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(54) **Release assembly and method of forming drilling tool**

(57) The invention relates to a release assembly and a method of forming a drilling tool for rock or overburden drilling. The release assembly (18) is arranged axially between two drilling tool components (14a, 14b). The release assembly comprises a release mechanism allowing an initial axial length (L1) to shorten (Ls) when a joint (15) of the drilling tool components (14) provided with connecting threads (20, 21) is turned in an opening direction (Ro). Then the release assembly has a decreased second axial length (L2) and friction forces in the joint decrease.

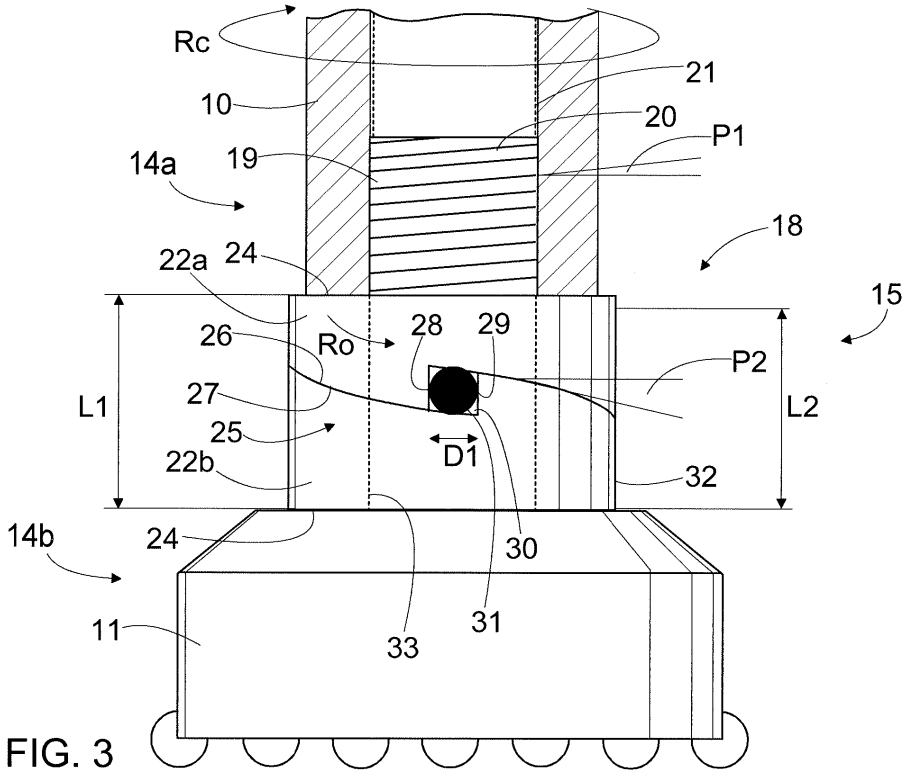

FIG. 3

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Description

Background of the invention

[0001] The invention relates to a release assembly of a drilling tool used in rock drilling and overburden drilling. The release assembly is intended to be arranged axially between two drilling tool components, which can be connected together at a joint by means of connecting threads.

[0002] The invention further relates to a use of the release assembly and a method of forming a drilling tool for rock drilling or overburden drilling.

[0003] The field of the invention is defined more specifically in the preambles of the independent claims.

[0004] In mines and at other work sites, drilling machines are used for drilling bore holes into rock surfaces and soil. The drilling machine comprises a rotating device for rotating a drilling tool during drilling. In many drilling applications the drilling machine also comprises a percussion device for generating impact pulses to the tool. The drilling tool may be composed of several drilling tool components, which are arranged axially successively and connected to each other by means of connecting threads. Opening of the connecting threads between the drilling components after drilling procedures has proven difficult. The connecting threads have a tendency to get stuck. The stuck joint causes loss of time and money.

Brief description of the invention

[0005] An object of the invention is to provide a novel and improved arrangement for release of connecting threads between drilling components. A further object is to provide a novel and improved method of forming a drilling tool.

[0006] The release assembly according to the invention is characterized in that the release assembly comprises a first counter element and a second counter element; at least one of the mentioned first and second counter elements is arranged in an intermediate component separate from the drilling tool components; the intermediate component has a contact surface facing towards the drilling component; and between the first counter element and the second counter element is formed a release mechanism allowing an axial length of the release assembly to be shortened in response to turning the connecting threads of the joint in an opening direction.

[0007] The method according to the invention is characterized by ensuring opening of the thread joint by arranging a release assembly at the joint between the successive drilling tool components; and rotating the thread joint in an opening direction and allowing simultaneously an axial length of the release assembly to be shortened, whereby frictional forces in the thread joint decrease.

[0008] An idea of the disclosed solution is that a drilling tool is provided with at least one release assembly. The release assembly is arranged at a joint between two successive axial drilling tool components. The release assembly has an axial length. The release assembly comprises a release mechanism, which allows the axial length of the release assembly to shorten when the joint is opened.

[0009] An advantage of the disclosed solution is that the release assembly provides easy opening of the connection threads between the successive drilling tool components. When the release mechanism shortens in response to the turning in the opening direction, friction forces are decreased and opening is facilitated.

[0010] According to an embodiment, the first counter element and a second counter element of the release assembly are counter surfaces, which are facing each other. An advantage of this embodiment is that counter surfaces are simple in design, relatively easy to form and durable in use.

[0011] According to an embodiment, the release assembly comprises at least one first intermediate component and at least one second intermediate component. Both of the intermediate components comprise counter surfaces facing each other, and contact surfaces facing the drilling components of the joint. Thanks to this embodiment, the release assembly is a separate and independent piece, which may be placed between the connectable drilling components without any modifications to a basic design of the drilling tool components.

[0012] According to an embodiment, the release assembly comprises one single intermediate component. Then the intermediate component is provided with the first counter surface and a contact surface. Further, one of the connectable drilling components of the joint is provided with the second counter surface. Thus, the second counter surface is an integrated part of the drilling tool component. This embodiment may be beneficial when the number of components or axial length of the release assembly needs to be minimized, for example.

[0013] According to an embodiment, the connecting threads and counter surfaces are opposite in handedness regarding their opening and closing directions. The connecting threads of the joint have a first handedness. The first counter surface and second counter surface are both provided with at least one inclined flank surface having a second handedness opposite to the first handedness of the connecting threads. Thus, the release assembly is arranged to be lengthened when the first counter surface and the second counter surface are turned relative to each other in a closing direction of the first handedness, and is arranged to be shortened when turned in an opening direction of the first handedness. In other words, when the connecting threads are right handed, the flank surfaces are left handed, and vice versa. An advantage of this embodiment is that inclined flank surfaces are easy to manufacture and they endure forces and wear well.

[0014] According to an embodiment, the connecting threads and the inclined flank surfaces of the counter surfaces are opposite in handedness regarding their

opening and closing directions. The connecting threads have a first pitch angle and the inclined flank surfaces have a second pitch angle. The second pitch angle is greater than the first pitch angle. Thanks to this embodiment even rather a small turning motion in the opening direction may decrease tightening force of the flank surfaces and generate needed axial shortening. However, the second pitch angle should be less than fivefold relative to the first pitch angle. This way, unintended opening of the release assembly may be avoided due to the influence of dynamic forces during the use of the drilling tool.

[0015] According to an embodiment, the second pitch angle of the inclined flank surfaces is 2 to 3 fold relative to the first pitch angle of the connecting threads. This embodiment has shown to be usable when tested in practice.

[0016] According to an embodiment, the second pitch angle of the inclined flank surfaces is smaller than the first pitch angle of the connecting threads. Thus, this embodiment is contrary to what has been described in the previous two chapters above. This embodiment may be usable in situations where an unintentional opening of the release assembly is a problem.

[0017] According to an embodiment, the first counter surface is provided with one or more first transverse surfaces and the second counter surface is provided with one or more second transverse surfaces. The transverse surfaces are transverse relative to the inclined flank surfaces. The transverse surfaces may be in axial direction, perpendicular to the flank surfaces or in a desired angular direction. The first transverse surface is facing the second transverse surface and one or more flexible member is arranged between them. The flexible member occupies a distance between the transverse surfaces. The flexible member prevents the transverse surfaces from being positioned in contact with each other. In other words, the flexible member allows the counter elements or surfaces to be turned in their opening direction relative to each other.

[0018] According to an embodiment, the above mentioned flexible member is made of one or more resilient materials, such as rubber or elastic polymer. When the release assembly is turned in the opening direction, the resilient material may be temporarily compressed or reshaped.

[0019] According to an embodiment, the above mentioned flexible member is a separate element, which is installed between the transverse surfaces facing each other. The separately manufactured flexible member is easy to place between the transverse surfaces and it can be changed later if need be. At its simplest implementation the separate flexible member may be a rubber piece.

[0020] According to an embodiment, one or both of the opposing transverse surfaces are covered by a resilient material, which serves as the flexible member. Between the transverse surfaces there may be a space filled with the resilient material. Alternatively, the faces of the transverse surfaces may be coated with the resilient material. The resilient material may be rubber or rubber -like material. Some polymers, such as polyurethane PU, are also suitable for the purpose. In this embodiment the flexible member is prearranged or integrated in the release assembly, thus allowing easy and fast mounting of the release assembly.

[0021] According to an embodiment, the transverse surfaces are held at a distance from each other by means of one or more spring members. When the release assembly is turned towards the opening direction, then the spring member will compress and allow the release assembly to be shortened in the axial direction. In some situations it may be more convenient to use the spring member as a flexible member instead of the above mentioned resilient material.

[0022] According to an embodiment, the contact surface of the intermediate component is provided with one or more friction zones having an intentionally increased friction coefficient. The friction zone may be provided with intentionally increased surface roughness. The friction zone may comprise a knurling, for example. Alternatively, the friction zone may be covered with friction material having a greater friction coefficient compared to the basic material of the intermediate component. The contact surface may have one or several smaller friction zones, and one or more additional zones without the disclosed feature, or alternatively, the entire contact surface is treated for obtaining the increased friction coefficient for the entire area. The idea of the friction zone is to prevent unintentional opening of the connecting threads by increasing friction forces between the intermediate component and the connectable drilling tool component.

[0023] According to an embodiment, the contact surface of the intermediate component has a tapered shape. Thanks to the tapered shape, contact area between the intermediate piece and the connectable drilling tool component may be increased. The intermediate component may comprise the tapered contact surface on an outer periphery, or alternatively on an inner periphery of the intermediate component.

[0024] According to an embodiment, the intermediate component has an outer periphery and an inner periphery, which both comprise one or more curved surfaces. The outer periphery and the inner periphery may both have closed form.

[0025] According to an embodiment, the intermediate component has a ring shaped configuration, whereby it has an outer circumference and an inner circumference. The intermediate component may have a circular or elliptical shape, for example.

[0026] According to an embodiment, the intermediate component is formed of two or more separate pieces. The intermediate component may be sleeve like piece which is formed of two halves, for example.

[0027] According to an embodiment, the counter surface of the intermediate component is formed of two or more separate pieces. The intermediate piece may be

provided with several counter pieces mounted in recesses on the counter surface.

[0028] According to an embodiment, the release assembly is intended to be used in a down-the-hole drilling (DTH). Then the release assembly is arranged between a drill bit assembly and a down-the-hole percussion device. The drill bit assembly comprises a drill bit and fastening members for fastening the drill bit. The down-the-hole percussion device is also known as a DTH-hammer.

[0029] According to an embodiment, the release assembly is used in the DTH -drilling. The release assembly is arranged between a locking nut of the drill bit assembly and the DTH -hammer. The locking nut is also known as a driver sub.

[0030] According to an embodiment, the release assembly is intended to be used in an extension drilling. Then the release assembly is arranged between two successive drilling tool components. The drilling tool component may be a drill bit, a drill rod or a drill pipe, for example.

[0031] According to an embodiment, the release assembly is intended to be used in a rotary drilling. Then the release assembly is located between rotating unit and a drill bit. Between the rotating unit and the drill bit there may be one or more drill tubes or rods provided with connecting threads.

[0032] According to an embodiment, the release assembly is intended to be used in a top-hammer drilling. Then the release assembly is located between a drilling machine and a drill bit, which are located at opposite ends of the drilling equipment. Between the drilling machine and the drill bit there may be one or more drill tubes or rods provided with connecting threads.

[0033] The above-disclosed embodiments can be combined to form suitable solutions provided with necessary features disclosed.

Brief description of the figures

[0034] Some embodiments are described in more detail in the accompanying drawings, in which

Figure 1 is a side view of a rock drilling rig provided with a drilling unit,
Figure 2 shows schematically the principle of DTH drilling,
Figure 3 is a schematic and partly sectional side view of a release assembly arranged between two consecutive drilling tool components,
Figure 4 is a schematic side view of a release assembly when turned in an opening direction,
Figure 5 is a schematic side view of a release assembly wherein a spring serves as a flexible member,
Figure 6 is a schematic side view of a release assembly wherein a flexible, formable or resilient filling material serves as a flexible member,
Figures 7a - 7c show schematically and in axial direction intermediate components comprising several sections each provided with inclined flank surfaces and transverse surfaces in their counter surfaces,
Figures 8a and 8b show schematically contact surfaces of the intermediate component provided with one or more friction zones,
Figure 9 is a schematic side view of a release assembly comprising two intermediate components and being arranged in a shoulder contact in a joint between two drill rods,
Figure 10 is a schematic side view of a release assembly comprising only one intermediate component and being arranged in a shoulder contact in a joint between two drill rods,
Figure 11 is a schematic side view of a release assembly arranged inside a coupling sleeve of a joint between two drill rods and having a bottom contact,
Figure 12 is a schematic side view of a drill bit assembly of a DTH-drilling device,
Figure 13 is a schematic and partially sectional side view of a joint between a DTH -hammer and a drill bit assembly, wherein a release assembly has a shoulder contact,
Figure 14 is a schematic and partially sectional side view of an alternative joint between a DTH -hammer and a drill bit assembly, wherein a release assembly has a bottom contact,
Figure 15 is a schematic and partially sectional side view of an alternative joint between a DTH -hammer and a drill bit assembly, wherein a release assembly has an intermediate component provided with a tapered contact surface facing a drilling tool component,
Figures 16a - 16c are greatly simplified schematic views of an alternative release assembly, and
Figure 17 is a schematic view of a detail of an alternative release mechanism.

[0035] For the sake of clarity, the figures show some embodiments of the disclosed solution in a simplified manner. In the figures, like reference numerals identify like elements.

Detailed description of some embodiments

[0036] Figure 1 shows a rock drilling rig 1, comprising a rock drilling unit 2 which may be connected by means of a boom 3 to a movable carrier 4. The drilling unit 2 may comprise a feed beam 5 and a rock drilling machine 6 supported on it. The rock drilling machine 6 may be moved on the feed beam 5 by means of a feed device 7. The rock drilling machine 6 comprises a shank 8 at a front end of the rock drilling machine 6 for connecting a tool 9. The tool 9 may comprise one or more drill rods 10 and a drill bit 11 located at a distal end of the tool 9. The rock drilling machine 6 further comprises a rotating device 12 for rotating the shank 8 and the tool 9 connected to the shank 8. When the rock drilling is based on rotation

R and feed F of the tool then the drilling is known as rotary drilling. However, the rock drilling machine 6 may also comprise an impact device or percussion device 13 for generating impact pulses to the tool 9. When the rock drilling machine 6 is provided with the percussion device 13, which is located on an opposite end of the tool 9 as compared to the drill bit 11, the drilling is known as top-hammer drilling.

[0037] The tool 9, the drill rods 10 of the tool and the drill bit 11 are drilling tool components 14, which are arranged axially and consecutively. Between the consecutive drilling tool components 14 are joints 15 for interconnecting the components. The joint 15 may comprise connecting threads allowing mounting and dismounting of the joint by screwing the drilling tool components 14 relative to each other around the centre line of the tool 9. Further, the front end of the tool 9 may be connected to the shank 8 by means of a joint 15 comprising connecting threads. The connecting threads of the joints 15 may stuck, wherefore the joints 15 may be provided with a release assembly described in this application.

[0038] At a drilling site, one or more drill holes 16 are drilled with the drilling unit 2. The drill holes 16 may be drilled in a vertical direction, as is shown in Figure 1, or alternatively, in a horizontal direction or in an angular direction. The drill holes 16 may be drilled to a rock material or soil.

[0039] Figure 2 shows a drilling unit 2 for DTH -drilling. The drilling unit 2 differs from the one in Figure 1 in such a way that the percussion device 41 is at the opposite end of the tool 9 in relation to the rotating device 12 or rotation unit. During drilling, the percussion device 41 is in the drill hole 16, and the drill bit 11 may be connected directly to the percussion device 41. The drill bit 11 or a drill bit assembly may be connected to the percussion device 13 by means of a locking nut 37, known also as a driver sub. As it is shown in Figure 2, the tool 9 may comprise one or more drill rods 10 or tubes, which may be connected consecutively by means on joints 15 provided with connecting threads. Further, the rear end of the tool 9 may be connected to the shank 8 by means of a joint 15 also comprising connecting threads. Between the locking nut 37 and a front end of the percussion device 41 is also a joint 15 with connecting threads. The connecting threads of the joints 15 may stuck, wherefore the joints 15 may be provided with a release assembly described in this application. The tool, the extension drill tubes, the drill bit assembly and the percussion piston are all drilling tool components 14, which are arranged axially and one after the other and are used during drilling. Between the consecutive drilling tool components 14 are joints 15 for connecting the components to each other.

[0040] Figure 3 discloses a release assembly 18 in a simplified manner. In this embodiment the release assembly 18 is arranged in a joint 15 between two consecutive axial drilling tool components 14a and 14b, which are in this particular example a drill tube 10 and a drill bit 11 provided with a fastening part 19. An outer surface of the fastening part 19 is provided with outer connecting threads 20 and the drill tube 10 is provided with inner connecting threads 21. The connecting threads 20, 21 match to each other and they have a first pitch angle P1. The release assembly 18 may comprise a first intermediate component 22a and a second intermediate component 22b, which are separate from the drilling tool components 14a, 14b. The intermediate components 22a, 22b have contact surfaces 24 facing the drilling tool components 14. The intermediate components 22a, 22b comprise counter elements facing towards each other and comprising a release mechanism 25 allowing an initial axial length L1 to be shortened in response to turning the connecting threads 20, 21 of the joint 15 in an opening direction Ro. The shortened axial length L2 after execution of the release mechanism 25 is shown in Figure 3, too. A closing direction Rc is also indicated in the Figure.

[0041] In the disclosed embodiment of Figure 3 the counter elements of the release mechanism 25 are a first counter surface 26 and a second counter surface 27, which are facing each other. The first counter surface 26 and the second counter surface 27 are both provided with one or more inclined flank surfaces. The connecting threads 20, 21 have a first handedness and the inclined flank surfaces of the counter surfaces 27, 28 have a second handedness. When the connecting threads are right-handed, the inclined flank surfaces are left-handed, and vice versa. The inclined flank surfaces of the counter surfaces 26, 27 have a second pitch angle P2. The second pitch angle P2 is greater than the first pitch angle P1 of the connecting threads 20, 21, as is clearly shown in Figure 3.

[0042] The first counter surface 26 may comprise a first transverse surface 28 and the second counter surface 27 may comprise a second transverse surface 29, which are facing each other. The transverse surfaces 28, 29 define a space 30 inside which is arranged a flexible member 31. The flexible member 31 occupies a distance D1 between the transverse surfaces 28, 29.

[0043] When the first counter surface 26 and the second counter surface 27 are turned relative to each other in a closing direction Rc, the axial length of the release assembly 18 is lengthened. The release assembly 18 then has the initial length L1. When the joint 15 opened and the first counter surface 26 is turned relative to the second counter surface 27 in an opening direction Ro, the axial length of the release assembly 18 is shortened. The release assembly 18 then has the second axial length L2 and as a consequence of that, friction forces are decreased in the joint 15 allowing easy opening of the joint 15. The flexible member 31 allows the relative movement of the intermediate components 22a, 22b towards the opening direction Ro. The flexible member 31 may be a separate piece arranged in the space 30. The flexible member may be a rubber piece, for example.

[0044] Let it further be mentioned that the intermediate components 22a, 22b may be sleeve-like pieces having an outer diameter 32 and an inner diameter 33. However,

other shapes and forms are also possible. An additional embodiment may comprise only one intermediate component 22a or 22b since one of the drill tool components 14a or 14b may have an integrated counter surface 26 or 27.

[0045] In Figure 4 the release assembly 18 is turned towards the opening direction Ro whereby the transverse surfaces 28 and 29 are moved towards each other and the space 31 occupied by the flexible member 30 has a decreased distance D2. The flexible member 31 may change its shape or may compress, depending on the structure and material used. In this embodiment the flexible member 31 is flattened allowing the relative movement of the intermediate components 22a, 22b and shortening Ls of length of the release assembly 18. The initial position of the first transverse surface 28 is shown in dotted lines.

[0046] In Figure 5 the flexible member 31 of the release assembly 18 is a spring arranged in the space 30. The spring may be a spiral spring, for example.

[0047] In Figure 6 the flexible member 31 is a flexible material cast, injected or otherwise arranged in the space 30. The flexible material filling the space 30 may be polyurethane, for example. The flexible material may combine the transverse surfaces 28, 29 together, whereby the intermediate components 22a, 22b are connected to form one uniform object. Figure 6 further differs from the solutions disclosed in Figures 3 - 5 in that the inclined flank surfaces of the counter surfaces 26, 27 are opposite in handedness. The handedness of the inclined flank surfaces may be designed according to the handedness of the connecting threads. The handedness is shown in Figures of this application only by way of example. The handedness of the release assembly 18 has no effect on other features shown in the Figures.

[0048] Figure 7a shows that the intermediate component 22 may comprise several inclined flank surfaces and transverse surfaces 29 in the counter surface 27. In the solution shown in Figure 7a the counter surface 27 is divided into four sections, but the number of sections may be 2 or 3, or more than 4.

[0049] In Figure 7b the intermediate component 22 is formed of two halves 23a and 23b. It is also possible to form the intermediate component of even more than two pieces. Figure 7b further shows that the transverse surfaces 29 may be coated with a flexible material, whereby the flexible member 31 is integrated to the intermediate component.

[0050] Figure 7c further shows that the intermediate component 22 may have a form different from a basic sleeve. The intermediate component 23 may have a slot 32, whereby the outer periphery is not closed. On the other hand the outer surface of the release assembly 18 needs not to be circular but may have any suitable form.

[0051] Figures 8a and 8b show that the contact surface 24 of the intermediate component 22 may comprise one or more friction zones 33, which all have an increased friction coefficient compared to a friction coefficient of the basic material of the intermediate component. The friction zone 33 may comprise a knurling or other surface treatment, or alternatively, it may comprise a coating.

[0052] Figure 9 shows a release assembly 18 arranged in a joint 15 between two drill rods or tubes of an extension drilling tool. The first drill tool component 14a may have a shoulder 34 against which the release assembly 18 is arranged.

[0053] Figure 10 shows an alternative embodiment of the solution of Figure 9. The release assembly 18 comprises only one intermediate component 22b since the first counter surface 26 and the first transverse surface 28 are integrated to an end face of the first drilling tool component 14a.

[0054] Figure 11 shows a joint 15 wherein the second drill tool component 22b comprises a connecting sleeve 35. The release assembly 18 may be located at the bottom of the connecting sleeve 35.

[0055] Figures 9 - 11 may relate to top-hammer solutions, where the connecting threads are typically left-handed wherefore the inclined surfaces of the release assembly 18 are right-handed.

[0056] Figure 12 discloses a drilling tool assembly 36 comprising a drill bit 11 and a locking nut 37. The drill bit 11 may comprise a fastening part 19 around which a fastening portion 38 of the locking nut 37 may be arranged. The fastening portion 38 is provided with connecting threads 20. The locking nut 37 may further comprise a gripping portion 39. At a distal end of the fastening part 19 of the drill bit 11 is an impact surface 40 for receiving impact pulses. The fastening part 19 may slide axially relative to the locking nut 37 during the operation of the percussion device 41.

[0057] Figure 13 shows that a release assembly 18 may be placed between a down-the-hole percussion device 41 and a drilling tool assembly 36. The DTH percussion device 41 comprises a percussion piston 42 arranged to strike the impact surface 40 of the drilling tool assembly 36. The connecting threads 20 of the drilling tool assembly 36 are connected to connecting threads provided on an inner surface of the percussion device 41. The release assembly 18 allows easy opening of the connecting threads according to the principles described above in this application.

[0058] In Figure 14 the release assembly 18 is located in an alternative position as compared to the solution of Figure 13. The release assembly 18 is inside the percussion device 41 between a retaining element 43 and an end surface 44 of the fastening portion 38 of the locking nut 37. In Figure 14 the release assembly 18 has a bottom contact with the drilling tool components 14a, 14b of the joint 15, whereas in Figure 13 a shoulder contact is applied.

[0059] In Figures 13 and 14 the second intermediate component 22b of the release assembly 18 may be an integrated part of the locking nut 37. Then an upper surface of the gripping portion 39 may comprise elements needed for acting as a part of the release mechanism.

[0060] Figure 15 shows a joint 15, which has almost the same features as shown in the solution of Figure 13. However, in Figure 15 the second intermediate component 22b of the release assembly 18 has a tapered contact surface 24t against the gripping part 39 of the locking nut 37. Alternatively or in addition to, the contact surface 24 of the first intermediate component 22a may also have a tapered shape. Then, of course, the corresponding surfaces of the drilling tool components 14a, 14b facing the release assembly need to be tapered too. Furthermore, one could consider applying the disclosed tapered contact surfaces also at least in solutions of Figures 3, 9 and 10.

[0061] Figures 12 - 15 relate to DTH -hammer solutions, where the connecting threads are typically right-handed wherefore the inclined surfaces of the release assembly 18 are left-handed.

[0062] It should be noted that in Figures 3 and 9 - 15 the disclosed release assembly 18 may be substituted with a different type of mechanism allowing the axial length of the release assembly to shorten when turned in opening direction.

[0063] Figures 16a - 16c show basic principles of alternative release assemblies 18. The Figures are greatly simplified. In Figure 16a one or more release elements 45 are arranged between intermediate components 22a, 22b. The release element 45 may be connected to the intermediate components 22a, 22b by means of joints 46 allowing the release element 45 to turn when the connected drilling tool components 14a, 14b are turned in the opening direction Ro. Then the release element 45 may turn towards a situation shown by dotted lines and may cause the initial axial length of the release assembly 18 to shorten as indicated by an arrow Ls. Figures 16b and 16c show embodiments wherein one of the two intermediate components 22a, 22b is integrated as a part of the drilling tool component 14a, 14b.

[0064] Figure 17 discloses a detail of an alternative release mechanism of a release assembly 18. A first counter element or surface 47 may be provided with one or more projecting parts 48 and a second counter element or surface 49 may be provided with one or more recesses 50, cavities or slots. When an opening movement Ro is directed to the release assembly 18 the projecting part 48 and the recess 50 move towards each other and finally the projecting part 48a may locate in the recess 50. Then an axial length of the release assembly is shortened, as indicated by an arrow Ls.

[0065] The drawings and the related description are only intended to illustrate the idea of the invention. In its details, the invention may vary within the scope of the claims.

Claims

1. A release assembly of a drilling tool for rock and overburden drilling,
wherein the release assembly (18) is to be arranged axially between two drilling tool components (14) connectable together at a joint (15) by means of connecting threads (20, 21);
characterized in that
the release assembly (18) comprises a first counter element and a second counter element;
at least one of the mentioned first and second counter elements is arranged in an intermediate component (22) separate from the drilling tool components (14);
the intermediate component (22) has a contact surface (24) facing the drilling component (14); and
between the first counter element and the second counter element is formed a release mechanism allowing an axial length (L1) of the release assembly (18) to be shortened (L2) in response to turning the connecting threads (20, 21) of the joint (15) in an opening direction (Ro).

2. The release assembly as claimed in claim 1, **characterized in that**
the first counter element and a second counter element are counter surfaces (26, 27), which are facing each other.

3. The release assembly as claimed in claim 2, **characterized in that**
the release assembly (18) comprises at least one first intermediate component (22a) and at least one second intermediate component (22b), which both comprise counter surfaces (26, 27) facing each other, and which both comprise contact surfaces (24) facing the drilling components (14) of the joint (15).

4. The release assembly as claimed in claim 2, **characterized in that**
the release assembly (18) comprises one single intermediate component (22);
the intermediate component (22a or 22b) is provided with the counter surface (26 or 27) and the contact surface (24); and
one of the connectable drilling components (14a or 14b) of the joint (15) is provided with the second counter surface (26 or 27), whereby the second counter surface (26 or 27) is an integrated part of the drilling component (14a or 14b).

5. The release assembly as claimed in claims 2 to 4, **characterized in that**
the connecting threads (20, 21) of the joint (15) have a first handedness;and
the first counter surface (26) and second counter surface (27) are both provided with at least one inclined flank surfaces having a second handedness opposite to the first handedness of the connecting threads (20, 21), whereby the release assembly (18) is ar-

ranged to be lengthened when the first counter surface (26) and the second counter surface (27) are turned relative to each other in a closing direction (Rc) of the first handedness, and is arranged to be shortened (Ls) when turned in an opening direction (Ro) of the first handedness.

6. The release assembly as claimed in claim 5, **characterized in that**
the connecting threads (20, 21) have a first pitch angle (P1);
the inclined flank surfaces have a second pitch angle (P2); and
the second pitch angle (P2) is greater than the first pitch angle (P1).

7. The release assembly as claimed in claim 5 or 6, **characterized in that**
the first counter surface (26) is provided with at least one first transverse surface (28) and the second counter surface (27) is provided with at least one second transverse surface (29), which are transverse to the inclined flank surfaces;
the at least one first transverse surface (28) is facing the at least one second transverse surface (29); and
at least one flexible member (31) is between the at least one first transverse surface (28) and the at least one second transverse surface (29) thus occupying a distance (D1) between the transverse surfaces (28, 29).

8. The release assembly as claimed in claim 7, **characterized in that**
at least one separate resilient element serves as the flexible member (31).

9. The release assembly as claimed in claim 7, **characterized in that**
at least one of the transverse surfaces (28, 29) is covered by a resilient material, which serves as the flexible member (31).

10. The release assembly as claimed in any one of the preceding claims, **characterized in that**
at least one contact surface (24) is provided with at least one friction zone (33) having intentionally increased surface roughness or is covered with material having a greater friction coefficient compared to the basic material of the intermediate component (22).

11. The release assembly as claimed in any one of the preceding claims, **characterized in that**
at least one contact surface (24t) is tapered.

12. A use of the release assembly as claimed in any one of the preceding claims,
characterized by
using the release assembly (18) in down-the-hole drilling, wherein the release assembly (18) is arranged between a drill bit assembly (36) and a down-the-hole percussion device (41), and wherein the drill bit assembly (36) comprises a drill bit (11) and fastening members (37, 38, 39, 43) for fastening the drill bit (11).

13. The use according to claim 12, **characterized by**
arranging the release assembly (18) between a locking nut (37) of the drill bit assembly (36) and the down-the-hole percussion device (41).

14. A use of the release assembly as claimed in any one of the preceding claims 1 to 11,
characterized by
using the release assembly (18) in extension drilling, wherein the release assembly (18) is arranged between two successive drilling components (14).

15. A use of the release assembly as claimed in any one of the preceding claims 1 to 11, **characterized by**
using the release assembly (18) in rotary drilling, wherein the release assembly (18) is between a rotating unit (12) and a drill bit (11).

16. A method of forming a drilling tool for rock or overburden drilling;
the method comprising:

connecting and detaching at least two drilling tool components (14) to each other by means of a thread joint (15) comprising connecting threads (20, 21); and
turning the drilling tool components (14) relative to each during the connection and detaching;
characterized by
ensuring opening of the thread joint (15) by arranging a release assembly (18) to the joint (15) between the successive drilling tool components (14); and
rotating the thread joint (15) in an opening direction (Ro) and allowing simultaneously an axial length (L1) of the release assembly (18) to shorten (18), whereby frictional forces in the thread joint (15) decrease.

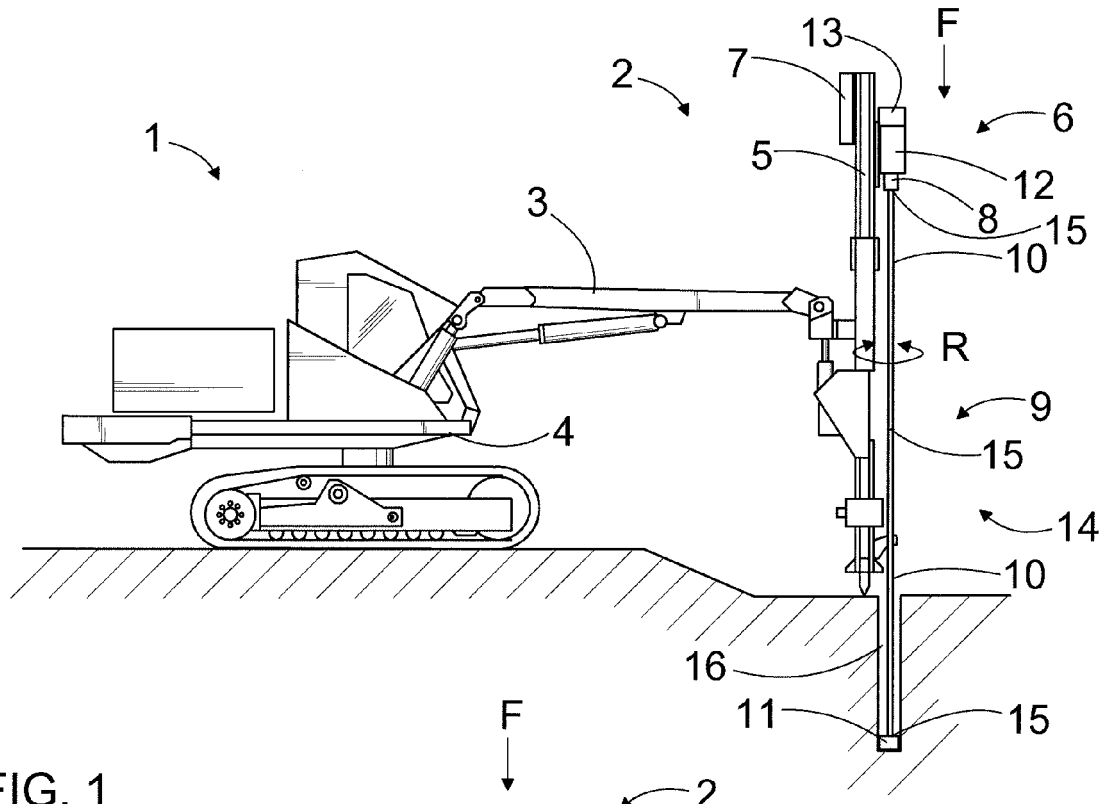

FIG. 1

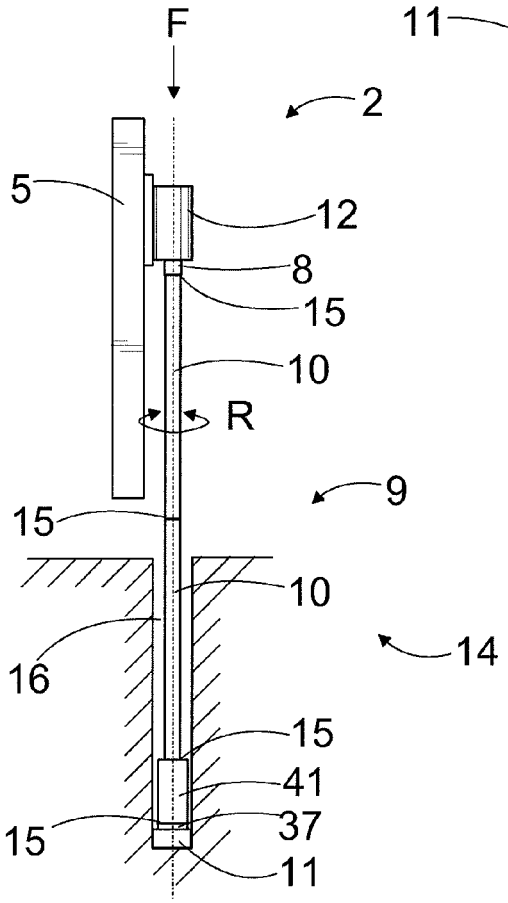

FIG. 2

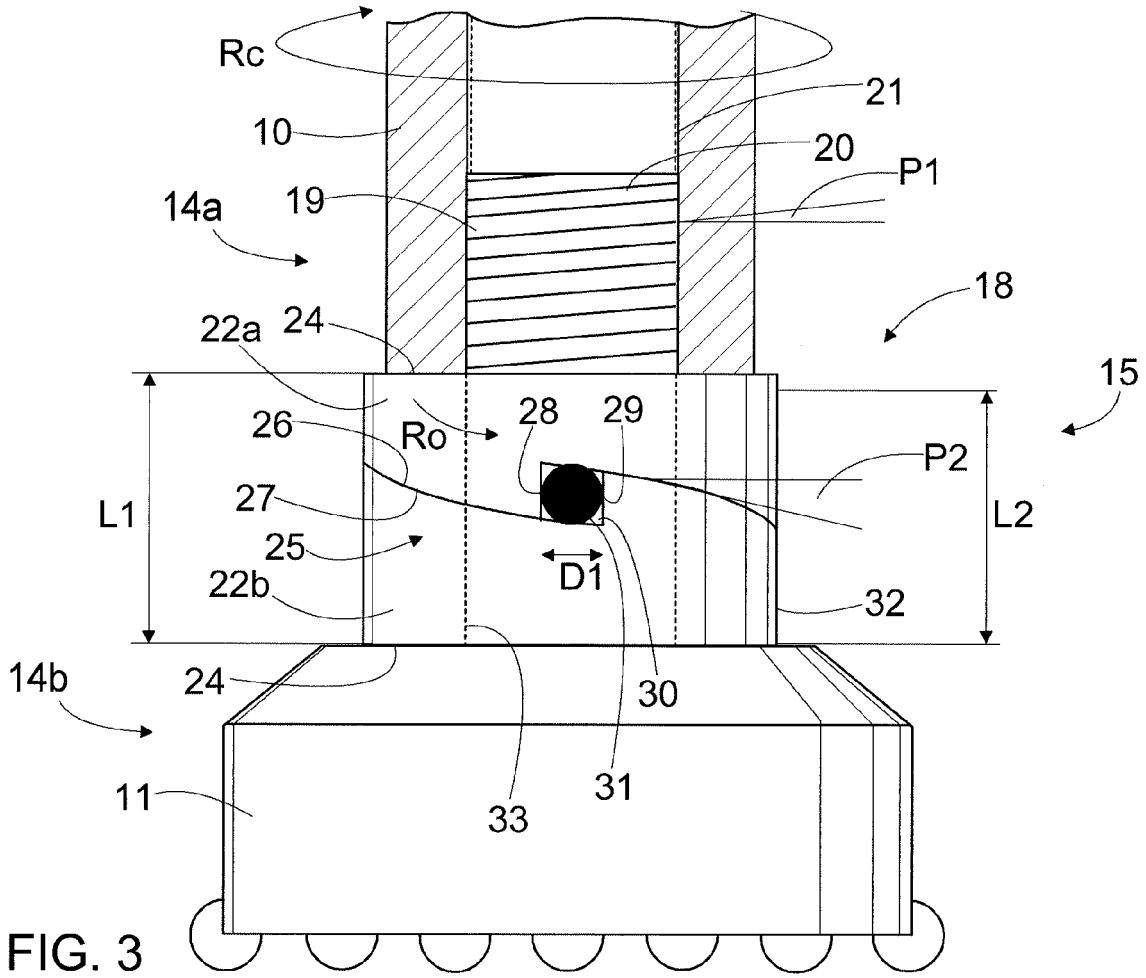
Rc
21
10
20
P1
14a
19
18
22a
24
15
26
Ro
28
29
P2
L1
27
L2
25
D1
22b
32
14b
24
30
11
31
33

FIG. 3

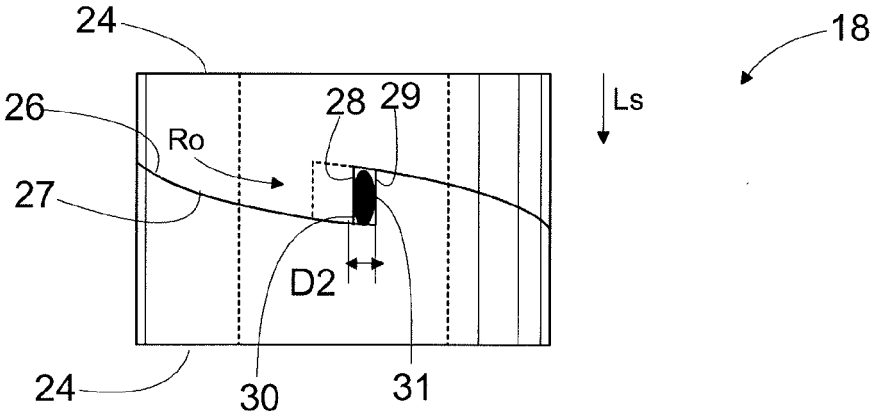
24
18
26
28
29
Ls
Ro
27
D2
24
30
31

FIG. 4

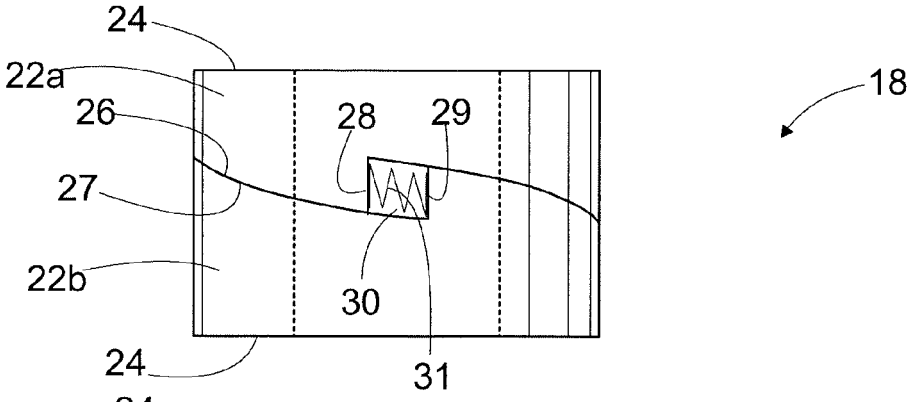

FIG. 5

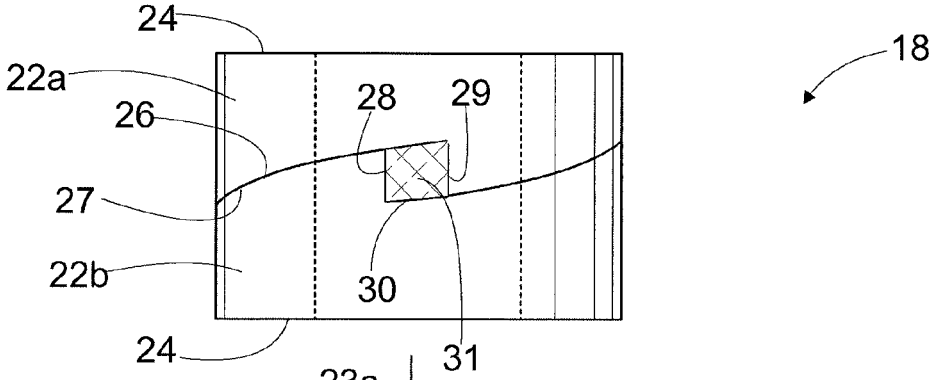

FIG. 6

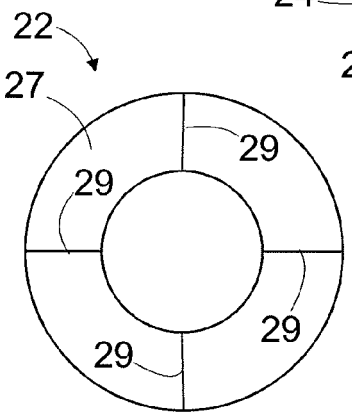

FIG. 7a

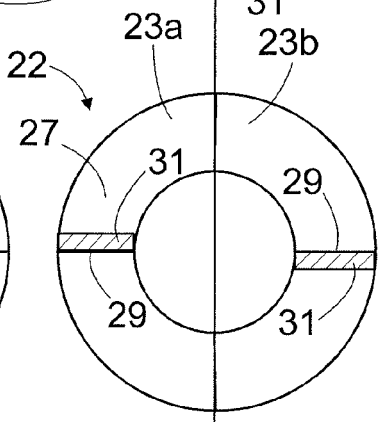

FIG. 7b

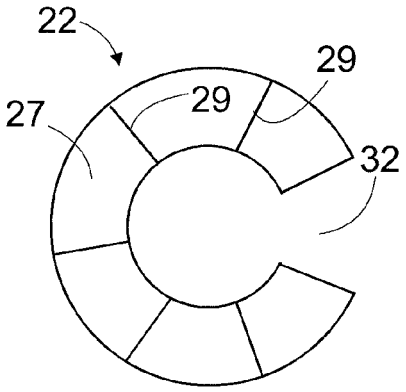

FIG. 7c

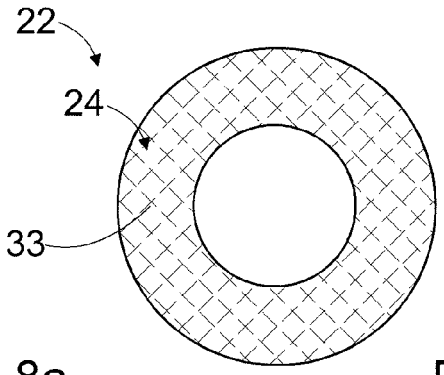

FIG. 8a

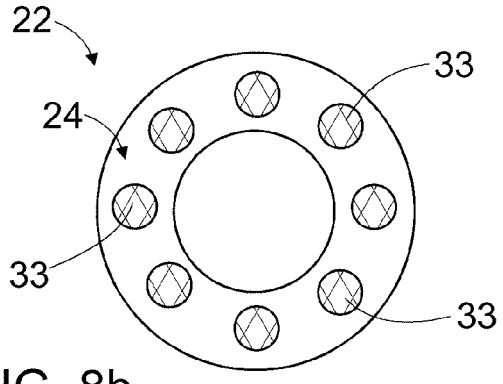

FIG. 8b

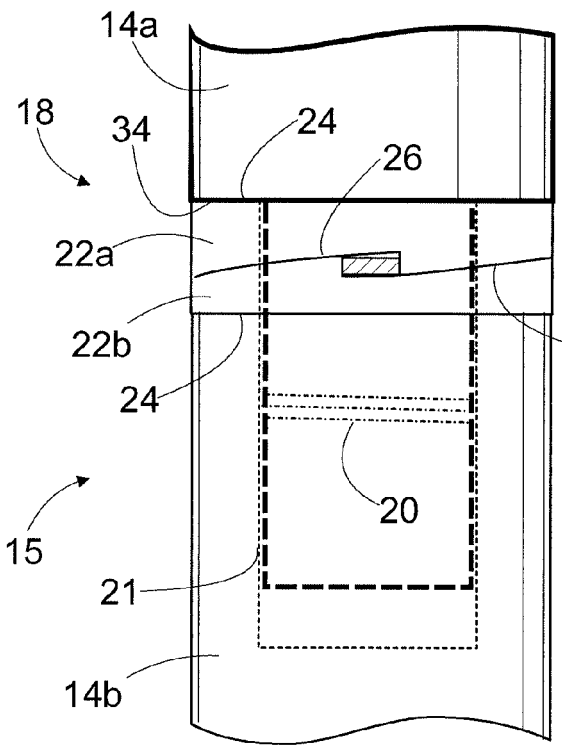

FIG. 9

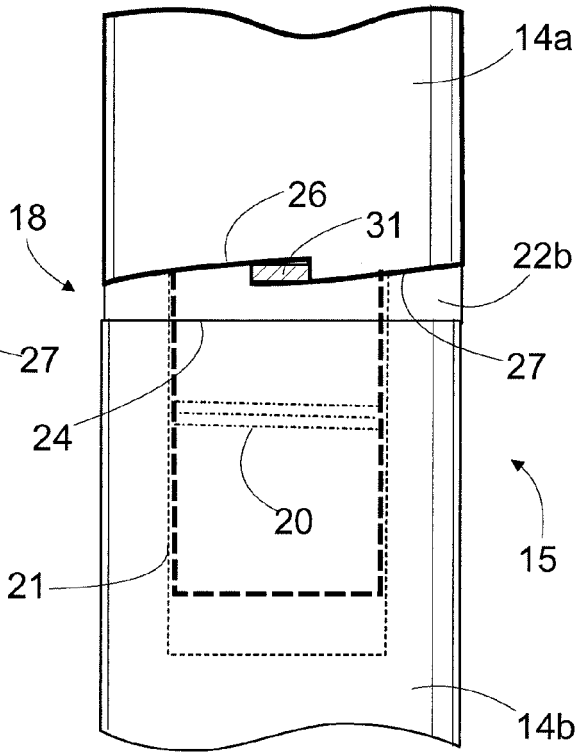

FIG. 10

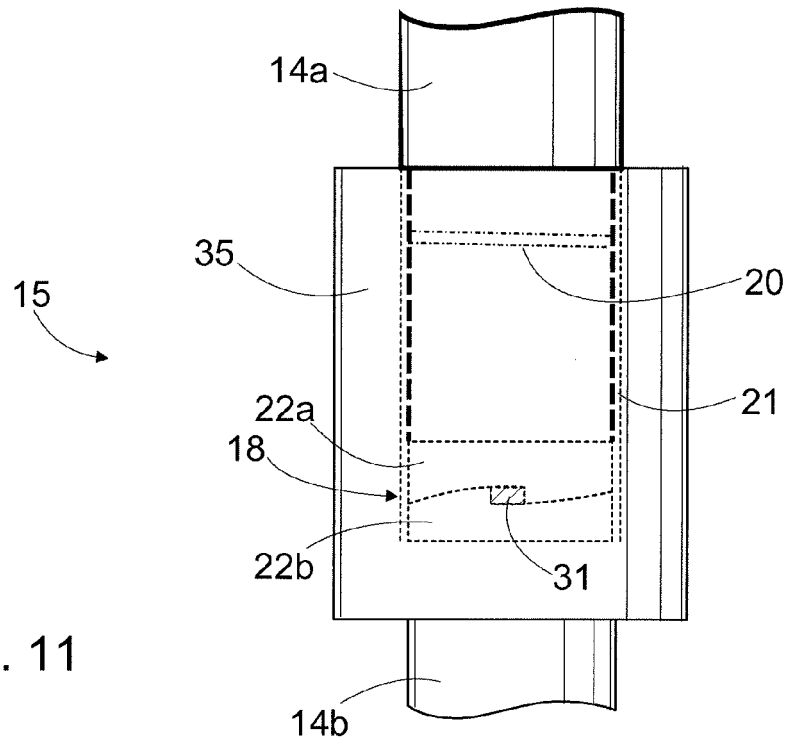

FIG. 11

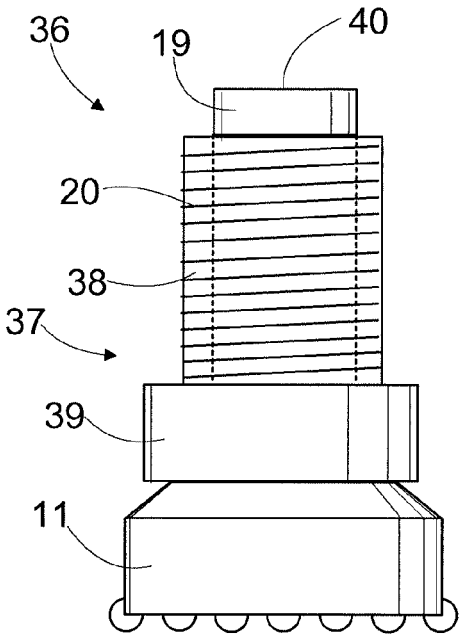

FIG. 12

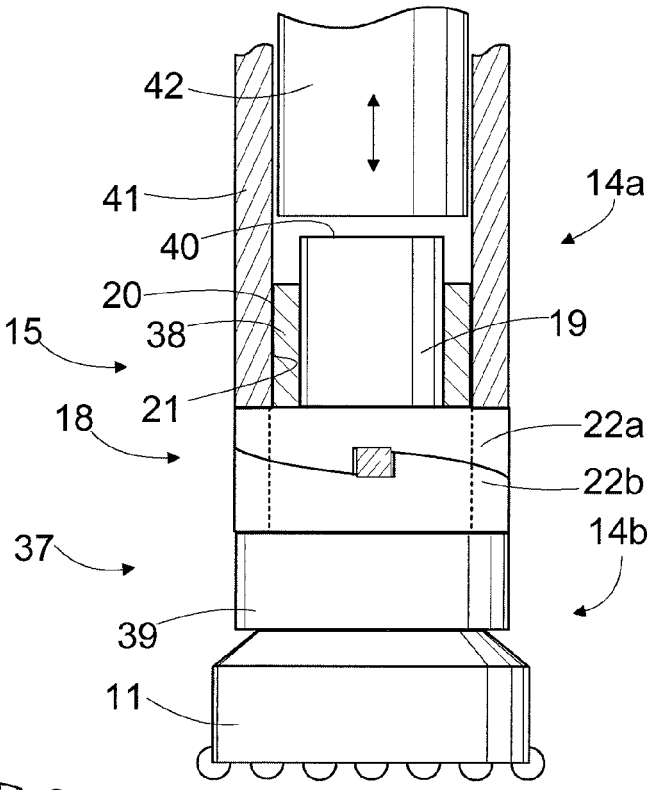

FIG. 13

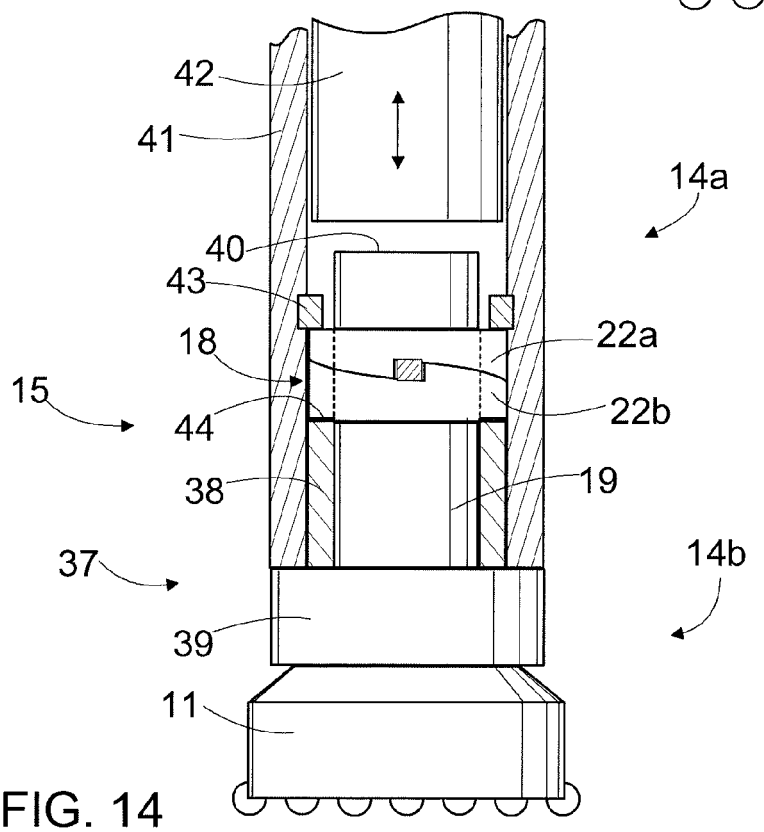

FIG. 14

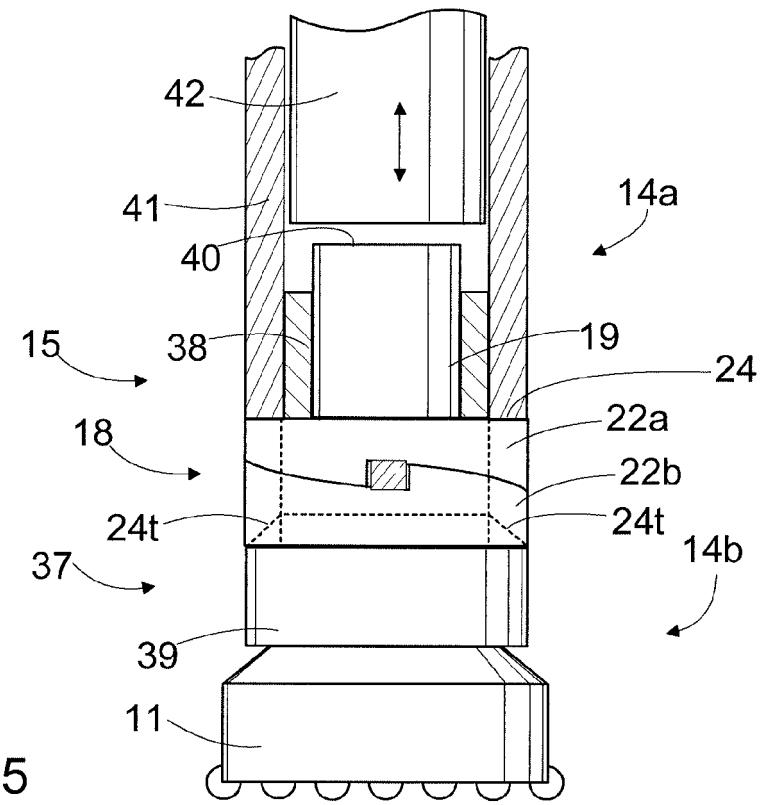

FIG. 15

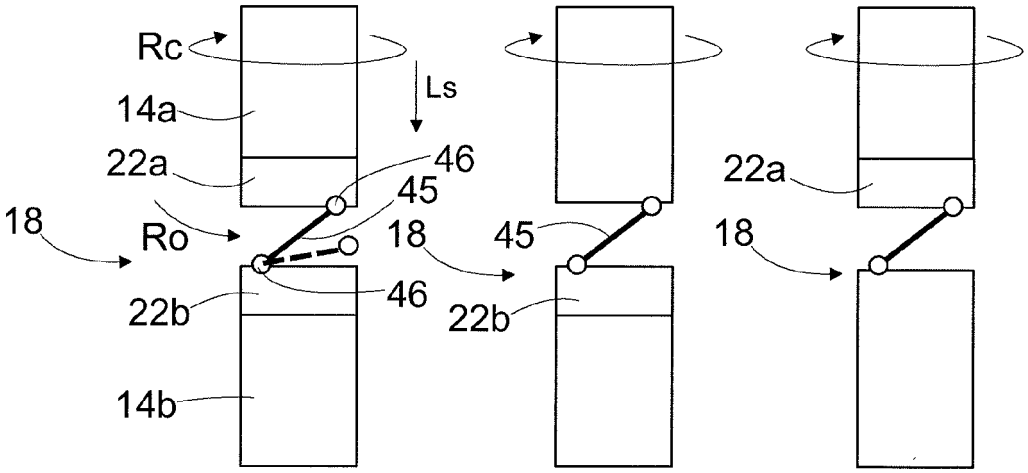

FIG. 16a FIG. 16b FIG. 16c

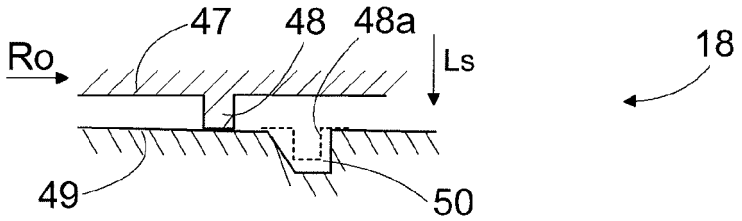

FIG. 17

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EUROPEAN SEARCH REPORT

Application Number
EP 13 19 0766

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 3 248 129 A (BROWN JOE R) 26 April 1966 (1966-04-26) * column 2 - column 3; figures 1,2 *	1,2,4, 12-16 3,5-11	INV. E21B17/046 E21B17/06
A	US 2 937 854 A (KINLEY MYRON M ET AL) 24 May 1960 (1960-05-24) * the whole document *	1-16	
A	US 2 067 377 A (ERWIN BURNS ET AL) 12 January 1937 (1937-01-12) * the whole document *	1-16	
A	US 2 819 877 A (ERNEST KOPPL) 14 January 1958 (1958-01-14) * the whole document *	1-16	
			TECHNICAL FIELDS SEARCHED (IPC) E21B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 February 2014	Morrish, Susan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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26-02-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 2937854 A	24-05-1960	NONE	
US 2067377 A	12-01-1937	NONE	
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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82