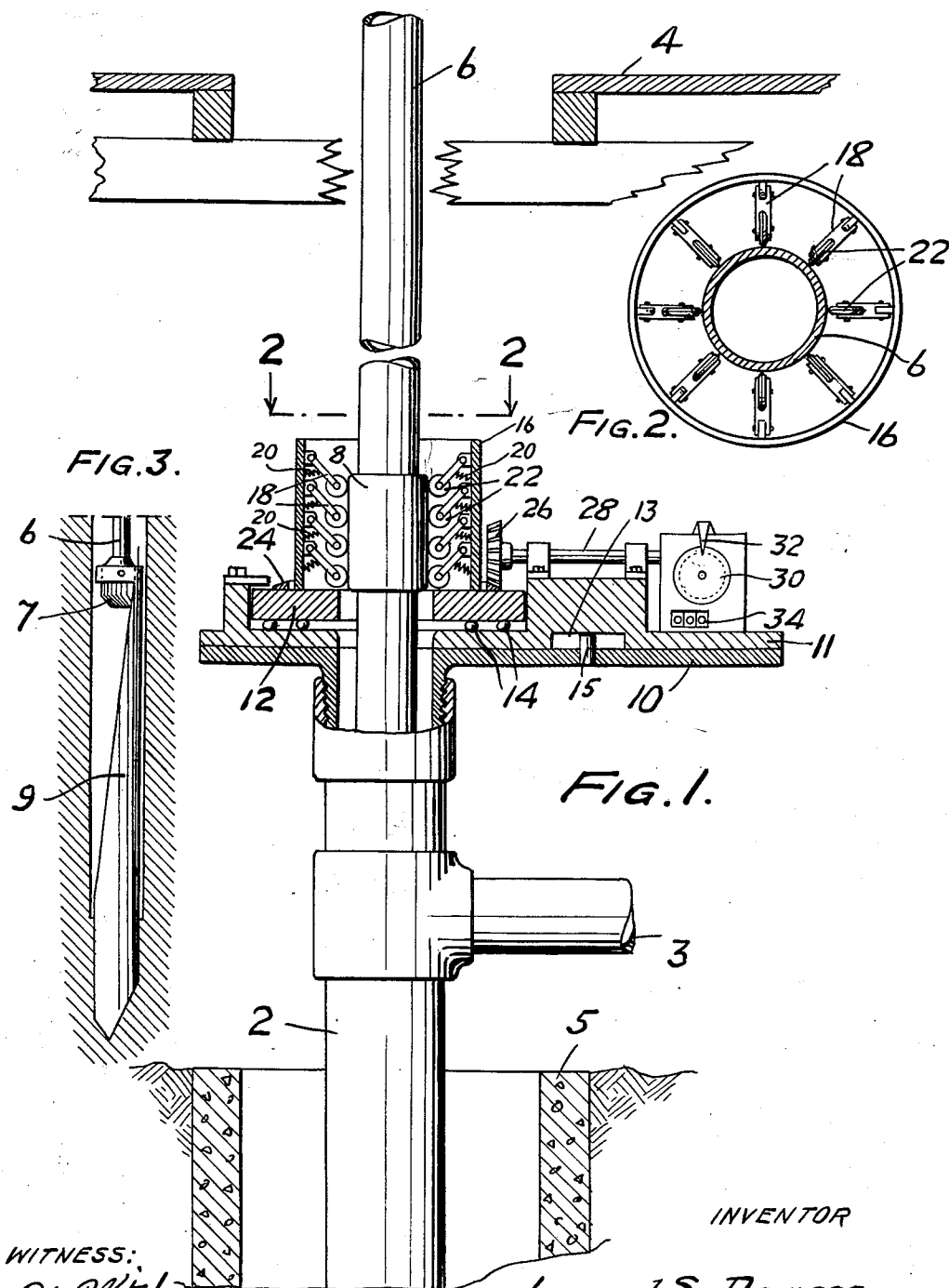
April 23, 1940.

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2,197,790

DRILL STEM ORIENTING DEVICE

Filed Aug. 13, 1938



T175-40

WITNESS:

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Patented Apr. 23, 1940

2,197,790

UNITED STATES PATENT OFFICE

2,197,790

DRILL STEM ORIENTING DEVICE

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Application August 13, 1938, Serial No. 224,684

4 Claims. (Cl. 255—1)

This invention relates to a drill stem orienting device designed to give information concerning the azimuthal position of the lower end of a drill stem.

5 In the drilling of bore holes, it frequently becomes necessary to locate in some portion of the bore hole an apparatus or device the azimuthal position of which should be known. For example, well surveying devices have been provided adapted to record inclination of a bore hole, which devices are adapted to be lowered on drill stems and located by manipulation of the drill stem in predetermined azimuthal position; or, alternatively, if located in arbitrary position, their azimuthal position must be determined through knowledge of the manipulations of the drill stem. The orientation, or determination of orientation, of such instruments has heretofore been effected by carefully aligning each new length of the drill stem with the preceding length in the hole as the drill stem is made up, by sighting, for example, on some distant object, with devices such as telescopes secured to the lengths of drill stem, with the idea of insuring that the position of the lower portion of the drill stem may be ascertained when the uppermost section is located in a determinable position.

The same procedure has been carried out in setting whipstocks and other tools.

The orientation methods just described are obviously difficult to carry out, since sights must be made upon the joining of each new section of the drill stem, with the result that the lowering of the drill stem carrying the devices to be oriented is a rather slow process.

It is the object of the present invention to provide a device and method for the orientation of drill stems which will automatically indicate to a high degree of accuracy at all times the angular position of the lower end of the drill stem, subject to such corrections as may be necessary from a mathematical standpoint due to the tortuosity of the hole in accordance with the considerations set forth in the patent to Kothny No. 2,006,556, dated July 2, 1935. Hereinafter, when mention is made of the indication of the angular position of the lower end of the drill stem it will be understood that what is meant is the apparent orientation which would exist if the hole were straight. If the hole is not straight calculations from its known path will readily give the corrections to be applied.

The broad object of the invention, as well as specific objects primarily relating to details of

construction, will become apparent from the following description, read in conjunction with the accompanying drawing, in which:

Figure 1 is a vertical sectional view illustrating the improved device applied to a drill stem at the surface in order to determine the orientation of its lower end;

Figure 2 is a horizontal section taken on the plane indicated at 2—2 in Figure 1; and

Figure 3 is a fragmentary sectional view illustrating a whipstock as an example of a device which may be oriented by the device and method herein disclosed.

The surface pipe of a bore hole is indicated at 2. Generally, this pipe and lower casing extend downwardly a substantial distance below the surface during the drilling operation to prevent caveins during the drilling, which occur in an uncased portion of the hole. The mud flow line connected to the upper end of the casing is illustrated at 3. It will be understood that the casing is associated with the usual conventional devices such as a blow out preventer, bleeding elements and the like, which do not affect the apparatus or method of the present invention. The derrick floor located above the pit 4 and on which the assembly of the portable lengths of drill stem takes place is indicated at 4. Through this and the casing extends the drill stem made up of sections 6 coupled by joints 8 of slightly larger diameter. As indicated in Figure 3, the drill stem may carry a bit 7 and also a whipstock or other instrument such as 9, indicated therein. As specifically shown, the whipstock arrangement is of the character illustrated in Kothny Patent 2,107,420, dated February 8, 1938. The drill stem is used to carry the whipstock to a given position wherein it is to be oriented prior to continuation of drilling. Instead of a whipstock, the drill stem may carry other tools or devices, as, for example, a well surveying instrument, in which case, of course, the stem will not carry a bit. Whatever the device carried by the drill stem, it is an object of the present invention to provide simple means for locating it in predetermined position or for ascertaining its arbitrary position.

The device for effecting this result is preferably located below the derrick floor so as not to interfere with the conventional manipulations above the floor in joining the lengths of the drill stem during the lowering operation. The improved device comprises a base 10, which may be located in predetermined position with respect to the upper end of the surface pipe being pref-

erably supported thereby as illustrated. Arranged to slide on the base 10 there is a support 11 which is provided with a radially extending slot 13 embracing a pin 15 extending upwardly from the base 10. On the support 11 there is located a rotary member 12, preferably rolling on steel balls 14, located in annular grooves and arranged to be lubricated so as to minimize friction. The member 12 carries an upright cylinder 16 within which are pivoted a number of levers 18 pressed upwardly and inwardly by strong compression springs 20 and carrying at their inner ends discs 22 having peripheries formed with sharp edges adapted to bear against the drill stem which is being lowered. The sharp edges are such as to prevent relative rotation of the drill stem and member 12, while nevertheless the discs 22 are free to rotate so as to permit upward or downward components of motion of the drill stem. The discs are accurately set with their edges in vertical planes and are also rigidly held against any movement in an annular direction with respect to the cylinder 16. From this arrangement it will be obvious that angular motions imparted to the drill stem will be transmitted exactly to the member 12. Thus the rotation of member 12 will measure exactly the rotation of the stem. The member 12 is provided with bevel gear teeth 24 meshing with a bevel pinion 26 secured to a shaft 28 coupled through reduction gearing to a disc 30 moving adjacent a pointer 32. The disc 30 is preferably so geared to the shaft 28 that a single revolution of the drill stem will correspond to a single revolution of this disc. An additional indicator may be provided, for example, as indicated at 34, to indicate the total number of revolutions of the drill stem, in case this is a matter of importance.

The use of this apparatus will be apparent from the above description of its construction. The lowermost length of the drill stem carrying the device to be oriented, i. e., a tool, surveying instrument or the like, is located within the cylinder 16, and its position with respect to the device is noted as well as the original reading on the indicating disc 30 and on the auxiliary indicator 34. Assembly of additional lengths of drill stem may then be effected in conventional fashion and the drill stem lowered without paying any particular attention to the rotation. In other words, the assembly and lowering may be accomplished as rapidly as might be the case if ordinary drilling was to occur. During the lowering operation, as the joints 8 pass the disc 22 they will merely yield outwardly, permitting such passage to take place. Such outward yielding does not effect any rotation of the cylinder 16, and hence at all times the disc 30 would indicate the rotation of the lower end of the drill stem subject to corrections of the type indicated above, which, if the bore hole is substantially straight, are zero or, at any rate, negligible.

At the end of the lowering operation, it is only necessary to note the indication on the disc 30 and the auxiliary indicator 34. If it is merely desired to bring the device such as a whip-stock to a given orientation, the drill stem may then be rotated until the indicator 30 shows that the drill stem is properly oriented. If, on the other hand, it is necessary to take into account the complete rotations of the drill stem, the auxiliary indicator 34 will indicate how many have taken place and, if desired, the drill stem may be rotated to the desired position. In general, this

will be unnecessary, and the primary purpose of the indicator 34 would be to show whether it could be expected that substantial friction may have caused a torsional twisting of the lower end of the drill stem. If so, the twisting may be taken out of the drill stem in the usual fashion by imparting up and down movements to the drill stem. Thus it can be insured that the drill stem is under negligible torsion so that it can be safely assumed that the indicator 30 is truly representing the angular position of the lower end. If the device is not to be turned to a predetermined position, but rather there is only desired a knowledge of an arbitrary position assumed by it, the indicator 30 will show such position. It will be understood that where the appended claims refer to means for orienting a drill stem or device the term is intended to include the giving of an indication of an arbitrary orientation as well as the location of the drill stem or device in a desired location.

It will be obvious that the device of the present invention will give accurate results only if, during the rotation of the drill stem, the drill stem is concentric with the cylinder 16. To maintain this condition despite wobbling of the drill stem, the support 11 is movable on the base 10 subject to the restraint due to the engagement of pin 15 within slot 13. In order that the final reading should be accurate, the drill stem should be brought to a position concentric with the upper end of the casing, which should also have been the position at the beginning of the lowering operation. By thus bringing the support 11 to its initial position any errors due to lateral displacements will be corrected.

The withdrawal of the drill stem may be carried out without hindrance, the discs 22 being preferably made large enough to ride over the joints despite the fact that the carrying levers may be extending downwardly and inwardly. The device is preferably so constructed that the rotating parts 12 and 16 may be removed over the upper end of the drill stem if necessity arises.

What I claim and desire to protect by Letters Patent is:

1. A device for orienting drill stems comprising a fixed support, means engaging the drill stem to be rotated by rotary components of motion of the drill stem, but allowing free axial components of motion of the drill stem without being rotated, means for mounting the first mentioned means for translational movements with the drill stem relative to said support to maintain the axis of rotation of said means substantially coincident with the axis of the drill stem, and means for indicating the rotary movements of the first mentioned means.

2. A device for orienting drill stems comprising a fixed support, means rotatable with the drill stem and comprising devices engaging the drill stem and offering substantial resistance to rotary motion of the means relative to the drill stem, but allowing free axial components of motion of the drill stem without being rotated, means for mounting the first mentioned means for translational movements with the drill stem relative to said support to maintain the axis of rotation of said means substantially coincident with the axis of the drill stem, and means for indicating the rotary movements of the first mentioned means.

3. A device for orienting drill stems comprising a fixed support, means rotatable with the drill stem and carrying a plurality of sharp-

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- edged discs and means for supporting said discs with their peripheries in tangential contact with the drill stem lengthwise thereof, whereby said discs offer substantial resistance to rotary motion of the means relative to the drill stem, but allow free axial components of motion of the drill stem without being rotated, means for mounting the first mentioned means for translational movements with the drill stem relative to said support to maintain the axis of rotation of said means substantially coincident with the axis of the drill stem, and means for indicating the rotary movements of the first mentioned means.
4. A device for orienting drill stems comprising a fixed support, means rotatable with the drill stem and carrying a plurality of sharp-

edged discs and means for supporting said discs with their peripheries in tangential contact with the drill stem lengthwise thereof, whereby said discs offer substantial resistance to rotary motion of the means relative to the drill stem, but allow free axial components of motion of the drill stem without being rotated, said supporting means being arranged to allow yielding of said discs upon passage of joints of the drill stem, means for mounting the first mentioned means for translational movements with the drill stem relative to said support to maintain the axis of rotation of said means substantially coincident with the axis of the drill stem, and means for indicating the rotary movements of the first mentioned means.

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