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Feb. 8, 1944. C. W. BREUKELMAN 2,340,861

ORIENTING DEVICE

Filed Aug. 2, 1940 2 Sheets-Sheet 1

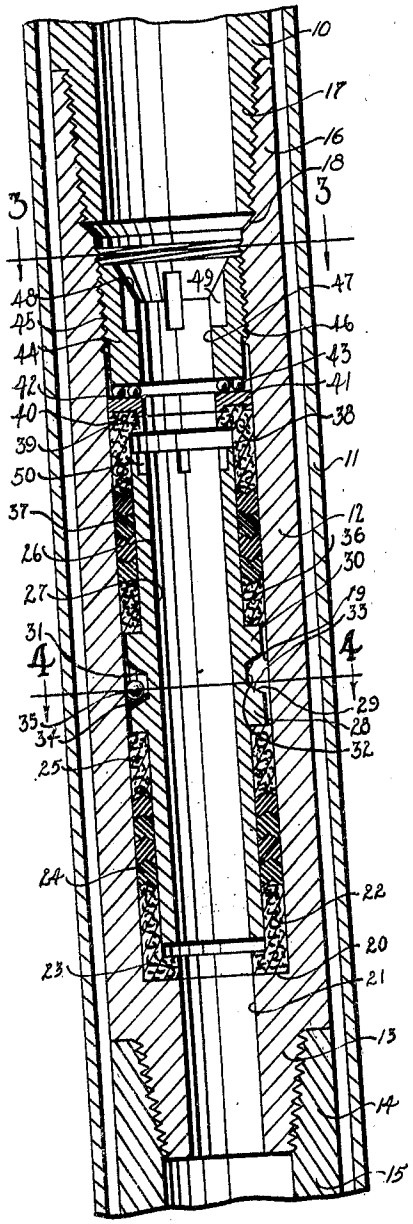


Fig 1

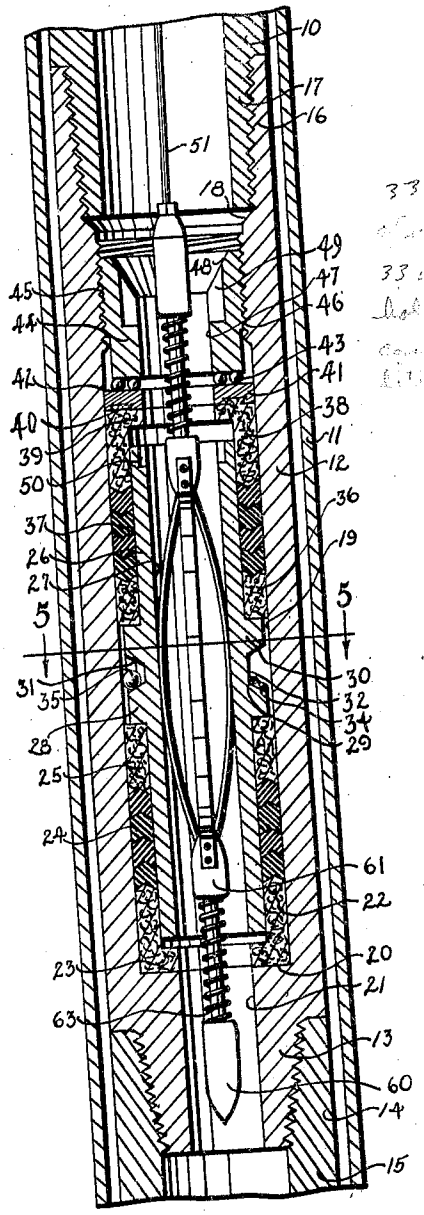


Fig 2

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ORIENTING DEVICE

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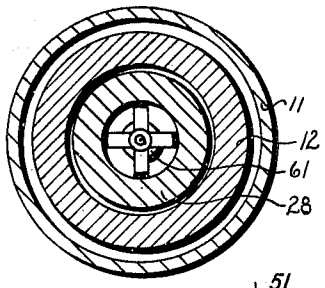


Fig. 5

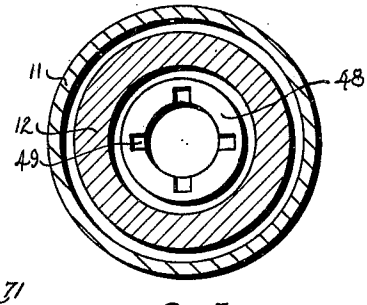


Fig. 3

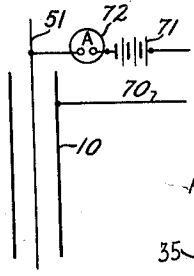


Fig. 8

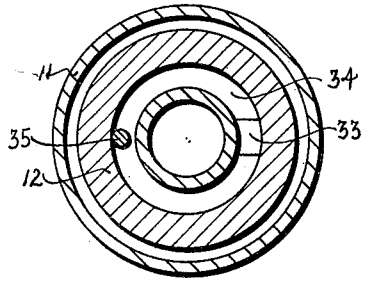


Fig. 4

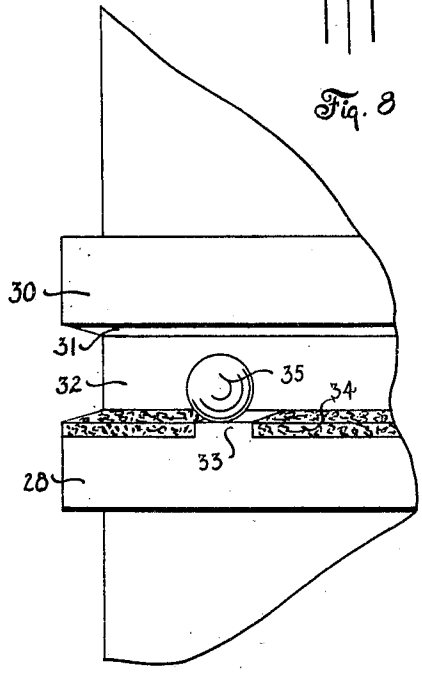


Fig. 6

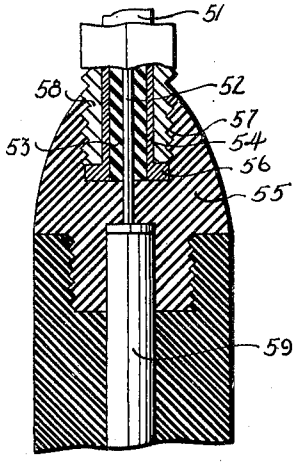


Fig. 7

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UNITED STATES PATENT OFFICE

2,340,861

ORIENTING DEVICE

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Application August 2, 1940, Serial No. 349,457

9 Claims. (Cl. 255—1.6)

This invention relates to new and useful improvements in orienting devices.

It is a known fact, that well bores seldom follow an absolutely vertical path. The great depth of some wells, and the flexibility of the drill stem employed, cause the well bore to deviate from the absolute vertical in various directions and degrees. Sometimes the well bore deviates so far from a vertical course that it is necessary to start a new bore or hole vertically downward from a point above the deviating portion in an effort to straighten out the well bore. At times such as these, and in various other instances, it is desirable to have an orienting device which will indicate to the operator the radial position of a certain tool within the well bore, so that the tubing string supporting the tool may be rotated to bring the tool into a proper radial position. For instance, in setting a whipstock in a well bore, it is necessary that the face of the whipstock be directed so that the well bore will be deflected in the proper direction. An orienting device will accomplish such a result.

One object, therefore, of this invention is to provide an improved orienting device wherein means are provided for indicating the radial position of a tool within a well bore.

Another object of the invention is to provide an improved orienting device wherein means are provided for indicating the azimuth of a well bore.

A further object of the invention is to provide an improved orienting device which may be connected into a string of tubing or a similar conductor, so that a suitable tool may be placed above or below the device in the tubing string.

An important object of the invention is to provide an improved orienting device which may be connected in a tubing string or a similar conductor without materially obstructing the flow passages of said tubing string whereby drilling fluid and other fluids may be pumped or flowed upwardly and downwardly through said tubing and various other operations carried out, such as the running of surveying instruments.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Figure 1 is a longitudinal sectional view of an orienting device constructed in accordance with the invention, showing the device lowered into a well casing upon a tubing string,

Figure 2 is a view similar to Figure 1, showing the contact member lowered into position within the orienting device,

Figure 3 is a horizontal cross-sectional view taken on the line 3—3 of Figure 1,

Figure 4 is a horizontal cross-sectional view taken on the line 4—4 of Figure 1,

Figure 5 is a horizontal cross-sectional view taken on the line 5—5 of Figure 2,

Figure 6 is an enlarged view of a portion of the orienting device showing a portion of the contactor ring and the contactor ball,

Figure 7 is an enlarged view of the upper end of the contact member, and

Figure 8 is an electrical circuit diagram.

In the drawings, the numeral 10 designates a section of tubing or a similar conductor which is lowered into a well bore or casing 11. An elongate tubular member 12, having substantially the same outside diameter as the tubing section 10, is suspended from the lower end of the tubing section, and an externally screw-threaded pin 13 formed on its lower end. The pin 13 engages in an internally screw-threaded box 14 formed on the upper end of a tubing section 15, whereby the latter is supported by the member 12. The member 12 is provided at its upper end with an internally screw-threaded box 16 adapted to engage an externally screw-threaded pin 17 formed on the lower end of the tubing section 10. In this manner, the member 12 is connected directly into a tubing string within a well bore.

The member 12 is provided with an internal annular beveled shoulder 18 below the box 16, and an axial bore 19 extends downwardly from said shoulder. The bore 19 is reduced near the lower end of the member to form an annular shoulder 20. The reduced portion 21 of the bore 19 extends from the shoulder 20 to the lower end of the pin 13.

An annular collar 22 is disposed in the lower portion of the bore 19 so as to rest upon the shoulder 20. The collar 22 is formed of fibre or some suitable insulating material, and is provided at its lower end with an annular inwardly directed flange 23. The inside diameter of the flange 23 is substantially equal to the inside diameter of the bore 21 so that the former constitutes a continuation of the latter. A plurality of suitable circular packing rings 24 rests upon the upper end of the collar 22 so as to engage the inner wall of the bore 19. It has been found desirable to use the chevron type packing rings,

as is shown in the drawings, Figures 1 and 2, placed so as to have their vertices directly upwardly. A collar 25, circular in cross-section and formed of some suitable insulating material, is disposed in the bore 19 above and abutting the packing ring 24.

An elongate sleeve 26 is disposed within the bore 19, and has an axial bore 27 substantially equal in diameter to the diameter of the bore 21. The outer diameter of the sleeve is of such magnitude as to allow the sleeve to telescope the collar 25, the packing ring 24 and the upper portion of the collar 22, while maintaining a snug fit therewith.

An annular external flange 28 is provided on the sleeve 26 near the mid-portion thereof, and is formed with its upper face 29 beveled downwardly. A similar flange 30 is positioned above the flange 28 and has its lower face 31 beveled upwardly. In this manner, an external annular groove 32 is provided at the mid-portion of the sleeve 26. The flange 28 rests upon the upper end of the collar 25, so that the sleeve is supported within the bore 19. As will be noted in the drawings, the flanges 28 and 30 are not of sufficient width as to contact the member 12. The upper surface or face 29 of the flange 28 is milled out to a slight depth throughout its entire circumference except for a smaller portion 33. A split insulating washer 34 engages in the milled out portion of the flange, and a small ball 35 formed of some conducting material, rests upon the washer 34 within the groove 32.

An insulating collar 36, similar to the collar 25 encircles the sleeve 26 above the flange 30 and rests thereupon. A plurality of packing rings similar to the rings 24 rest upon the collar 36, and encircle the sleeve 26. A second collar 38 is disposed above the packing rings 37. The collar 38 is similar to the collar 22 and is provided with an annular inwardly-directed flange 39, similar to the flange 23. An annular dove-tail 40 is formed upon the upper face of the collar 38, and engages in a dove-tail groove 41 formed in the lower side of an annular bearing ring 42 disposed above said collar.

A plurality of bearing balls 43 are disposed between the bearing ring 40 and a retainer collar 44, so as to receive the thrust of said collar. The retainer collar 44 carries external screw-threads 45 upon its upper portion, said threads being adapted to engage in internal screw-threads 46 formed in the upper portion of the bore 19. The collar 44 is provided with an axial bore 47, and has its upper edge 48 beveled, whereby various tools may be readily inserted in the bore 47. A plurality of rectangular recesses 49 are formed about the upper inner edge of the collar, and are adapted to be engaged by a suitable tool (not shown) so that the collar may be rotated. As the retainer collar 44 is rotated and screwed downwardly in the threads 46, the collars 38 and 36 and the packing rings 37 will be forced downwardly toward the flange 30. This latter action compresses the rings 37 to pack off the upper portion of the sleeve 26 and forces the flange 28 to bear downwardly against the collars 22 and 25, the packing rings 24 and the shoulder 20. In this manner, the rings 24 are compressed to pack off the lower portion of the sleeve 26. A plurality of recesses 50 are provided on the upper end of the sleeve to allow the latter to be engaged by a suitable tool (not shown) and rotated to any desirable position with respect to the member 12 before the retainer collar 44 is tightened.

It will be noted in the drawings (Figures 1 and 2), that the sleeve 26 is completely insulated from the member 12 by the insulating collars and the packing rings. The ball 35 contacting the member 12 and the flange 28 provides the only means of contact between the two members. When the device is lowered into a well opening which is not perpendicular with respect to the earth's surface, the ball 35 will naturally assume the lowest possible position in the groove 32. The ball therefore remains on the low side of the well opening regardless of the rotative position of the member 12 and the sleeve 26. This fact is utilized in the setting of a whipstock or some similar tool.

In operating the device a whipstick, or any tool (not shown) which must be oriented in the well bore, is placed on the tubing string below the member 12. The sleeve 26 is then rotated within the member 12 until the portion 33 of the flange 28 bears the proper radial displacement with respect to the tool, and the retainer collar 44 is tightened to hold the sleeve in place. Any suitable mark can be made at the upper end of the sleeve in longitudinal alinement with the contact portion 33, whereby the operator by sighting through the bore of the sleeve can easily aline such mark with the face of the whipstock. It is quite common in this art to use such alining marks. It will be observed that the whipstock is usually rigidly fastened to the lower end of the member 12 and thus, the sleeve 26 can be turned so as to vertically aline the contact portion 33 of said sleeve with the face of the whipstock before the collar 44 is tightened. When the tubing assembly is lowered into the well the contact portion 33 will lie above and substantially in vertical alinement with the face of the whipstock; however, the operator will not know in which direction the whipstock is facing. He will usually know the direction in which the well is inclining and the degree of deviation from the perdendicular, because it is common practice to make a preliminary survey of the well hole to ascertain these facts.

After the assembly has been lowered into the well, a suitable electrical contact device A is lowered in the tubing by means of an electric cable 51. This device may be of any suitable construction so long as it is capable of closing an electric circuit through either the tubing 10 or the sleeve 26, when in sliding engagement with either. In order to make a complete circuit, the cable 51 is connected by a circuit wire 70 with the tubing 10, as is clearly shown in Figure 8. A battery 71 or other source of electrical current is connected in the wire, which wire also has an ammeter or other electrical indicator 72 connected therein. As the device A is moved down the tubing the ammeter will register an electrical potential thereacross until the device A enters and contacts the sleeve 26. Unless the ball 35 is resting on the contact portion 33, which it will seldom if ever do, the circuit through the ammeter will be broken, thus informing the operator that the device A has entered the sleeve 26.

The operator now slowly turns the tubing 10, a portion of a complete rotation. The ball 35 resting upon the insulating track 34 seeks the low side of the hole. When the tubing has been turned far enough to bring the contact portion 33 under the ball 35, the circuit will be closed through the member 12 which is connected with the tubing 10. When the circuit is closed, it will be indicated on the ammeter. This will show

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the operator that the face of the whipstock is opposite the low side of the well hole. Following the usual practice, the tubing may then be turned the required number of degrees to face the whipstock in the direction in which it is desired to drill. In this manner, the device may be utilized to properly orient a tool within a well bore. It will be noted that the bore of the tubing is only slightly obstructed by the sleeve **26**, so that various operations requiring circulation through the tubing may be carried out, and in addition, surveying instruments may be run down through the sleeve.

Any suitable type of contact member may be used. However, a specific type is shown in the drawings and will herewith be described. The member A is adapted to be lowered into the bore of the tubing string by an insulated cable **51**, which is also utilized to carry an electric current to the member. The cable is provided with the usual conductor wire or wires **52** covered by insulating material **53**. If desired, the cable may be encased in a flexible protective covering **54**.

The lower end of the cable enters into a head **55** formed of suitable insulating material. The protective covering **54** carries an external annular flange or lip **56** at its lower end, which lip fits into an internally screw-threaded axial recess **57** formed to the upper end of the head **55**. A retainer nut **58** encircles the cable above the lip and engages in the recess **57** as to secure the cable to the head. The wire **52** extends downwardly and engages the upper end of an elongate rod **59** mounted in the head **55**. The rod **59** extends some distance below the head **55** and has a shoe **60** formed of a non-conductive material disposed on its lower end. A pair of anchor members **61** are slidably mounted on the rod **59**, and are spaced apart and connected to one another by a plurality of arcuate outwardly bowed spring members **62**. A pair of coil springs **63** encircle the rod and are compressed, one between the head **55** and the upper anchor member **61**, and the other between the shoe **60** and the lower anchor member **61**. Thus the coil springs **63** tend constantly to urge the anchor members together, thereby forcing the spring members **62** to assume their outermost position. As the contact member is lowered into the tubing string, the springs **63** serve to hold the members **62** against the inner wall of said tubing.

As may be seen, an electric current may flow from the wire **52** to the rod **59**, and thence through the anchor members **61** to the spring members **62**. From the spring members the current may flow to the tubing **10** or to the sleeve **26** and member **12**.

The device is simple and positive in its operation, yet allows many additional operations to be performed. The sleeve **26** is positively packed off by the packing rings **24** and **37** so that liquid may not enter between the sleeve and the member **12** so as to cause a short circuit or deposit foreign matter to impede the action of the ball **35**.

Various changes, alterations and modifications may be made in the size, shape and arrangement of the herein described elements, within the scope of the appended claims.

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

1. A device for use in an electrical well orienting assembly including, an outer tubular member adapted to be connected in a well tubing string and capable of conducting electrical current, a sleeve rotatably mounted in the bore of the tubular member and electrically insulated therefrom, means for fastening the sleeve in a predetermined position, an electrically insulated track carried by the sleeve in circumferential relation to the bore of the tubular member, said track having an electrical contact point exposed therein and electrically connected with the sleeve, and a gravity-controlled electrical contact ball mounted on said track in rolling contact with the bore of the tubular member.

2. A device of the character described including, a tubular member adapted to be connected in a tubing string, a sleeve rotatably mounted in the member, a circular track on the exterior of said sleeve having an electrical contact point, a ball confined on the track and adapted to engage said contact point and the tubing member when the member is rotated, and means for fastening the sleeve and the contact point of the track in a known relation to a well tool when such tool is connected with the tubular member.

3. A well orienting apparatus including, a tubular member adapted to be connected in a tubing string and to a tool to be oriented, a sleeve rotatably mounted in the member and having a passage therethrough for a well tool, the sleeve being electrically insulated from the member, means for turning the sleeve to adjust it to a known position with relation to the tool to be oriented, means for fastening the sleeve in the member in its adjusted position, and means for closing an electric circuit between the sleeve and the member when the member and sleeve are rotated to a known position in the well.

4. A well orienting apparatus as set forth in claim 3 wherein the circuit closing means includes a gravity-controlled movable element for closing the circuit when the tubular member is rotated to a known position in the well.

5. A well orienting apparatus including, a tubular member adapted to be connected in a tubing string and to a tool to be oriented, a sleeve rotatably mounted in the member and having a passage therethrough for a well tool, the sleeve being electrically insulated from the member, means for turning the sleeve to adjust it to a known position with relation to the tool to be oriented, means for fastening the sleeve in the member in its adjusted position, a source of electrical current supply electrically connected with the tubular member, and means having electrical connection with said source and adapted to be lowered into the sleeve when the member is in position in the well to close the circuit through the sleeve when the circuit closing means closes the circuit between the sleeve and the member.

6. A well orienting device including, a tubular member adapted to be connected in a tubing string and a tool to be oriented, a rotatably adjustable sleeve mounted in the member and electrically insulated therefrom, a circular electrically insulated track in the exterior of said sleeve having a single exposed electrical contact connected with said sleeve, an electrical contact ball freely movable around said track in engagement with the bore of the tubular member adapted to close an electrical circuit from said sleeve to the member when the member is rotated to bring the contact point into engagement with the ball, and circuit means for supplying an electric current having circuit connection with said member and sleeve, the circuit being closed only when the ball engages the contact.

7. A well apparatus as set forth in claim 6

wherein the circuit means includes a contact element movable into the sleeve to make electrical contact with the sleeve.

8. A well orienting device including, a tubular member adapted to be connected in a well string and to a tool to be oriented, said member having a passage therethrough, a sleeve mounted for rotative adjustment in the member, means for electrically insulating the sleeve from the member, means for fastening the sleeve in the member, an insulated track in the outer surface of the sleeve having an exposed contact point, and a ball confined on the track by the member and adapted to engage with the contact point of the track when the member is rotated.

9. In combination in a well orienting apparatus, a well tubing string carrying a tool to be oriented, a tubular member connected in the tubing string, a rotatably adjustable sleeve disposed in the member and electrically insulated therefrom, gravity-controlled circuit closing means between the sleeve and the member, a source of electric current supply connected with the tubing and the member, an electrical contact member adapted to be lowered into the tubing and sleeve connected with the source of electric current supply, and an electrical indicator in the connection between the source of current supply and the device for indicating the passage of said device from the tubing into the sleeve and for indicating the operation of the circuit closing means when the tubing is rotated.

CHRISTIAN W. BREUKELMAN.