

[54] **CIRCULATING SLEEVE**
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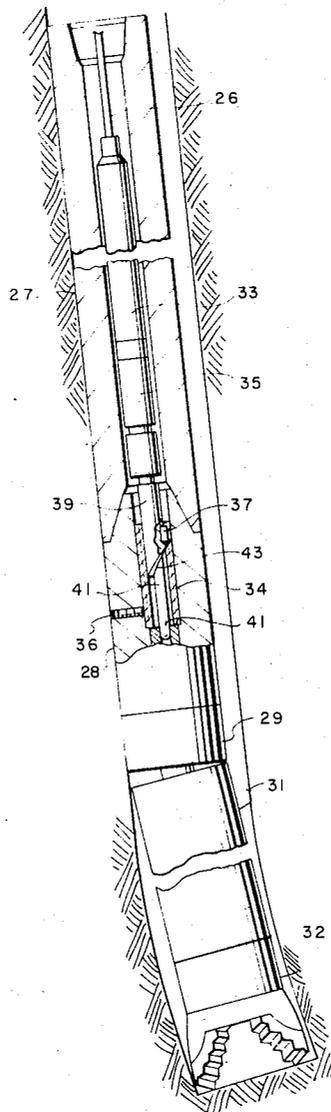
[57] **ABSTRACT**

In a drilling system, a subassembly provides a means for seating an instrument housing in the drill string during a drilling operation and for permitting a normal flow of drilling fluids around the instrument housing. The seat also provides means for orienting the instrument housing in a predetermined position relative to a portion of the drill system.

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5 Claims, 3 Drawing Figures



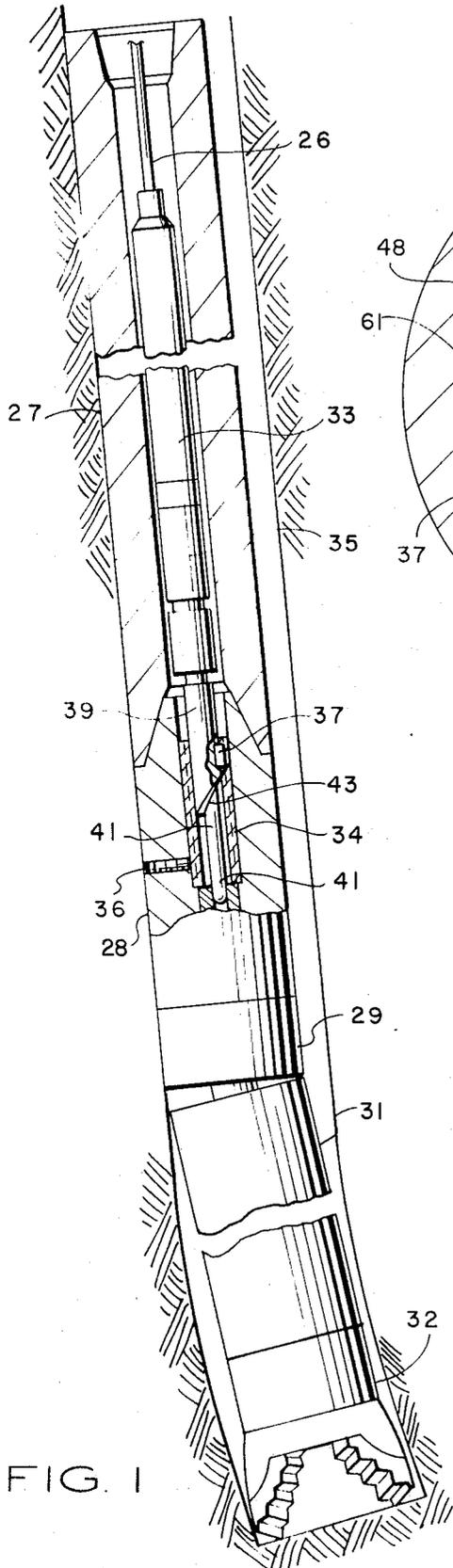


FIG. 1

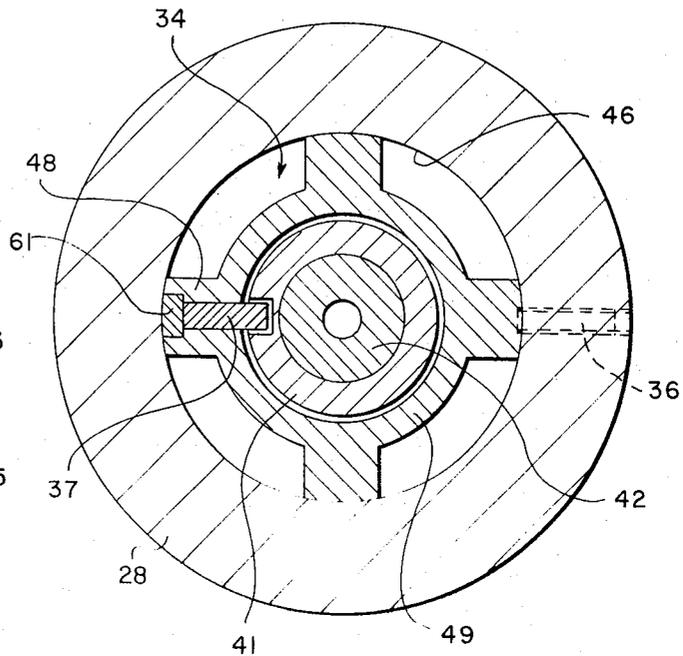


FIG. 3

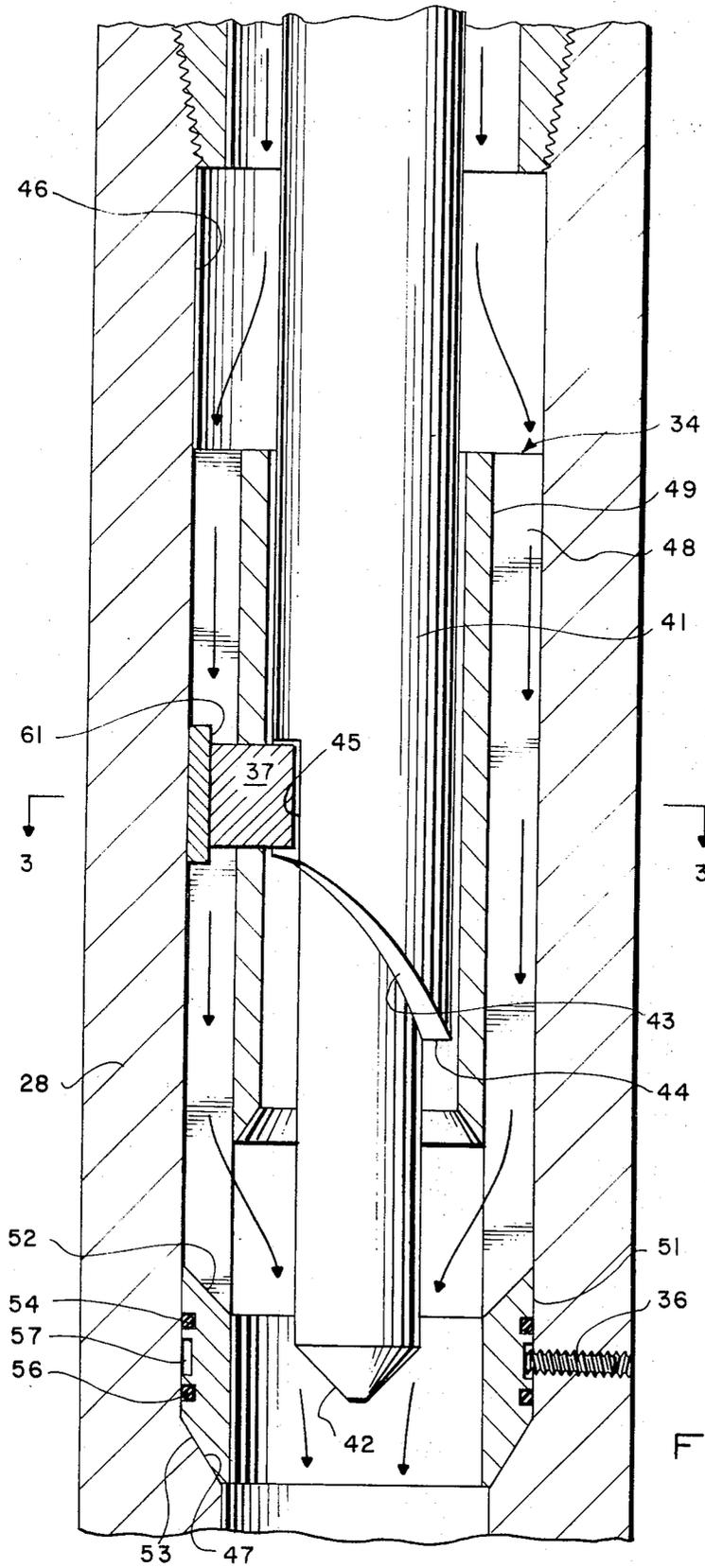


FIG. 2

CIRCULATING SLEEVE

BACKGROUND OF THE INVENTION

The present invention pertains to a circulating sleeve and more particularly to an apparatus for orienting an instrument within a drill string and providing for the circulation of fluid about the instrument to permit drilling when an instrument is seated therein.

When drilling boreholes in the earth's surface it is often desirable for various reasons to deviate the holes from a vertical course through the earth formations. The term "directional drilling" is applied to such operations. One example of the use of such directional drilling operations is found in the drilling of oil wells from offshore platforms. It is a common practice to build large drilling platforms which are permanently secured to the ocean floor and from which a multiplicity of wells are drilled. Because of the number of wells which are drilled from a single platform, it is necessary to drill the holes laterally away from the platform so that earth formations containing petroleum reservoirs may be penetrated at distances laterally spaced from the platform. This procedure permits production from as great an area as possible from a single platform. It is easily understood how important the maintenance of direction and dip of such boreholes is in order to penetrate particular formations at predetermined depths and thereby intersect the desired petroleum reservoirs.

One technique for obtaining such information as to the direction of a borehole is to cease drilling and run a surveying instrument into the drill pipe on a wire line. Alternatively, the instrument may be go-deviled to the bottom of the drill pipe. The instrument is oriented with respect to the drill stem by means of a "muleshoe" sub located at the lower end of the drill stem. The "muleshoe" is simply a device for capturing the tool and orienting the tool in a predetermined radial direction with respect to a position on the drill stem. For example, the drill stem normally used in such a directional drilling operation includes what is normally termed a "bent sub," at its lower end which places a bend in the lower end of the stem and thereby permits angular deviation of the drill bit. The "muleshoe" is normally oriented with respect to the "bent sub." This in turn orients the instrument which is being positioned in the lower end of the drill stem. This series of orientation procedures provides a correlation between the direction in which the drill bit is angled and the directional alignment of the survey instrument. After the survey instrument is operated to generate a record, generally by means of a timing mechanism, the tool is retrieved to the surface by means of a wire line. The record is then processed and examined to determine the direction in which the hole is being drilled.

More recently, techniques have been developed for passing an instrument into the drill stem by means of a conductor cable to provide continuous directional information to the surface during the drilling operation. This technique also utilizes the method described above of locating the instrument within a "muleshoe" which in turn is oriented in a particular radial direction with respect to a "bent sub" in the drill string. Thus, the information which is received at the surface indicative of the direction in which the survey instrument is positioned is correlated with the direction that the bit is angled.

It is common in such directional drilling operations to use a mud motor or turbine for rotating the drill within the borehole. Such a motor or turbine requires the continuous circulation of drilling fluids through the motor to provide the power for turning the drill. Therefore, it is essential that a constant flow of drilling fluids be maintained through the system even while an instrument is positioned within the drill stem.

It is therefore an object of the present invention to provide a new and improved circulating sub for receiving an orientation instrument within a drill string.

SUMMARY OF THE INVENTION

With this and other objects in view, the present invention contemplates a drill pipe having a recessed portion therein forming a seat within the bore of the pipe. A sleeve which is sized for reception within the recessed portion has a shoulder which when received within the recess mates with the seat. A plurality of longitudinal ribs are formed on the sleeve and extend upwardly from the shoulder. Means extend inwardly from the sleeve for engaging a mating surface on an instrument housing to thereby locate the instrument in a predetermined manner within the sleeve.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic drawing of the lower portion of a drill string, including a rotating bit sub and mud motor together with an apparatus for receiving and positioning an instrument in the drill pipe in accordance with the present invention;

FIG. 2 is a detailed sectional view of the positioning and orienting apparatus; and

FIG. 3 is a cross sectional view taken along lines 3—3 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1 of the drawings, the lower end of the drill stem is shown including a drill collar 27 and a muleshoe orienting sub 28. A bent sub 29, mud motor or turbine 31, and a rotating bit sub 32 are positioned below the orienting sub. An instrument which for the purpose of this disclosure shall be referred to as an orienting tool 33, is shown positioned within the interior bore of the drill collar and is connected at its upper end with a conductor cable 26 extending to the surface. Typically, the conductor cable would extend through a line wiper at the surface and be taken up on a motor driven drum which permits its payout and take up during operations. The line wiper is constructed to seal off well pressure at the well head during line operations in the drill pipe.

Referring again to the lower end of the drill stem, a muleshoe sleeve 34 is shown positioned within the muleshoe orienting sub 28 and is oriented therein in a predetermined fashion. The sleeve 34 is held in the predetermined position within the sub by means of a screw or the like 36 extending through the side wall of the sub 28. The muleshoe sleeve 34 is shown having a key 37 positioned in its sidewall and extending inwardly into the sleeve bore. The muleshoe and its key are normally oriented directionally with respect to the bent sub and thus with respect to the drill bit which derives its direction of inclination by means of the bent sub. This predetermined alignment of the muleshoe key with respect to the bent sub is convenient for purposes of determin-

ing the original orientation of the drill with respect to surface indications of tool direction and thereafter for making compensating changes in drilling direction. The muleshoe sleeve or circulating sleeve as it will be hereinafter referred to, may be utilized to positionally locate various types of instruments within a drill pipe; however, since one of its primary uses is for locating directional drilling orienting instruments this disclosure will continue to use such an instrument as an example.

The orienting tool 33 which is shown schematically in FIG. 1 includes a muleshoe 39 which is secured to the lower end of the tool string. The muleshoe includes a protruding shaft or stinger 41 having a tapered end 42 (see FIG. 2) for guiding the stinger into the muleshoe sleeve 34. A shoulder 43 extends spirally around opposite sides of the stinger, meeting at a pointed terminus 44, to form a camming surface. On the opposite side of the tool from the terminus 44, the spiral shoulders 43 meet to form a short longitudinally extending slot 45. The slot 45 is sized to receive the inwardly extending key 37 on the muleshoe sleeve 34 when the tool 33 is positioned in the drill pipe. The tool string 33 further includes a muleshoe adjuster which permits rotation of the muleshoe 39 relative to the tool string 33. The adjuster includes mating portions (not shown) between the muleshoe and tool string to permit relative rotation therebetween, and a locking collar 35 for securing the tool string and muleshoe in a fixed rotational position. Greater detail of the muleshoe and its functional use with an orienting tool is shown in co-pending U.S. Pat. application Ser. No. 86,877, now U.S. Pat. No. 3,718,194, which is assigned to same assignor as the present application.

Referring next to FIG. 2 of the drawings, the circulating sleeve 34 and its cooperative relationship with the sub 28 is shown in greater detail. Sub 28 has a recessed bore portion 46 with a tapered seat 47 at its lower end. The circulating sleeve 34 is shown positioned within the sub 28. The sleeve 34 has a body portion 49 with longitudinal ribs 48 extending outwardly therefrom into contact with the recessed inner bore portion 46 of the sub 28. The longitudinal ribs 48 extend downwardly below the lower end of the body portion 49. A cylindrical sleeve 51 is formed at the bottom end of the longitudinal ribs. Tapered top and bottom surfaces 52 and 53, respectively, are formed on the sleeve 51. The lower surface 53 is arranged to matingly seat on the tapered surface 47 of the recessed bore 46 in sub 28. Upper and lower peripheral grooves 54 and 56, respectively, are formed on the surface of the exterior wall of sleeve 51, and are sized to receive O-ring seals therein. Another peripheral groove 57 is formed between the grooves 54 and 56 in the outer wall of the sleeve 51 for receiving an inwardly extending end portion of a set screw 36. The body portion 49 of the circulating sleeve 34 and one of the longitudinal ribs 48 have an aligned opening formed through the rib and body portion for receiving the key 37. The key 37 has an enlarged shoulder portion 61 formed thereon which abuts a complimentary shoulder formed in the rib opening.

In the operation of the system described herein the following method is employed: the circulating sleeve 34 is inserted into the upper end of sub 28 until the lower tapered surface 53 on sleeve 51 is matingly seated on tapered surface 47 within the bore of sub 28. The circulating sleeve is then rotated within the bore of sub 28 until the key 37 which extends inwardly from the sleeve

is positioned in accordance with a predetermined arrangement to permit orientation with respect to a portion of the drill stem. Normally, the predetermined alignment of the key 37 is in some relationship with the bent sub 29 so that it is known that the muleshoe key 37 is pointing in a particular direction with respect to that in which the drill is pointing. This arrangement provides means for determining, by means of an orienting instrument to be located within the muleshoe sub in what direction the drilling operation is being conducted. In any event, after the key 37 and the circulating sub has been oriented within the sub 28, set screws 36 are rotated until they extend inwardly into the groove 57 on lower sleeve 51 and tightened therein to hold the sleeve in a fixed relationship with the sub 28 and thereby prevent its rotation within the sub. Next, the sub 28 is made up in the drill string and the drill string is lowered into the wellbore for purposes of performing the drilling operation.

Thereafter, when it is desired to lower an instrument into the drill stem by means of the cable 26 shown in FIG. 1, such instrument is lowered until the muleshoe stinger 41 extends into the circulating sub 34 whereupon the spiral camming surface 43 thereon engages the key 37 and produces a camming action to rotate the muleshoe until the longitudinal slot 45 of the muleshoe drips over the key 37. The procedure thus far described permits the instrument housing located above the muleshoe to be radially positioned within the drill stem in a predetermined manner. The arrangement of the circulating sub, seat and muleshoe permits the circulation of drilling fluids through the drill stem even when the instrument and muleshoe are seated within the drill string. This is provided by means of the annular spaces between the longitudinal ribs 48 and between the sleeve 51 and the lower end of the muleshoe. The path of such fluid circulation is shown by the arrows in FIG. 2.

With the circulating sub described herein the volume of fluid that may be circulated through the system is sufficient to drive the mud motor or turbine during drilling operations while permitting the continuous use of an orienting instrument.

While a particular embodiment of the present invention has been shown and described, it is apparent that changes and modifications may be made without departing from this invention in its broader aspects and therefore the aim in the appended claims is to cover all such changes and modifications as which fall within the true spirit and scope of this invention.

What is claimed is:

1. In a drilling system utilizing a hollow conduit for carrying a drilling fluid means for seating an instrument housing within the conduit while performing a drilling operation, which means includes: a seat formed within the bore of said conduit, a sleeve sized for reception within the bore of said conduit, shoulder means on one end of said sleeve for providing a mating reception of said sleeve within said seat, said shoulder means being sized for close fitting reception within said conduit, a plurality of longitudinal ribs on said sleeve extending above said shoulder means and key means extending inwardly from said sleeve for orienting an instrument housing.

2. The apparatus of claim 1 and further including a transverse opening extending through one of said ribs and sleeve for receiving said key means.

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3. The apparatus of claim 1 and further including means of locking said sleeve against relative movement with said conduit.

4. The apparatus of claim 3 wherein said locking means extends through the wall of said conduit and further including seal means on said shoulder arranged to be positioned above and below said locking means when said sleeve is seated in said conduit.

5. A circulating sleeve for seating and orienting an instrument housing within the bore of a drill pipe during a drilling operation and arranged to permit the flow of fluids through the drill pipe when an instrument housing is positioned therein, comprising: a sleeve for

reception within the bore of the pipe, and having a cylindrical portion with longitudinal ribs formed thereon for engaging the bore of the pipe and maintain said cylindrical portion in a spaced position from said bore; a shoulder formed on said sleeve for engaging a seat in the pipe; key means extending from the wall of said cylindrical portion into its bore for engaging a portion of the instrument housing to orient the housing with respect to said sleeve; and means on said sleeve for receiving a member extending from the wall of the pipe for holding said sleeve against rotation relative to the pipe.

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