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2,606,793

TOOL GUIDE

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Fig. 1.

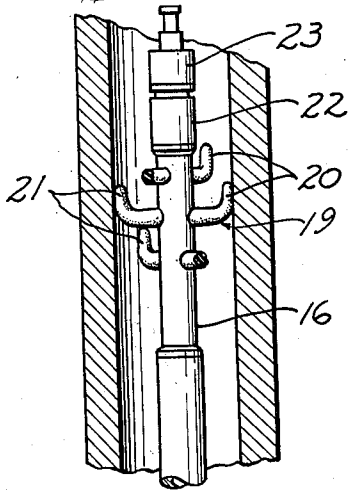


Fig. 2.

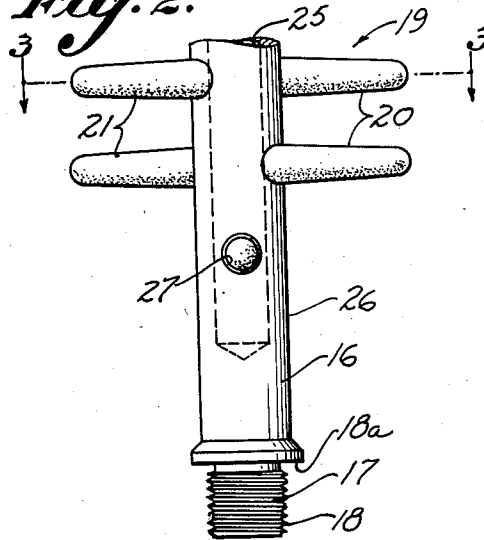


Fig. 3.

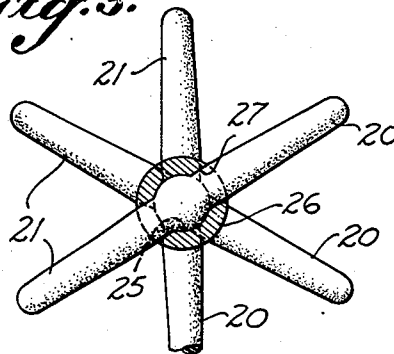


Fig. 4.

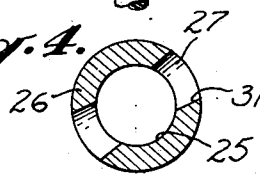


Fig. 5.

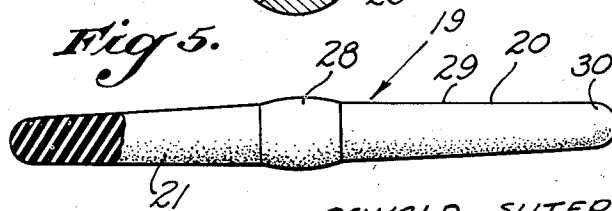
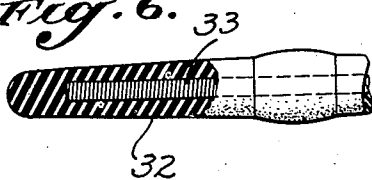


Fig. 6.



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TOOL GUIDE

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My invention relates generally to oil well tools, and more particularly to an improved tool guide or stabilizer.

During the drilling and operation of wells, it is frequently necessary to position a tool or instrument near the bottom of the well bore, and it is customary to lower or drop such tools without removing the drill stem or tubing which may be in the well. The tool has a generally cylindrical housing, smaller than the axial opening of the drill stem, and descends rapidly on the end of a line, or as a free falling spear or "go-devil." At the bottom of the pipe, the tool comes to rest on a baffle plate or similar abutment, and is then actuated to perform the necessary operation.

Many of these tools, such as inclination or directional recorders, must be axially aligned with the drill stem or well bore when the records are taken. Since the instrument housing must be substantially smaller in diameter than the internal diameter of the drill stem to descend freely therein, the instrument tends to incline to one side or the other of the drill pipe when it comes to rest. This introduces a considerable error in the readings of the instrument, and has led to the development of centering means which insure that the housing will be centered relative to the walls of the pipe in which it is seated, and hence in axial alignment therewith.

It is also desirable that the tool be guided during its descent, to avoid damage or shocks caused by striking collars or other internal offsets within the drill stem. Many prior guiding and centering devices have been proposed to serve these purposes, and some of the more recent types have given good results in operation.

A particular type in widespread use is that shown in United States Patent No. 2,195,871, issued April 2, 1940, to V. E. Kuster, which comprises a guide or centering member having a plurality of pliable fingers extending radially outwardly from the housing to engage and slide on the wall of the drill pipe. The fingers guide the tool during its descent, absorbing shocks which would otherwise be transmitted to the housing, and upon seating, serve to center the tool axially within the drill stem. My invention is directed to an improved guide or stabilizer of the Kuster type, and overcomes disadvantages inherent in the Kuster device, as well as in the prior devices.

An inherent disadvantage in all guides or centering means is that they may cause the tool to "hang up" or wedge, if a substantial internal restriction is encountered. Normally, these restrictions take the form of an annular shoulder

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or ring, and as the individual guide elements pass the restriction, they must be compressed inwardly toward the housing and then spring outwardly to again engage the wall of the pipe. If the guide elements or fingers are made with too much flexibility, they will not properly center the tool, and if they are too rigid, they cannot pass the restriction. However, by the use of finger elements which are arranged in a generally helical order, I provide a tool guide in which all the fingers are not transversely coplanar and need not be compressed at the same instant when the tool encounters an annular shoulder or restriction. I am thus able to maintain the necessary rigidity in the finger members to center the tool, and at the same time, decrease the danger of "hanging up." Moreover, I have developed an improved finger element which is more easily and positively attached to the tool, and is considerably cheaper to manufacture and use, since the entire guide need not be replaced if a single finger element becomes worn or distorted.

It is a major object of my invention to provide an improved resilient stabilizer which more positively centers the tool within a surrounding pipe, and at the same time decreases the danger of "hanging up."

A further object of my invention is to provide a tool stabilizer having a plurality of independent and interchangeable finger elements which may be separately replaced.

Another object of my invention is to provide a guide or stabilizer which may be rigidly mounted on the tool, and which cannot work loose during the descent of the tool within the drill pipe.

A still further object of my invention is to provide finger elements which are quickly and easily mounted within the stabilizer without the use of hand tools, and which cannot be detached by any impact during use.

Still another object of my invention is to provide a tool stabilizer which can be manufactured at a very low cost.

These and other objects and advantages of my invention will become apparent from the following detailed description of a preferred and modified form thereof, and from an inspection of the accompanying drawings, in which:

Figure 1 is a longitudinal cross-section of a drill pipe or the like, showing a "go-devil" carrying my improved tool stabilizer therein;

Figure 2 is a partial side elevation of the stabilizer, showing the spaced helical arrangement of the resilient finger members;

Figure 3 is a cross-section taken along the line

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3—3 of Figure 2, showing the radial spacing of the finger members;

Figure 4 is a cross-section, similar to Figure 3, with the finger members removed;

Figure 5 is a side elevation partially in section of a single finger member; and

Figure 6 is a longitudinal cross-section of a modified form of finger member.

Referring now to the drawings, and particularly to Figure 1 thereof, the numeral 10 indicates the lower portion of a drill stem or the like, positioned near the bottom of a well bore. An abutment, which may be an annular baffle plate 11, is secured in the drill stem 10 and is adapted to stop the travel of a tool 12 dropped or lowered from the top of the well bore. The tool 12 may be a spear or "go-devil" having an elongated cylindrical body or housing 14 to contain recording instruments (not shown), and a pointed head 15 on its lower end to drive against the baffle 11 and center the bottom of the tool within the pipe 10.

The baffle 11 is made with a series of ports 13 therethrough, and the go-devil 12 has a diameter smaller than that of the pipe 10 to allow drilling fluid to flow past these members and continue its normal circulation through the pipe. The go-devil 12 is also of reduced diameter so that it will fall freely within the pipe 10, and will therefore tend to come to rest or seat in an inclined position within the pipe if centering means are not provided. This would introduce a considerable error in the readings of an inclination or other survey instrument within the go-devil, since the instrument would not be aligned axially with the drill stem.

To center the upper end of the go-devil within the pipe 10, I provide a stabilizer body or adapter 16 which is rigidly connected to the top of the cylindrical housing 14, and carries a plurality of resilient finger members 19. Each of the members 19 has two opposed fingers 20 and 21 that extend perpendicularly through the stabilizer body 16 to slidably engage the inner wall of the pipe 10, and the respective members are arranged in spaced helical order along the length of the stabilizer body to provide multiple contacts with the periphery of the pipe. Although I have shown a stabilizer to center only the top of the go-devil 12, it will be understood that a similar device may be used at the bottom thereof, when it is not practical to use the baffle plate 11 or a similar centering means.

As may best be seen in Figure 2, the stabilizer body or adapter 16 has a closed lower end 17 of reduced diameter, having connecting means in the form of threads 18 to engage within the upper end of the housing 14, and rigidly secure the adapter thereon. Above the threads 18, an enlarged flange or shoulder 18a may be formed on the adapter 16 to seat against the housing 14 and positively seal therewith. The upper end 22 of the adapter 16 is similarly formed, and as is seen in Figure 1, engages a cap or overshot 23 used in retrieving the device from the well.

The central portion of the adapter 16 has an axial opening 25 therein, forming a tubular outer wall 26 which supports the individual finger members 19. Sets of holes 27 are bored transversely in the wall 26 on diametrically opposed sides, perpendicular to the axis of the adapter 16. Three sets of holes 27 are used in the preferred form, being spaced longitudinally and arranged in helical order. As is best seen in Figure

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3, each finger member 19 passes through a set of holes 27, and is angularly displaced from the adjacent members to provide opposed coplanar fingers 20 and 21, which are longitudinally displaced from, and at an angle of approximately 60° with the respective fingers 20 and 21 of the adjacent finger member. Because three finger members 19 are used, the fingers 20 and 21 divide the periphery of the pipe 10 into six equal segments and thus prevent the inclination of the go-devil 12 in any direction. If desired, more or less finger members 19 may be used, but the six-point contact of the preferred form has been found to be very satisfactory in centering the go-devil 12 within the drill pipe 10.

The finger members 19 are of a generally cylindrical shape formed of a resilient material such as rubber. They may be easily made by a simple extrusion process, and in the preferred form, have several layers of fabric embedded therein to improve the wearing qualities. As is seen in Figure 5, the finger member 19 has an enlarged central hub 28 between the fingers 20 and 21 which is larger in diameter than the holes 27, and is of the same length as the diameter of the axial opening 25 within the adapter 16. The fingers 20 and 21 taper outwardly at 29 to terminate in a rounded end portion 30 of reduced size. Adjacent the hub 28, the diameter of the fingers 20 and 21 is slightly larger than the external diameter of the holes 27. As is seen in Figure 4, the walls 31 of the hole 27 diverge inwardly at an angle of approximately 20°, thus clamping tightly on a finger member 19 inserted therein.

In order to seat the member 19 within the adapter 16, it is necessary to force the hub 28 through one of the holes 27 into the opening 25. Because of the tapered portion 29, the member 19 may be easily inserted in the adapter 16 until the hub 28 is adjacent the wall 26, and the entering finger member 20 or 21 extends through the opposed hole 27. By a hard pull on the entering finger, the device can then be stretched sufficiently to force the hub 28 through the hole 27. As can be understood, once the hub 28 is seated in the adapter, no amount of impacts on the fingers 20 and 21 will dislodge them from the adapter 16, but it is a simple matter to remove the member 19 by a straight outward pull should it become damaged or distorted after use. In prior devices, damage to a single finger has necessitated the replacement of the entire guide, with a consequent waste of time and material, while in my device each finger member 19 may be independently changed as desired.

The length of the finger members 19 is considerably greater than the internal diameter of the drill pipe 10, in which they are to be used, and the outer ends of the fingers 20 and 21 are therefore bent or turned opposite to the direction of travel of the go-devil 12. As is seen in Figure 1, the fingers 20 and 21 are turned upwardly as they would be during the descent of the go-devil 12. When the go-devil 12 is being removed, the fingers 20 and 21 would, of course, extend downwardly in the opposite direction. Because of their resilient and flexible construction, the finger members 19 bear firmly on the wall of the pipe 10 and keep the go-devil 12 centered therein at all times. The individual fingers 20 and 21 absorb shocks that would otherwise be transmitted to the housing 14, and thus help to protect the delicate instruments contained therein.

When the fingers 20 and 21 encounter an annular restriction within the pipe 10, such as a

drill collar, they must be compressed inwardly, and depending upon the force needed, there will be a tendency for the tool to hang up at this point. If all of the fingers 20 and 21 strike the restriction at the same instant, a compressing force of considerable magnitude is needed. By the use of helical spacing of the finger members 19, I have only one pair of fingers 20, 21 transversely coplanar; hence the force needed to flex the fingers inwardly need only be exerted against two fingers at a time, and is of reduced magnitude. Furthermore, the shock imparted to the stabilizer is proportionately reduced, and there is much less danger of tearing the fingers from the device. I have thus found that I am able to use fingers having more rigidity and hence better centering qualities, while at the same time reducing the danger of the tool "hanging up."

In Figure 6 a modified finger member 32 is shown. The external shape of the finger member 32 is similar to the finger member 19, but carries an internal resilient spring means 33. The spring means 33 may be a tightly wound coil spring of small diameter wire wound tightly in a small coil of many turns. Such a means adds greatly to the resilience of the finger member and allows the use of a plastic parent material having better wear resistance. In order to produce a finger member having good resistance to the severe rubbing and abrading which takes place during the descent of the go-devil, it is necessary to use a parent material which is semi-rigid and hence does not have the best possible resilient characteristics. By the use of the spring 33 I have been able to produce a finger member 32 which has better wearing and resilient qualities than has heretofore been possible.

While I have shown and described in detail both preferred and modified forms of my invention, fully capable of carrying out the aforementioned objects and advantages, I wish it to be understood that there are many modifications of design and construction that will be apparent to those skilled in the art, and I do not wish to be limited except as defined in the appended claims. I claim:

1. A stabilizing device for use on a tool adapted to be inserted in an elongated cylindrical pipe, which includes: a rigid hollow body adapted to be connected coaxially on the housing of said tool, and having a series of transverse holes therethrough spaced in non-planar circumferential order; and a plurality of resilient finger members having fingers extending through said transverse holes and projecting outwardly a distance greater than the difference between the radii of said body and said pipe, whereby to guide and center said tool in said pipe, said finger members having enlarged hubs sufficiently pliable to be forced through said transverse holes and thereafter lock said fingers in place.

2. A stabilizing device for use on an elongated oil tool which includes: a tubular body adapted to engage coaxially with the housing of said tool, and having a series of longitudinally spaced sets of opposed transverse holes therein; and a plurality of generally cylindrical resilient fingers having enlarged hubs locked between said opposed transverse holes, said fingers extending outwardly for engagement with the wall of a cooperating drill stem whereby to guide and center said tool therein.

3. A stabilizing device for use on an elongated oil tool which includes: a tubular body adapted to engage coaxially with the housing of said tool,

and having a series of longitudinally spaced sets of opposed transverse holes therein; and a plurality of generally cylindrical resilient finger members having enlarged hubs locked between said opposed transverse holes and internal spring means to increase the resilience of the parent material, said fingers projecting outwardly therefrom whereby to center and guide said tool within a drill stem.

4. A stabilizing device for use on an elongated oil tool which includes: a rigid tubular body having a series of sets of opposed transverse holes therein spaced in generally helical order; means on the ends of said body to connect said body coaxially with the housing of said tools; and a plurality of cylindrical tapered finger members having hubs of larger diameter than that of said transverse holes, and of a length equal to the internal diameter of said tubular body, said member being formed of a resilient material whereby said hubs can be forced through said transverse holes to lock said members within said tubular body and hold said fingers firmly in an outwardly projecting position, to engage the wall of a cooperating drill stem to guide and center said tool therein.

5. A stabilizing device for use on an elongated oil tool which includes: a tubular body having a set of opposed transverse holes therein; and a cylindrical finger member having a central hub of larger diameter than that of said transverse holes, and of a length equal to the internal diameter of said tubular body, said member being formed of a rubber-like material whereby said hub can be forced through said transverse holes to lock said member within said tubular body and hold said fingers in radially outwardly projecting position.

6. A stabilizing device for use on an elongated oil tool which includes: a rigid tubular body having closed ends and a series of helically spaced sets of opposed transverse holes with inwardly tapered walls therein; means on the ends of said body to connect said body coaxially with the housing of said tool; a plurality of cylindrical finger members having opposed outwardly tapered fingers and a central hub of larger diameter than the outer diameter of said transverse holes, and formed of a resilient material whereby said hubs can be forced through one of said holes to enter said tubular body and hold said fingers firmly in an outwardly projecting position, to engage the wall of a cooperating drill stem to center and guide said tool therein.

7. A stabilizing device for use on an elongated oil tool which includes: a rigid tubular body having closed ends and a series of helically spaced sets of opposed transverse holes with inwardly tapered walls therein; threaded means on the ends of said body to connect said body coaxially with the housing of said tool; and a plurality of cylindrical finger members of greater length than the internal diameter of a cooperating drill stem, said members having opposed outwardly tapered fingers and a central hub of larger diameter than the outer diameter of said transverse holes and of length equal to the internal diameter of said tubular body, each of said members being formed of a resilient material whereby said hub can be forced through one of said holes and seat in said tubular body between a set of opposed holes, to hold said fingers firmly in an outwardly projecting position whereby to engage the wall of said cooperating drill stem and thereby by guide and center said tool.

8. A stabilizing device for use on an elongated oil tool which includes: a tubular body having a set of opposed transverse holes therein; and a cylindrical finger member having a central hub of larger diameter than that of said transverse holes and of a length equal to the internal diameter of said tubular body, said member being formed of a wear-resistant and semi-resilient material, whereby said hub can be forced through said transverse holes to lock said member within said tubular body and hold the opposed fingers of said member in radially outwardly projecting position; and axially disposed coil spring means embedded within said fingers to increase the resilience of said fingers.

9. A stabilizing device for use on an elongated oil tool which includes; a rigid tubular body having closed ends and a series of helically spaced sets of opposed transverse holes with inwardly tapered walls therein; means on the ends of said body to connect said body coaxially with the housing of said tool; a plurality of cylindrical finger members having opposed outwardly tapered fingers and central hubs of larger diameter than the outer diameter of said transverse holes, and axially disposed tightly wound coil springs, said members being formed of a resilient material whereby said hubs can be forced through said holes to enter said tubular body and hold said fingers firmly in an outwardly projecting position, to engage the wall of a cooperating drill stem to center and guide said tool therein.

10. A stabilizing device for use on a tool adapted to be inserted within an elongated cylindrical pipe, which includes: a tubular body adapted to be connected coaxially on the housing of said tool, and having a series of transverse holes therethrough spaced in nonplanar circumferential order; and a plurality of finger members formed of a rubber-like material and having fingers formed to extend through said transverse holes and project outwardly a distance greater than the difference between the radii of said body and said pipe to guide and center said tool in said pipe, said finger members having hubs of larger diameter than said transverse holes and of length substantially equal to the internal diameter of said tubular body, said hubs yielding to be forced through said transverse holes and thereafter locking said fingers in place.

11. In a stabilizing device for use on a tool adapted to be inserted within an elongated cylindrical pipe, the combination which includes: a tubular body adapted to be connected coaxially with said tool and having a set of opposed transverse holes therein; and a generally cylindrical finger member formed of a rubber-like material and having a pair of opposed tapered fingers connected by a central hub of larger diameter than the diameter of said transverse holes and of length equal to the internal diameter of said tubular body, said hub being pliable to pass through one of said transverse holes and seat within said tubular body, and said fingers projecting outwardly a distance greater than the difference in radii between said body and said pipe.

12. In a stabilizing device for use on a tool adapted to be inserted within an elongated cylindrical pipe, the combination which includes: a tubular body adapted to be connected coaxially with said tool and having a set of opposed trans-

verse holes therein; a generally cylindrical finger member formed of rubber-like material and having a pair of opposed tapered fingers connected by a central hub of larger diameter than the diameter of said transverse holes, said hub being pliable to pass through one of said transverse holes and seat within said tubular body, and said fingers projecting outwardly a distance greater than the difference in radii between said body and said pipe; and spring means disposed axially along said fingers to increase the resilience thereof.

13. In a stabilizing device for use on a tool adapted to be inserted within an elongated cylindrical pipe, the combination which includes: a tubular body adapted to be connected coaxially with said tool and having a plurality of transverse holes therein; a plurality of generally cylindrical finger members formed of a semi-resilient rubber composition having sufficient hardness to resist abrasion, said members having outer tapered fingers and central hubs of larger diameter than the diameter of said transverse holes, said hubs being pliable to pass through said holes and seat within said tubular body, and said fingers projecting outwardly a distance greater than the difference in radii between said body and said pipe; and spring means disposed axially along said fingers to increase the resilience thereof.

14. A guide finger for a tool guide having a tubular body formed with a set of opposed transverse holes therein which comprises: a generally cylindrical member formed of rubber-like material and having a pair of opposed tapered fingers connected by a central hub of larger diameter than the diameter of said transverse holes, said hub being pliable to pass through one of said transverse holes and seat within said tubular body and said fingers projecting outwardly to guide said body.

15. A guide finger for a tool guide having a tubular body formed with a set of opposed transverse holes therein which comprises: a generally cylindrical member formed of rubber-like material and having a pair of opposed tapered fingers connected by a central hub of larger diameter than the diameter of said transverse holes, said hub being pliable to pass through one of said transverse holes and seat within said tubular body, and an axially extending spring embedded within the material of said fingers to increase the restoring power of said fingers upon deflection from the normal plane thereof.

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