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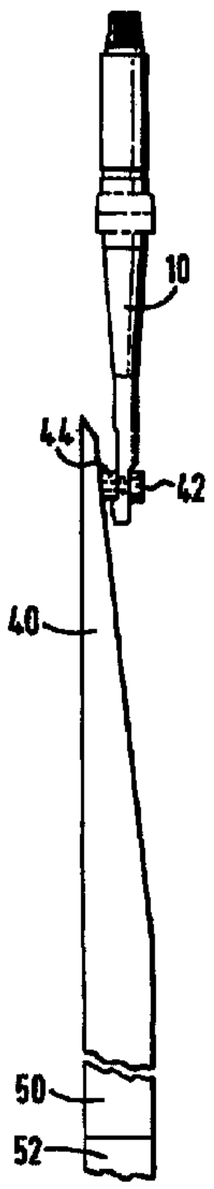
(54) **SYSTEME DE FRAISAGE POUR PUITS ET PROCEDE ASSOCIE**
(54) **MILLING SYSTEM AND METHOD IN A WELLBORE**



(57) L'invention porte sur un système servant à descendre au moins un élément dans un puits, et comportant une fraise (10, 60, 60a, 100) et un élément (40, 67, 80, 107) au moins s'y accrochant. De la fraise (10, 60, 60a, 100) ou de l'élément (40, 67, 80, 107), l'un est muni d'un épaulement, et l'autre, d'un crochet (22, 65, 81, 108), le dispositif étant tel qu'en exploitation ledit épaulement (44, 69, 74a, 104) et ledit crochet (22, 65, 81, 108) s'engagent l'un dans l'autre pour empêcher ladite fraise (10, 60, 60a, 100) et ledit élément (40, 67, 80, 107) de se désolidariser.

(57) A system for lowering at least one member into a wellbore, said system comprising a mill (10; 60; 60a; 100) and at least one member (40; 67; 80; 107) supported therefrom, characterised in that one of said mill (10; 60; 60a; 100) and said at least one member (40; 67; 80; 107) is provided with a shoulder (44; 69; 74a; 104) and the other of said mill (10; 60; 60a; 100) and at least one member (40; 67; 80; 107) is provided with a hook (22; 65; 81; 108), the arrangement being such that, in use, said shoulder (44; 69; 74a; 104) and hook (22; 65; 81; 108) engage to inhibit separation of said mill (10; 60; 60a; 100) and said at least one member (40; 67; 80; 107).

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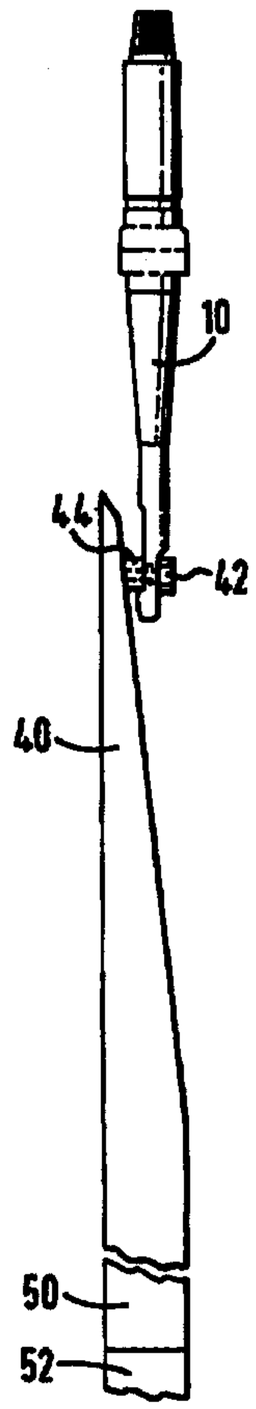
(54) Title: MILLING SYSTEM AND METHOD IN A WELLBORE

(57) Abstract

A system for lowering at least one member into a wellbore, said system comprising a mill (10; 60; 60a; 100) and at least one member (40; 67; 80; 107) supported therefrom, characterised in that one of said mill (10; 60; 60a; 100) and said at least one member (40; 67; 80; 107) is provided with a shoulder (44; 69; 74a; 104) and the other of said mill (10; 60; 60a; 100) and at least one member (40; 67; 80; 107) is provided with a hook (22; 65; 81; 108), the arrangement being such that, in use, said shoulder (44; 69; 74a; 104) and hook (22; 65; 81; 108) engage to inhibit separation of said mill (10; 60; 60a; 100) and said at least one member (40; 67; 80; 107).



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MILLING SYSTEM AND METHOD IN A WELLBORE

This invention relates to a system and a method for lowering at least one member into a wellbore and to a mill and a whipstock of the system.

Milling tools are used to cut out windows or pockets from a tubular, e.g. for directional drilling and sidetracking; and to remove materials downhole in a well bore, such as pipe, casing, casing liners, tubing, or jammed tools. The prior art discloses various types of milling or cutting tools provided for cutting or milling existing pipe or casing previously installed in a well. These tools have cutting blades or surfaces and are lowered into the well or casing and then rotated in a cutting operation. With certain tools, a suitable drilling fluid is pumped down a central bore of a tool for discharge adjacent or beneath the cutting blades. An upward flow of the discharged fluid in the annulus outside the tool removes cuttings or chips from the well resulting from the milling operation.

Prior art sidetracking methods employ a variety of wellbore mills, including, but not limited to, well known starting mills and window mills. A whipstock deflects a mill laterally while it is being moved downwardly in a well during rotation of the mill to cut an elongated opening pocket, or window in well casing.

Certain prior art well sidetracking operations which employ a whipstock also employ a variety of different mills and milling systems used in a certain sequence. This sequence of operation may require a plurality of "trips" into the wellbore. For example, in certain multi-trip operations, an anchor, slip mechanism, or an anchor-packer is set in a wellbore at a desired location. A whipstock-mill combination tool is then run into the wellbore by first properly orienting a stinger at the

bottom of the tool with respect to a concave face of the tool's whipstock. Typically a starting mill or a window mill is releasably secured at the top of the whipstock, e.g. with a shearable member, e.g. a shearable screw or a setting stud and nut connected to a pilot lug on the whipstock. This setting stud bears the entire load of whatever is connected beneath the lowermost mill. The tool is then lowered into the wellbore oriented and anchored. Putting weight down on the tool then shears the setting stud, freeing the lowermost mill, e.g. a window mill or a starting mill from the tool. The mill is diverted into the casing and the casing is milled in some cases as the pilot lug is milled off. The mill moves downwardly while contacting the concave portion and cuts an initial window in the casing. If a starting mill is the lowermost mill, it is then removed from the wellbore. A window mill, e.g. on a flexible joint of drill pipe, is lowered into the wellbore and rotated to mill down from the initial window formed by the starting mill. Then additional mills may be used behind the window mill to lengthen and/or finish the casing window if desired.

There has long been a need for efficient and effective wellbore milling methods and systems in which a significant weight can be hung from a mill without inadvertent shearing of a shear stud connecting a mill to a whipstock, particularly in wellbore sidetracking procedures and the production of multiple lateral wellbores.

According to the invention, there is provided a system for lowering at least one member into a wellbore, said system comprising a mill and at least one member supported thereon, characterised in that one of said mill and said at least one member is provided with a shoulder and the other of said mill and at least one member is

provided with a hook, such that, in use, said shoulder and hook engage to inhibit separation of said mill and said at least one member.

Preferably, said system comprises a shear pin arranged between said mill and said at least one member.

Advantageously, said system comprises a latch arranged between said mill and said at least one member.

Preferably, the latch is hydraulically actuable.

Advantageously, said hook and said shoulder are disengagable by rotation of said mill.

Preferably, said hook is provided with a lip extension.

Advantageously, said shoulder is formed on a lug.

Preferably, said lug is made from a millable material.

Advantageously, mill comprises a starting mill, a window mill or both.

Preferably, said at least one member comprises a whipstock.

Advantageously, said at least one member also comprises at least one of an anchor, a packer, anchor-packer, an orienting device, a plug, one or more tubulars, one or more spacers for repositioning said whipstock.

There is also provided a mill and a whipstock used in the system of the invention.

There is also provided a method for lowering at least one member into a wellbore using the system of the invention, the method comprising the step of lowering said at least one member on a mill and disengaging said hook from said shoulder to detach the at least one member from said hook.

For a better understanding of the invention, reference will now be made, by way of example, to the accompanying drawings, in which:

Figures 1, 3 and 4 are side views of a first, second and third embodiment of a starting mill in accordance with the present invention;

Figure 2 is a cross-sectional side view of part of the starting mill of Fig. 1;

Figure 5 is a side schematic view of a system according to the present invention;

Figure 6a is a side perspective view of a window mill in accordance with the present invention; Figure 6b is a front view of a whipstock in accordance with the present invention, usable with the mill of Figure 6a;

Figure 7a is a side perspective view of a window mill in accordance with the present invention; Figure 7b is a front view of a whipstock in accordance with the present invention, usable with the mill of Figure 7a; Figure 7c is a top view of the mill of Fig. 7a;

Figure 8a is a side cross-sectional side view of a system according to the present invention; and Figure 8b is a cross-sectional view along line 8b-8b of Fig. 8a.

Referring to Figures 1 and 2, there is shown a starting mill 10 according to the present invention with a main body 12 having a top 14 and a bottom 16 with a flow bore 17 therethrough extending from the top 14 to exhaust ports 18.

A lower tapered part of the mill 10 ends in a hook portion 20 that has a lip 22 sized and configured for positioning below a top lug 44 of a whipstock 40 so that the lug 44 can rest thereon, thereby allowing the whipstock 40 to hang from the hook portion 20. A hole 24 through the bottom 16 of the mill 10 permits a shear stud 42 to be arranged through the mill 10 with part projecting into a corresponding hole in lug 44.

The mill 10 may include any known blade and/or milling matrix material to provide cutting action. In the embodiment shown in Fig. 1, a plurality of milling blades 30 are secured to or formed of the main body 12. In one aspect, the blades are dressed with matrix milling material (e.g. KUTRITE (tm) material); with milling inserts; or with both – in any known pattern, array, or combination.

Referring to Figure 3 there is shown a similar starting mill to that shown in Figure 1. Like reference numerals are used for like parts. Blades 30 are dressed with matrix miling material 31 and with inserts 32.

Referring to Figure 4 there is shown a similar starting mill to that shown in Figure 1. Like reference numerals are used for like parts. Blades 30 are dressed with matrix milling material 33.

Figure 5 shows a starting mill (e.g. the mill 10) secured by a shear stud 42 to a lug 44 of a whipstock 40. Numeral 50 indicates schematically a whipstock anchor mechanism (e.g. anchor - hydraulically and/or mechanically settable, settable slip device, anchor-packer) and numeral 52 indicates schematically one or more tubulars secured below the anchor mechanism.

Although the mill in Figure 5 is shown as a starting mill, it is within the scope of this invention for any mill, mill system, or mill-drill tool to have a hook portion as described above and be used with a whipstock as shown in Figure 5.

Figure 6a shows a window mill 60 with a body 62 and a milling end 63. At least one hook recess 64 is formed in the body 62 providing a shoulder 69 and, in one aspect as shown there are a plurality of such recesses spaced-apart around the mill body 62. A corresponding top hook portion 65 of a lug 66 of a whipstock 67 is releasably held in he recess 64. In one aspect an hydraulically

actuable latch 68 projects movably and outwardly over the top of the top hook portion to releasably maintain the top hook portion in the recess.

Figure 7a shows a window mill 60a with a hook recess 74 providing a shoulder 74a, the hook recess 74 having a tapered end portion 70 so that mill rotation facilitates release of the top hook portion 81 of a whipstock 80 shown in Fig. 7b.

Figures 8a and 8b show a mill 100 according to the present invention with a body 102 and a pilot end 103 having a support shoulder 104. A shear stud 105 extends through a top lug 106 of a whipstock 107 into the pilot end 103 of the mill 100. the support shoulder 104 underlies a projecting portion 108 of the top lug 106 and thereby supports the whipstock 107 (and anything connected therebeneath). The mill body and milling surfaces of the mill 100 and/or of the pilot end 103 may be dressed with any known matrix milling material and/or inserts in any known arrangement, combination, array or pattern by any known method.

Claims:

1. A system for lowering at least one member into a wellbore, said system comprising a mill (10;60;60a;100) and at least one member (40;67;80;107) supported therefrom, characterised in that one of said mill (10;60;60a;100) and said at least one member (40;67;80;107) is provided with a shoulder (44;69;74a;104) and the other of said mill (10;60;60a;100) and at least one member (40;67;80;107) is provided with a hook (22;65;81;108), the arrangement being such that, in use, said shoulder (44;69;74a;104) and hook (20;65;81;108) engage to inhibit separation of said mill (10;60;60a;100) and said at least one member (40;67;80;107).

2. A system as claimed in Claim 1, wherein said system comprises a shear pin (42) arranged between said mill (10;60;60a;100) and said at least one member (40;67;80;107).

3. A system as claimed in Claim 1 or 2, wherein said system comprises a latch (68) arranged between said mill (10;60;60a;100) and said at least one member (40;67;80;107).

4. A system as claimed in Claim 3, wherein the latch (68) is hydraulically actuable.

5. A system as claimed in any preceding Claim, wherein said hook (65;81) and said shoulder (69;74a) are disengagable by rotation of said mill (60;60a).

6. A system as claimed in any preceding Claim, wherein said hook (65) is provided with a lip extension.

7. A system as claimed in any preceding Claim, wherein said shoulder (44;108) is formed on or by a lug (44;106).

8. A system as claimed in Claim 7, wherein said lug (44;106) is made from a millable material.

9. A system as claimed in any preceding Claim, wherein said mill (10;60;60a;100) comprises a starting mill, a

window mill or both.

10. A system as claimed in any preceding Claim, wherein said at least one member (40;67;80;107) comprises a whipstock (40).

11. A system as claimed in Claim 10, wherein said at least one member (40;67;80;107) also comprises at least one of an anchor, a packer, anchor-packer, an orienting device, a plug, one or more tubulars, one or more spacers for repositioning said whipstock (40).

12. A mill of the system as claimed in any preceding Claim.

13. A whipstock of the system as claimed in Claim 10 or 11.

14. A method for lowering at least one member into a wellbore using the system as claimed in any preceding Claim, said method comprising the step of lowering said at least one member on a mill and disengaging said hook from said shoulder to detach the at least one member from said hook.

FIG. 1

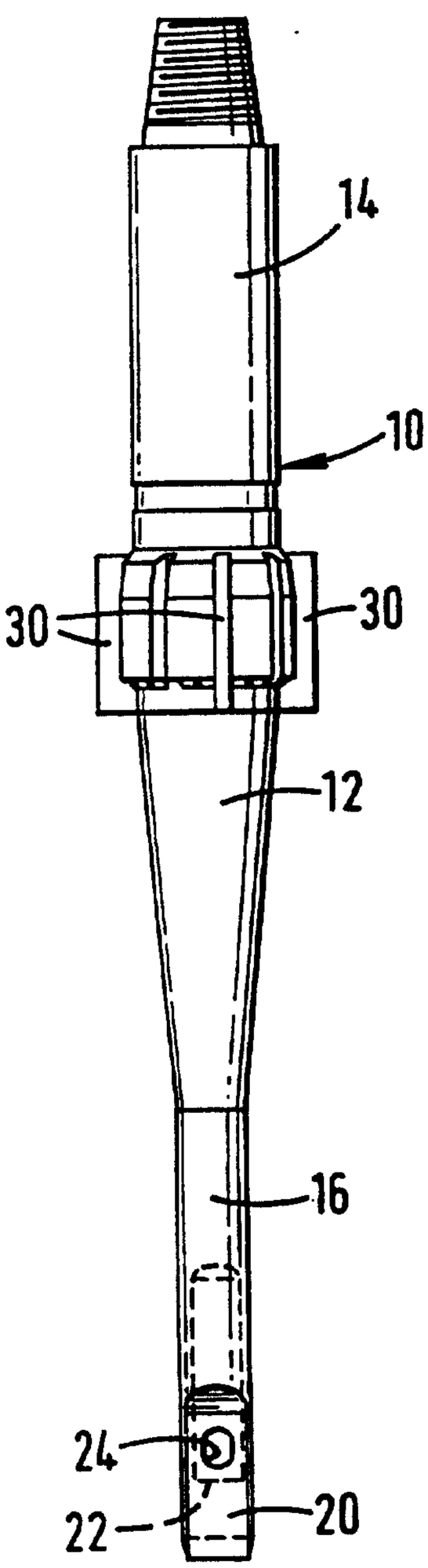

FIG. 2

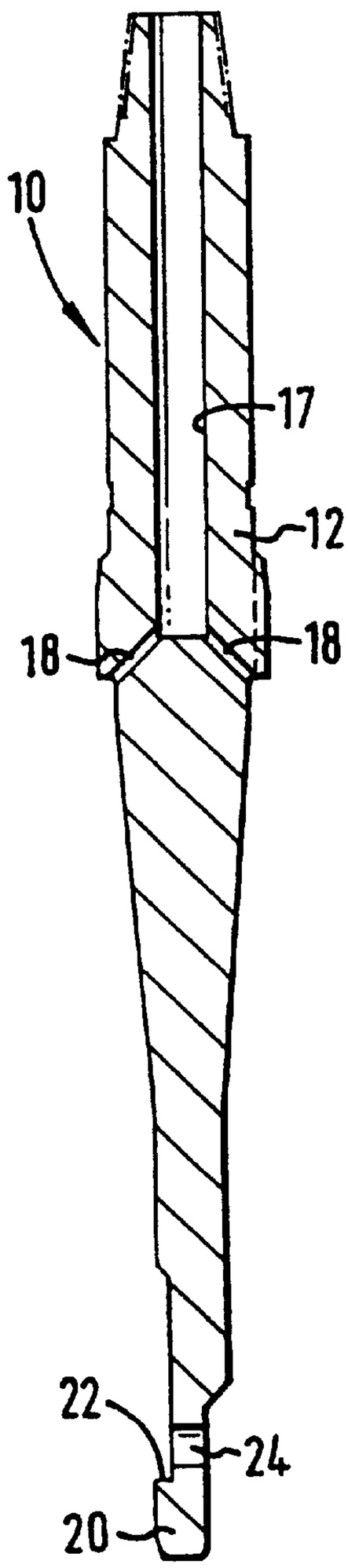

FIG. 3

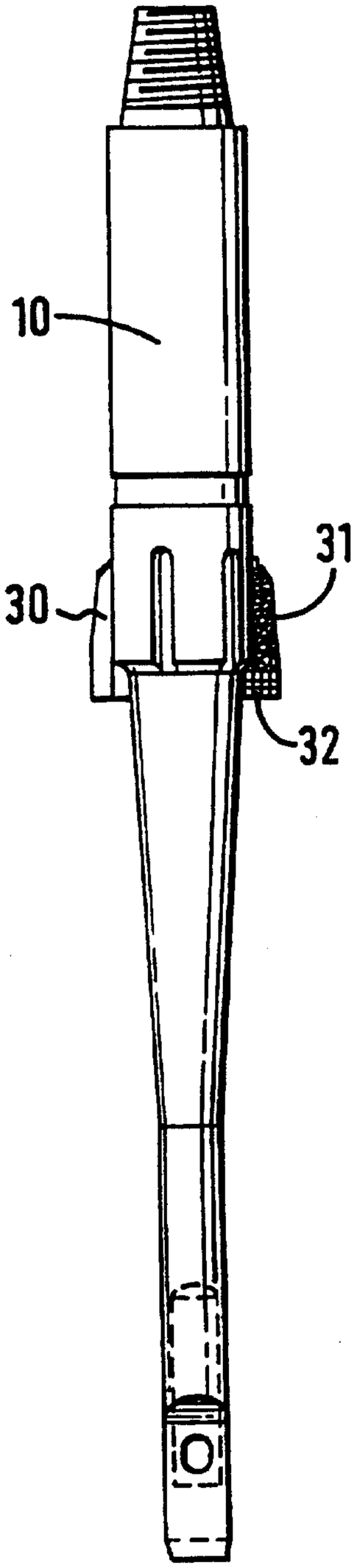

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FIG. 4

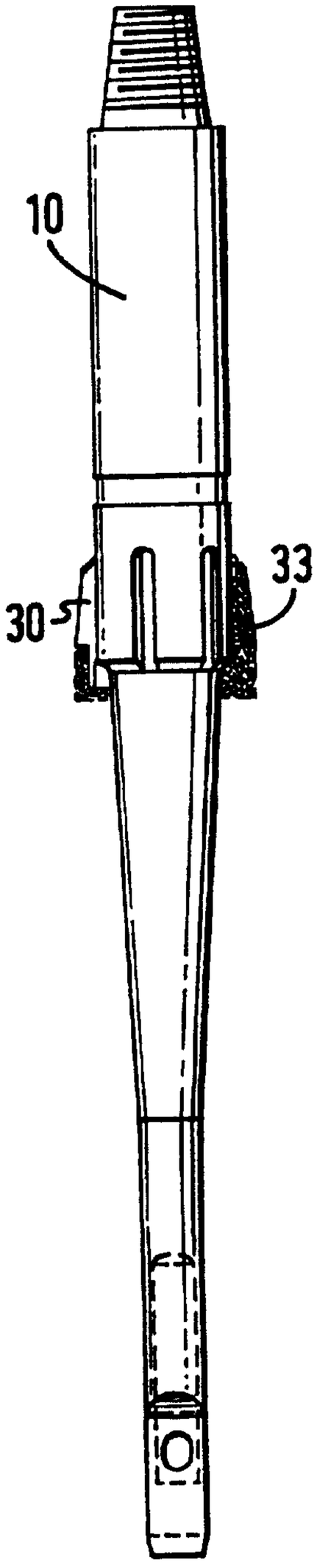

FIG. 5

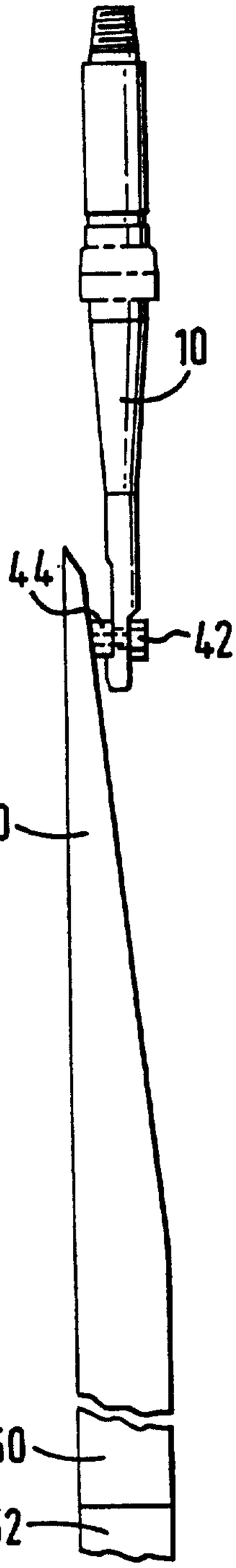

FIG. 6a

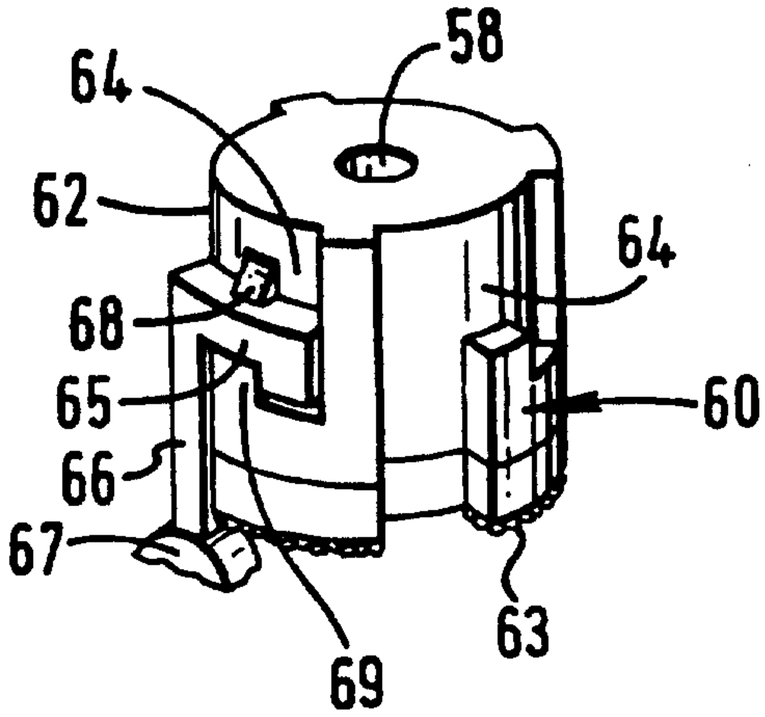

FIG. 6b

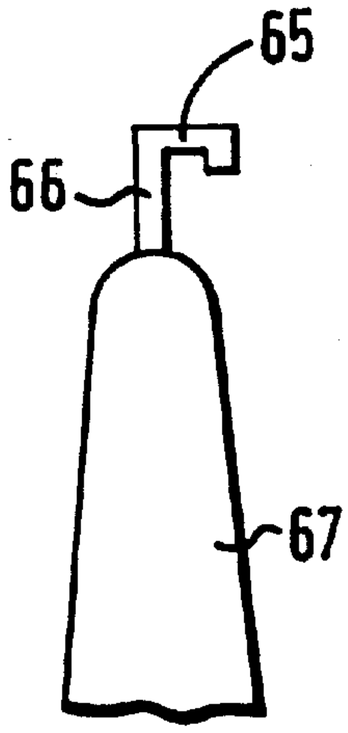

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FIG. 7a

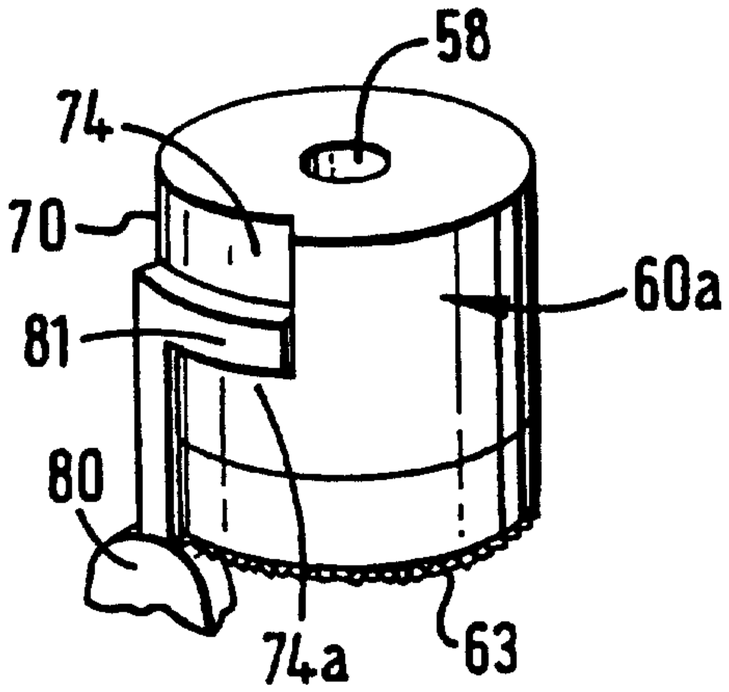


FIG. 7b

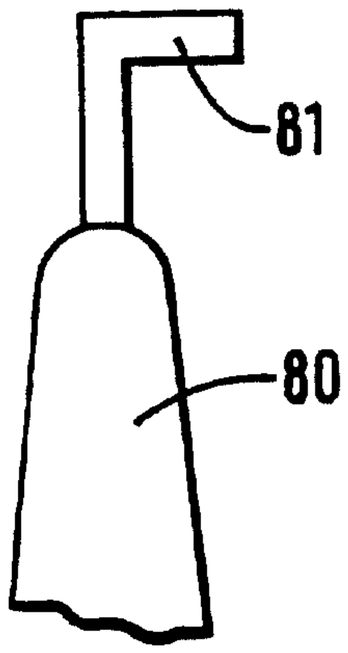
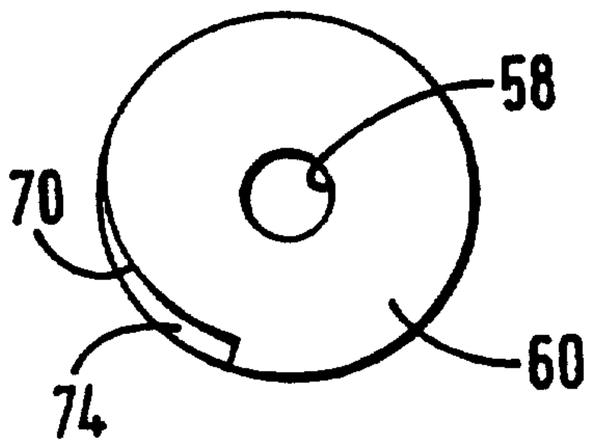


FIG. 7c



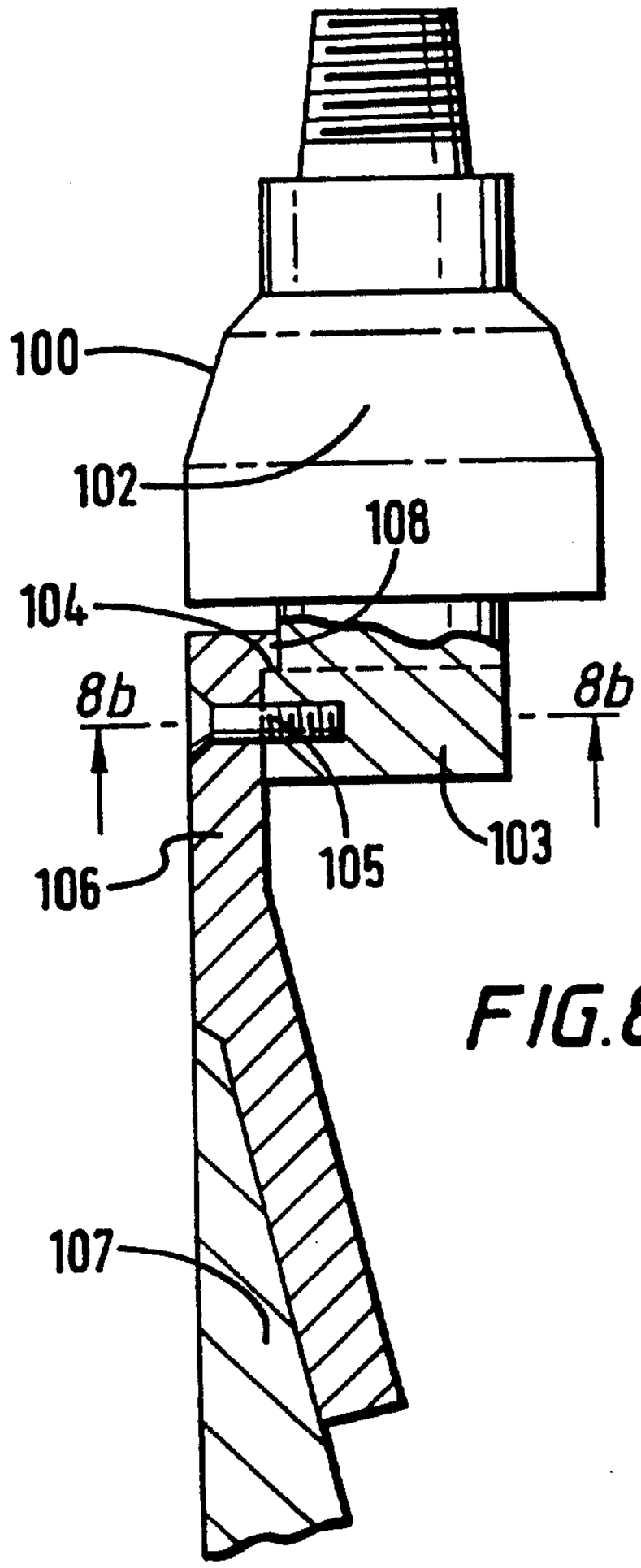


FIG. 8a

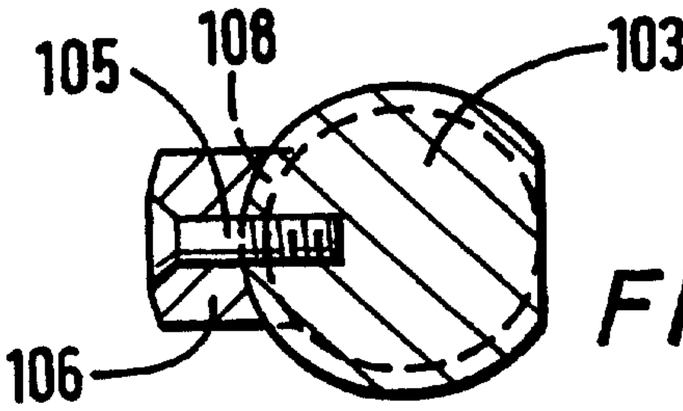


FIG. 8b

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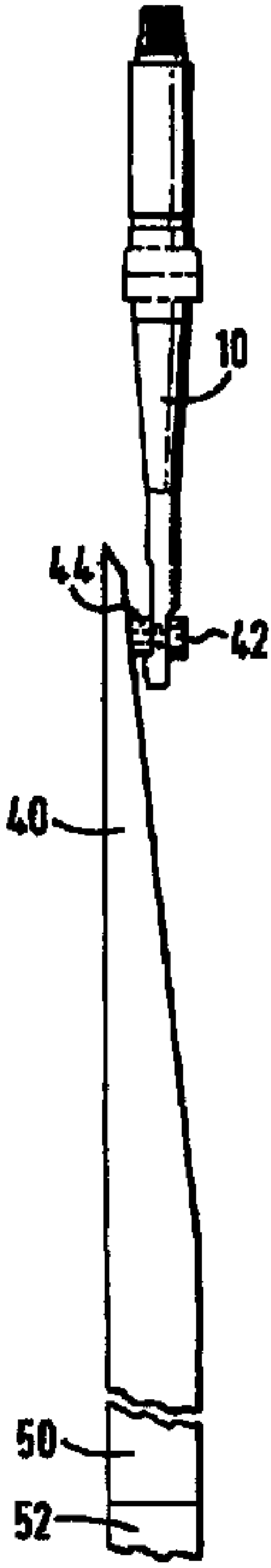
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