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[Continued on next page]

(54) Title: METHOD FOR STIFFENING PROTECTIVE STRUCTURE OF ROCK DRILLING RIG, AND PROTECTIVE STRUCTURE OF ROCK DRILLING RIG

(57) Abstract: The invention relates to a method for stiffening a protective structure of a rock drilling rig, and a protective structure (7) of a rock drilling rig, the protective structure surrounding, at least partly, a drill rod, a rock drill or a feed device of the rock drilling rig. At least some drill rods (9) laying in wait for use are fastened to the protective structure (7) in order to make the protective structure (7) stiffer during use of the rock drilling rig (1).

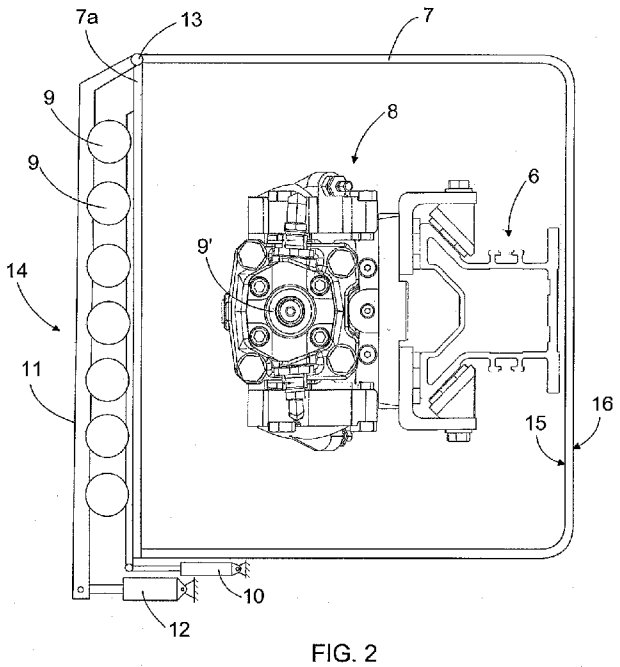


FIG. 2

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METHOD FOR STIFFENING PROTECTIVE STRUCTURE OF ROCK DRILLING RIG, AND PROTECTIVE STRUCTURE OF ROCK DRILLING RIG

BACKGROUND OF THE INVENTION

[0001] The invention relates to a method for stiffening a protective structure of a rock drilling rig, the protective structure surrounding, at least partly, a drill rod, a rock drill or a feed device of the rock drilling rig.

[0002] The invention further relates to a protective structure of a rock drilling rig, the protective structure being provided for the purpose of surrounding, at least partly, a drill rod, a rock drill or a feed device of the rock drilling rig.

[0003] Typically, in drilling rock or stone, rock drilling rigs are used that are provided with one or more booms installed on a carrier and a rock drill movably installed on a feed beam thereon. Usually, the feed beam is installed at an end of the boom to be movable by means of a separate cradle such that it may be brought into a desired position and in a desired direction for drilling. For these various movements of the boom and the feed beam, the rock drilling rig is provided with different cylinders or hydraulic motors known per se that are able to be driven by hydraulic fluid.

[0004] Rock drilling produces noise. The noise is at least mostly caused by the operation of a percussion device of the rock drilling rig and a resulting stroke of a tool on the rock and, further, by the influence of a rotating motion and possible other operations.

[0005] Typically, such noise causes various problems. This noise, spreading quite extensively to the surroundings, causes more and more problems particularly in the vicinity of residential areas. In order for the noise not to restrict working hours or places, attempts have been made in surface drilling in particular to solve the issue by using various protective structures, such as noise reduction housings.

[0006] On the other hand, the movable parts of a rock drilling rig are also problematic as far as occupational safety is concerned, and outsiders may also be at risk e.g. at sites located in the vicinity of housing settlements. A way to improve the safety of an operator of such machinery, other workers and those otherwise moving about in the area is to shield the movable parts by a protective structure which prevents anyone from getting too close to the movable parts during use of the machinery.

[0007] During drilling, the feed beam is subjected to great loading forces that make the feed beam bend and distort. In order for the stiffness of the rock drilling rig and the parts thereof, including e.g. the feed beam, the rock drill and various protective structures, to withstand these forces, it has to be adapted according to a maximum load. When employing a technique called extension rod drilling, drill rods laying in wait for use are typically stored in a separate place called a drill rod magazine. The drill rod magazine adds to the mass of a rock drilling unit, and the forces exerted on the drilling unit are thus at their greatest when drill rods are kept in store in the magazine. Typically, the rock drilling unit and the parts thereof are dimensioned according to this maximum load.

BRIEF DESCRIPTION OF THE INVENTION

[0008] An object of the present invention is to provide a novel and improved method for stiffening a protective structure of a rock drilling rig, and a protective structure of a rock drilling rig.

[0009] A method according to the invention is characterized by fastening at least some drill rods laying in wait for use to the protective structure in order to make the protective structure stiffer during use of the rock drilling rig.

[0010] A protective structure according to the invention is characterized in that the protective structure is provided with means for enabling at least some drill rods laying in wait for use to be fastened to the protective structure in order to make the protective structure stiffer during use of the rock drilling rig.

[0011] An idea underlying the invention is to utilize drill rods that are kept in store to make a protective structure stiffer, since a load of a rock drilling unit and the parts thereof is at its greatest when the drill rods are not yet in use. Consequently, in practice, the rock drilling unit then has a structure with a variable stiffness, rather than a structure and parts thereof dimensioned according to a maximum load.

[0012] In the present context, in addition to various machinery for rock drilling and excavation, a rock drilling rig also refers to any machinery for performing other rock-related tasks, such as bolting and rotary boring machines.

[0013] An advantage of the invention is that the stiffness of the rock drilling unit is at its greatest when drill rods are kept in store within the protec-

tive structure, i.e. exactly when the mass and load of the rock drilling unit are at their greatest. The stiffness, mass and overall dimensions of the rock drilling unit and the parts thereof may thus be reduced and, at the same time, the use and mass of a separate drill rod magazine are avoided, which enables the use of several separate frame or support structures to be avoided. Furthermore, a noise reduction capacity of a cover or housing structure provided in some embodiments may improve and resonance may decrease as the mass of the rods increases the mass of the protective structure and enhances the stiffness of the protective structure. The solution also enables mechanisms associated with the procedures of replacing drill rods and opening and closing covers to be combined.

BRIEF DESCRIPTION OF THE FIGURES

[0014] Some embodiments of the invention are described in closer detail in connection with the accompanying drawings, in which

Figure 1 schematically shows a rock drilling rig with a protective structure, such as a noise reduction housing,

Figure 2 schematically shows a protective structure in a direction of section A-A of Figure 1,

Figure 3 schematically shows a second protective structure in the direction of section A-A of Figure 1,

Figure 4 schematically shows a third protective structure in the direction of section A-A of Figure 1,

Figure 5 is a schematic cross-sectional view showing a fourth protective structure, and

Figure 6 is a schematic cross-sectional view showing a fifth protective structure.

[0015] For the sake of clarity, the figures show some embodiments of the invention in a simplified manner. In the figures, like reference numerals identify like elements.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Figure 1 schematically shows a rock drilling rig 1 provided with a carrier 2. Usually, the carrier is equipped with wheels or tracks; in this case, by way of example, tracks 3. A boom 4, which in a manner known per se may consist of one or more boom parts (in the figure, by way of example, one part), is fastened to the carrier 2 in a manner known per se. The boom 4 may

be any boom structure known per ser; therefore, it is not necessary to describe it in greater detail herein. In a manner known per se (not shown), the boom 4 is pivotally fastened to the carrier 2 such that by means of actuators known per se, such as pressure medium cylinders or the like, it may be rotated to a desired angle with respect to the carrier.

[0017] Pivotally with respect to the boom, a cradle 5 is connected to one end of the boom 4 such that the cradle 5, in turn, has a feed beam 6 installed therein movably in its longitudinal direction. The feed beam 6 may be moved with respect to the cradle 5 in a manner known per se by means of a pressure medium cylinder 6a. The feed beam 6 is provided with a rock drill known per se (not shown) for drilling holes by a drill rod (not shown) and a commonly known drill bit (not shown) attached thereto. The feed beam and the rock drill as well as at least a part of the drill rod, typically a majority of a part of the drill rod residing outside the hole, are surrounded by a protective structure 7, which in the embodiment shown in Figure 1 consists of two different parts but which may also consist of one part or more than two parts.

[0018] The rock drilling rig 1 and the noise reduction housing 7 shown in Figure 1 are only an example of a rock drilling rig and a protective structure arranged therein, in this case a noise reduction housing, to which the solution may be applied. A rock drilling rig wherein a protective structure according to the invention is arranged may differ greatly from the one shown in Figure 1.

[0019] Typically, a drill rod arranged in a drilling centre may consist of either one single drill rod, or a length of a drill rod may be increased by connecting several drill rods to one another, these interconnected drill rods thus providing one operationally uniform rod called an extension rod. This is useful when drilling deep holes in particular. Typically, drill rods laying in wait for use are stored in a place called a drill rod magazine, and when necessary, they are taken therefrom to be connected to the extension rod arranged in the drilling centre. The term drill rod may thus refer to one single drill rod or an extension rod consisting of several successively connected drill rods. Further, the term drill rod may refer to a part of a drill rod when a plurality of such parts may be connected successively in order to form a single drill rod or extension rod. Depending on the embodiment, a drill rod may be a solid rod, its interior may be provided with a channel for conveying a flushing medium or, typically in extension rod drilling, it may also be a hollow tube. In Figures 2 and 3, drill rods lay-

ing in wait for use are indicated by reference numeral 9 while drill rods or an extension rod arranged in a drilling centre for drilling are indicated by reference numeral 9'.

[0020] Figure 2 shows part of a rock drilling rig in a direction of section A-A of Figure 1. The figure shows an embodiment wherein a rock drill 8 and at least a part of a drill rod 9' or drill rods 9' arranged in the drilling centre is surrounded by a protective structure 7, e.g. a noise reduction housing or a machine-safety-related safety structure. The protective structure 7 has an inner surface 15 and an outer surface 16. Part of the protective structure forms a cover 7a, which may be moved by one or more cover actuators 10. In different embodiments, the cover 7a may have a length of the entire protective structure 7 or less, as well as a width of the protective structure 7, or it may be narrower or wider, as long as it is at least long and wide enough to enable the drill rods 9 to be transferred into and out of the protective structure 7 through the cover. In addition, on the other hand, the cover 7a is provided for covering a corresponding opening in the protective structure 7 in a manner suitable for the purpose of use, such as noise reduction or machine safety, of the protective structure 7. The basic structure of the cover 7a should also be sufficiently light and easy to open in order for the protective structure 7 not to interfere with service and maintenance work, for instance.

[0021] In the embodiment according to Figure 2, at least some of the drill rods 9 that are not in use are arranged in connection with the outer surface 16 of the protective housing 7; to be more precise, at the outer surface of the cover 7a of the protective housing 7. A part of the protective housing 7, more precisely, the cover 7a of the protective structure 7 and a mechanism 11, then acts as a drill rod magazine 14 by which the drill rods 9 laying in wait for use are locked or fastened to the protective structure 7 during use of the rock drilling rig 1. By locking or fastening the drill rods 9 to the protective structure 7, the mass and stiffness of the drill rods 9 laying in storage in wait for use may be utilized to make the protective structure 7 stiffer. Since the mass of the rock drilling unit and the parts thereof and thus a need for stiffness are at their greatest exactly when the drill rods reside in the drill rod magazine 14, it is particularly advantageous to use the drill rods 9 to make the structure stiffer. Correspondingly, the need for stiffness is at its smallest when the drill rods 9 are combined into an extension rod 9' arranged into a drilling centre in order to be used for drilling. The use of drill rods 9 to make the structure stiffer provides a

structure with a variable stiffness, thus enabling the rock drilling unit and the parts thereof to be dimensioned in an optimal manner, taking different uses and situations into account, instead of setting the dimensions according to a maximum load. Further, when using this solution, the cover 7a may be implemented as a light and easily openable construction, which makes service and maintenance work easier to carry out, for instance.

[0022] Figure 2 shows how the cover is provided with a mechanism 11 wherein at least one mechanism actuator 12 is arranged for moving the mechanism. The mechanism 11 is provided for moving a next drill rod 9 available in the drill rod magazine 14 to a position wherefrom a manipulator 18, e.g. of the kind schematically shown in Figure 3, may pick up the drill rod and bring it into the drilling centre to constitute an extension for the extension rod 9'. In this description, this position wherefrom the manipulator 18 may pick up the drill rod 9 is called a replacement position. Depending on the embodiment, the replacement position may be a special position into which a drill rod 9 is moved by the mechanism 11 to be picked up by the manipulator 18, as disclosed above. In different embodiments, the replacement position may also be a normal storing and locking or fastening position of a drill rod 9 laying in wait for use if this position allows the drill rod 9 in this position to be picked up by the manipulator 18. The actuator 10 of the cover 7a and the actuator 12 of the mechanism 11 may be e.g. pressure medium cylinders, such as hydraulic or pneumatic cylinders, or linear motors.

[0023] In the embodiment according to Figure 2, the cover 7a and the mechanism 11 are pivotally fastened to the protective structure 7 by a single joint 13. In such a case, the actuators 10 of the cover 7a and the actuators 12 of the mechanism 11 may be placed on a side of the protective structure 7 opposite to the joint 13, in accordance with the figure. Alternatively, the cover 7a and the mechanism 11 may be separately connected by joints to the protective structure 7. A further alternative is to connect the cover 7a and the mechanism 11 to the protective structure 7 by using no joints at all but by means of the actuators 10 of the cover 7a and the actuators 12 of the mechanism 11, in which case the actuators 10 of the cover 7a and the actuators 12 of the mechanism 11 are arranged on both sides of the cover 7a. This enables the cover 7a and the mechanism 11 to be connected to the protective structure 7 by these actuators.

[0024] When drill rods 9 are added from the drill rod magazine 14 to constitute an extension for the extension rod 9' in the drilling centre, the mechanism 11, the actuators 10 of the cover 7a, and the actuators 12 of the mechanism 11 are used for opening the cover 7a and for moving the drill rods 9 in the drill rod magazine 14 substantially parallel to a direction of the surface of the protective structure 7. In such a case, the mechanism 11 comprises means, such as a chain mechanism, a magazine-type mechanism, a spring-return revolver mechanism or another mechanism based on linear or rotational motion, for moving the drill rods 9. The handling and transfer of the drill rods 9 from the drill rod magazine 14 to constitute an extension for the extension rod 9' in the drilling centre may be implemented e.g. by a manipulator 18 of the kind schematically shown in Figure 3. In Figure 3, the manipulator 18 is in its entirety placed inside the protective structure 7 but it could also be placed either in its entirety or in part outside the protective structure, in which case e.g. part of a surface of the protective structure 7 to be directed downwards as viewed in Figure 3 may be opened in order to insert the manipulator 18 into the protective structure. The manipulator 18 may be implemented in several different manners known per se to those skilled in the art.

[0025] In different embodiments, the drill rods 9 may be arranged at the outer and/or inner surface of the cover 7a and, in addition thereto or instead thereof, on the sides of the protective structure 7 or at least partly around the protective structure 7. In such a case, one or more mechanisms 11 should also enable each drill rod 9 to be transferred to the replacement position. One or more mechanisms 11 may then be arranged outside and/or inside the protective structure 7. In addition, as necessary, some of the drill rods 9 may also be placed somewhere else than in connection with the protective structure 7.

[0026] Figure 3 shows a second embodiment wherein drill rods 9 laying in storage in wait for use are utilized to make the protective structure 7 stiffer. As distinct from the solution shown in Figure 2, in this embodiment at least some of the drill rods 9 are placed in connection with the inner surface 15 of the protective structure 7. Thus, the protective structure 7 directly serves as a drill rod magazine 14 as well. This structure is simpler than the structure disclosed above, because no cover equipped with opening actuators is needed in the protective structure 7 in order to transfer the drill rods 9 from storage to the extension rod 9'. Further, if the transfer of the drill rods 9 from storage to use may be implemented directly from a storage position by means of a manipula-

tor 18 known per se, no separate mechanism is necessarily required for bringing the drill rods 9 laying in wait for use to be available to the manipulator 18. In such a case, the storage position then also serves as a replacement position. This enables the drill rods 9 to be locked or fastened to the inner surface 15 of the protective structure 7 e.g. by a simple mechanical locking 17 or fastening 17, as shown in Figure 3. The mechanical locking 17 may be implemented e.g. by making the locking parts from a flexible material or by using another support based e.g. on form-locking. If desired, the locking may also be arranged e.g. by a mechanism corresponding to the one shown in connection with Figure 2. When necessary, the drill rod 9 may also be transferred to the replacement position by the mechanism 11.

[0027] In addition to the embodiments shown in Figures 2 and 3, the protective structure 7 may also be stiffened by locking or fastening only some of the drill rods 9 laying in storage in wait for use into connection with the protective structure 7. Further, the protective structure 7 may also be stiffened by placing some of the drill rods 9 into connection with the outer surface 16 of the protective structure 7 and some of them into connection with the inner surface 15 of the protective structure 7. In such a case, it is usually necessary to provide the protective structure 7 with an opening to enable the drill rods 9 to be transferred from outside the protective structure 7 to the inside thereof into the drilling centre, and a cover structure, e.g. a cover 7a, for covering such an opening.

[0028] Figure 4 further shows yet a third embodiment wherein drill rods 9 laying in storage in wait for use are utilized for stiffening the protective structure 7. In the embodiment shown in Figure 4, the drill rods 9 are placed inside the protective structure 7 but they are separated by the cover 7a from a space in which the rock drill 8 is located in an operational situation wherein the cover 7a is closed. The cover 7a may be opened and closed by means of the actuator 10 of the cover 7a.

[0029] In some embodiments of the solution, the feed beam 6 may, partly or completely, constitute a protective structure 7, such as a noise reduction housing or a safety structure, or, depending on the point of view, in such a case the protective structure 7 serves as a feed beam 6 or a part thereof. In such a case, the inside of the protective structure 7 may be provided with guides along which a rock drill is moved. Further, the drill rod magazine functionality may be arranged in this structure e.g. by applying the principle shown

in Figure 2 or 3. This solution provides a very simple structure wherein the feed beam 6, the protective structure 7, and the drill rod magazine 14 are integrated. A similar solution is shown in Figure 5 which schematically and in cross-sectional view shows a feed beam 6 which is groove-like or provided with a U-shape section and which partly surrounds a rock drill 8; in other words, in the embodiment of Figure 5, the feed beam 6 constitutes a part of the protective structure 7. The rock drill 8 is supported against the feed beam 6 via sliders 20 or slide rails 20. The feed beam 6 is further shown to be provided with a support surface 21 to enable the feed beam 6 to be fastened to the rock drilling rig. The embodiment according to Figure 5 is further shown to be provided with a cover 7a which is supported against the feed beam 6 through a joint 13 such that the cover 7a may be opened and closed e.g. for the duration of service and maintenance work. The cover 7a forms a part of the protective structure 7, and the feed beam 6 and the cover 7a together form the protective structure 7 surrounding the rock drill 8. Further, drill rods 9 laying in wait for use are fastened to the inner surface of the cover 7a such that they make the structure of the cover 7a, i.e. the structure of the protective structure 7, stiffer during use of the rock drilling rig 1. Another structure of the aforementioned kind is shown in Figure 6 wherein the protective structure 7 is arranged to surround the rock drill 8. The rock drill 8 is supported against the protective structure 7 via sliders 20 or slide rails 20; in other words, the protective structure 7, together with the sliders 20, constitutes a feed beam for the rock drill 8. In the embodiment shown in Figure 6, the protective structure 7 thus forms a part of the feed beam. Further, drill rods 9 laying in wait for use are fastened to the inner surface of the protective structure 7 such that they make the structure of the protective structure 7 stiffer during use of the rock drilling rig 1.

[0030] In some cases, the features disclosed in the present application may be used as such, irrespective of other features. On the other hand, when necessary, the features disclosed in the present application may be combined to provide different combinations.

[0031] The drawings and the related description are only intended to illustrate the idea of the invention. The details of the invention may vary within the scope of the claims. Figures 1 to 4 show a use of a protective structure according to the solution in a rock drilling rig wherein the rock drill is placed to be movable on the feed beam. However, the solution may also be

applied to a technique called down-the-hole (DTH) drilling, wherein the rock drill resides at the bottom of a hole being drilled.

CLAIMS

1. A method for stiffening a protective structure of a rock drilling rig, the protective structure (7) surrounding, at least partly, a drill rod (9), a rock drill (8) or a feed device of the rock drilling rig, c h a r a c t e r i z e d by

fastening at least some drill rods (9) laying in wait for use to the protective structure (7) in order to make the protective structure (7) stiffer during use of the rock drilling rig (1).

2. A method as claimed in claim 1, c h a r a c t e r i z e d by fastening at least some of the drill rods (9) laying in wait for use to an outer surface (16) of the protective structure (7).

3. A method as claimed in claim 1 or 2, c h a r a c t e r i z e d by providing the protective structure (7) with a cover (7a) and fastening at least some of the drill rods (9) laying in wait for use to a surface of the cover (7a).

4. A method as claimed in claim 3, c h a r a c t e r i z e d by providing the cover (7a) with at least one actuator (10) of the cover (7a), which is used for opening and closing the cover (7a).

5. A method as claimed in any one of the preceding claims, c h a r a c t e r i z e d by providing the protective structure (7) with a mechanism (11) which enables the drill rods (9) to be fastened to the surface of the protective structure.

6. A method as claimed in claim 5, c h a r a c t e r i z e d by moving the drill rods (9) by the mechanism (11) and an actuator (12) of the mechanism (11) substantially parallel to a direction of the surface of the protective structure (7) to a replacement position.

7. A method as claimed in any one of the preceding claims, c h a r a c t e r i z e d by moving the drill rod (9) from the replacement position to a drilling centre of the rock drill (8) by means of a manipulator (18).

8. A method as claimed in any one of the preceding claims, c h a r a c t e r i z e d by fastening at least some of the drill rods (9) laying in wait for use to an inner surface (15) of the protective structure (7).

9. A method as claimed in any one of the preceding claims, c h a r a c t e r i z e d by the protective structure (7) being a noise reduction housing.

10. A method as claimed in any one of the preceding claims, c h a r a c t e r i z e d by the protective structure (7) being a machine-safety-related safety structure.

11. A protective structure of a rock drilling rig, the protective structure (7) being provided for the purpose of surrounding, at least partly, a drill rod (9), a rock drill (8) or a feed device of the rock drilling rig, characterized in that the protective structure (7) is provided with means for enabling at least some drill rods (9) laying in wait for use to be fastened to the protective structure (7) in order to make the protective structure (7) stiffer during use of the rock drilling rig (1).

12. A protective structure as claimed in claim 11, characterized in that at least some of the means for fastening the drill rods (9) to the protective structure (7) are arranged on an outer surface (16) of the protective structure (7).

13. A protective structure as claimed in claim 11 or 12, characterized in that the protective structure (7) is provided with a cover (7a), and at least some of the drill rods (9) laying in wait for use are fastenable to a surface of the cover (7a).

14. A protective structure as claimed in claim 13, characterized in that the cover (7a) is provided with at least one actuator (10) of the cover (7a) for opening and closing the cover (7a).

15. A protective structure as claimed in any one of claims 11 to 14, characterized in that the protective structure (7a) is provided with a mechanism (11) to enable the drill rods (9) to be locked to the surface of the protective structure.

16. A protective structure as claimed in claim 15, characterized in that the drill rods (9) are movable by the mechanism (11) and an actuator (12) of the mechanism (11) substantially parallel to a direction of the surface of the protective structure (7) to a replacement position.

17. A protective structure as claimed in any one of claims 11 to 16, characterized in that the drill rods (9) are movable from the replacement position to a drilling centre of the rock drill (8) by means of a manipulator (18).

18. A protective structure as claimed in any one of claims 11 to 17, characterized in that at least some of the drill rods (9) laying in wait for use are fastenable to an inner surface (15) of the protective structure (7).

19. A protective structure as claimed in any one of claims 11 to 18, characterized in that the protective structure (7) is a noise reduction housing.

20. A protective structure as claimed in any one of claims 11 to 19, characterized in that the protective structure (7) is a machine-safety-related structure.

21. A protective structure as claimed in any one of claims 11 to 20, characterized in that the protective structure (7) is arranged to constitute at least a part of the feed beam (6).

22. A protective structure as claimed in any one of claims 11 to 20, characterized in that the feed beam (6) is arranged to constitute at least a part of the protective structure (7).

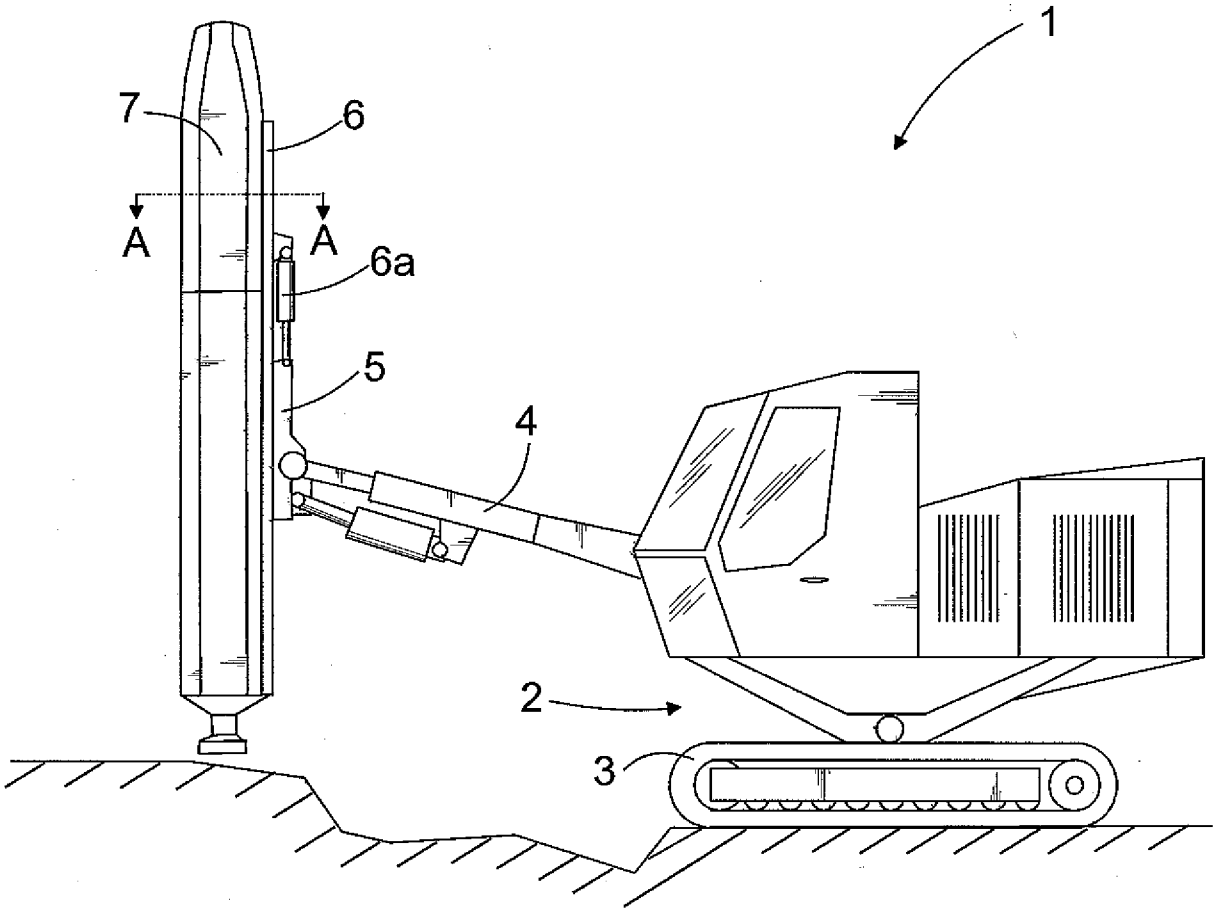


FIG. 1

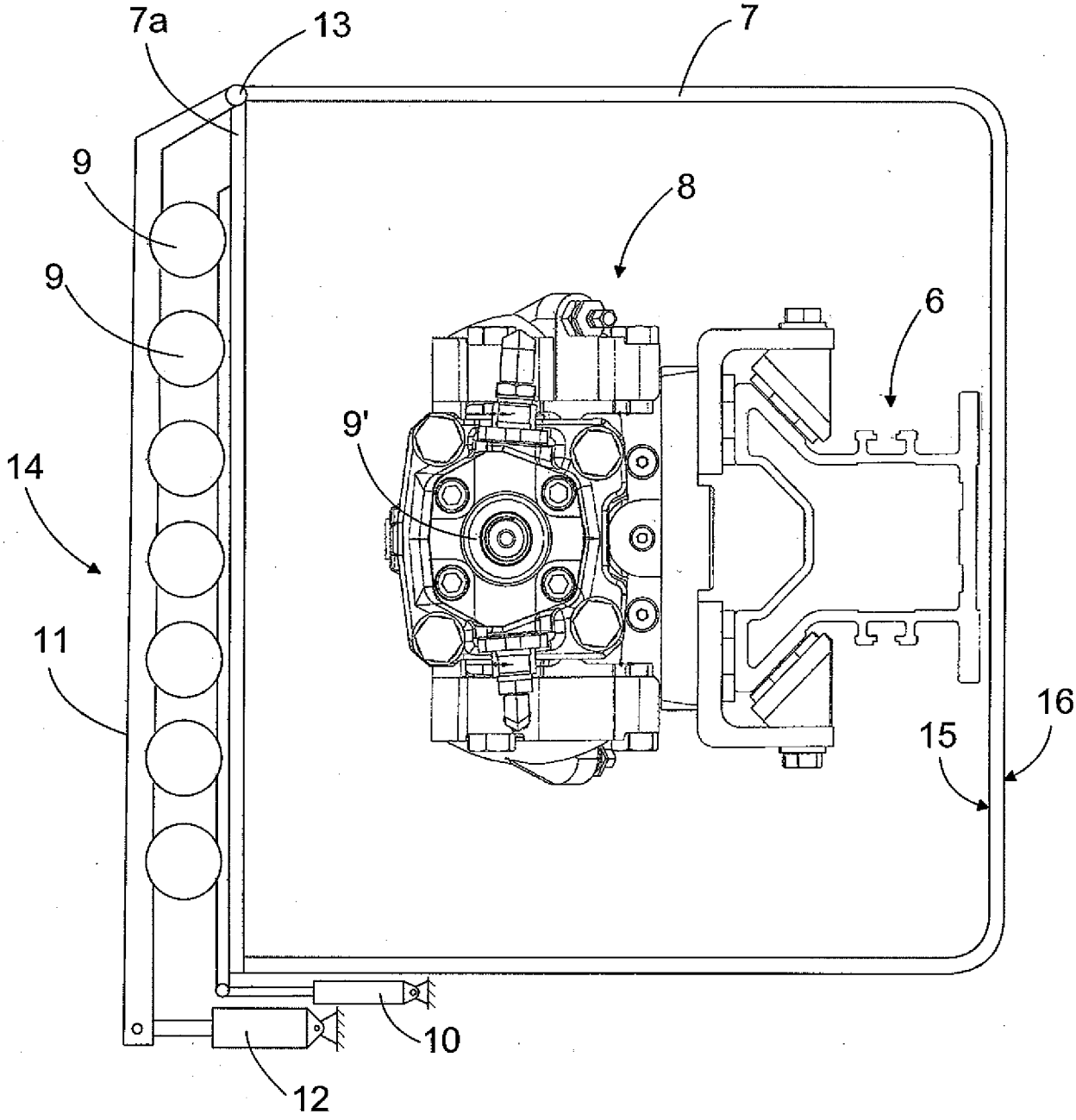


FIG. 2

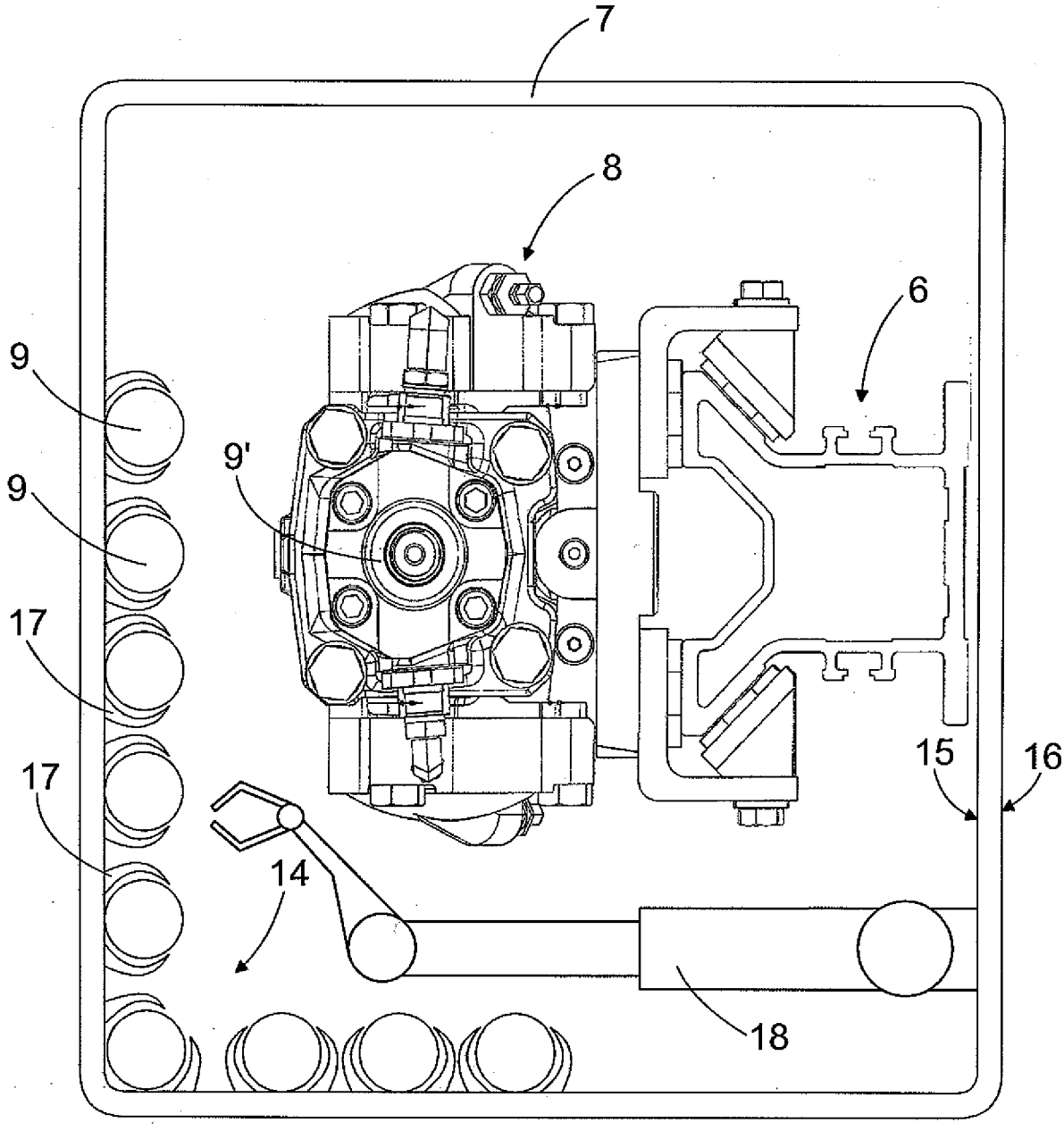


FIG. 3

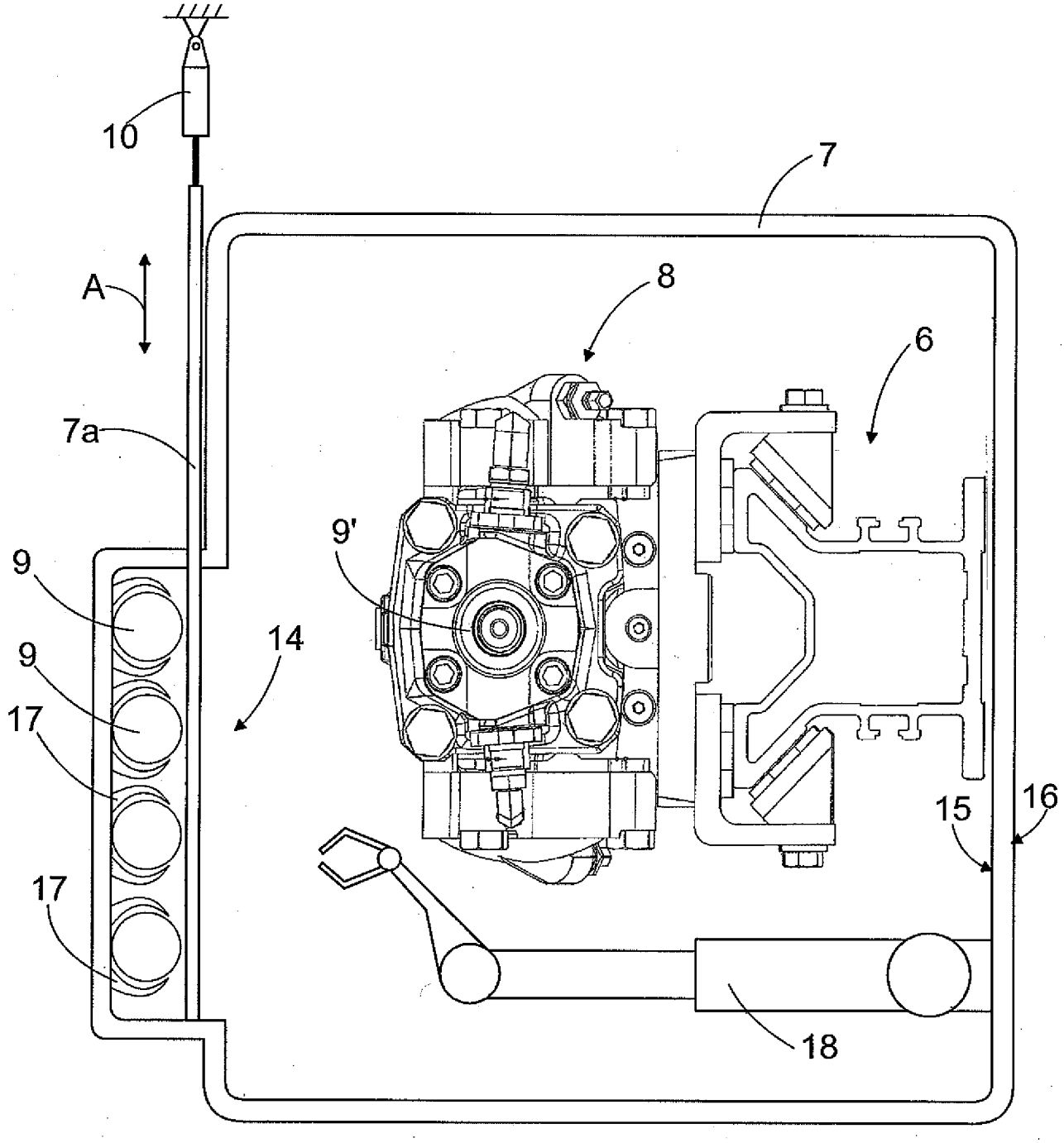


FIG. 4

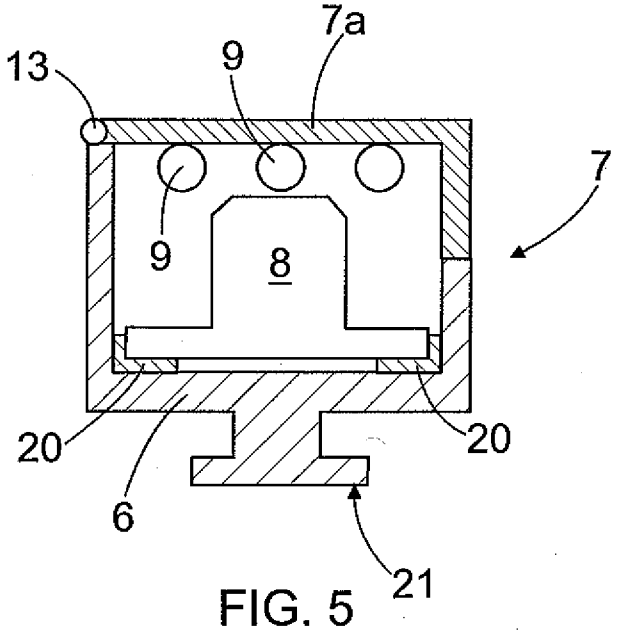


FIG. 5

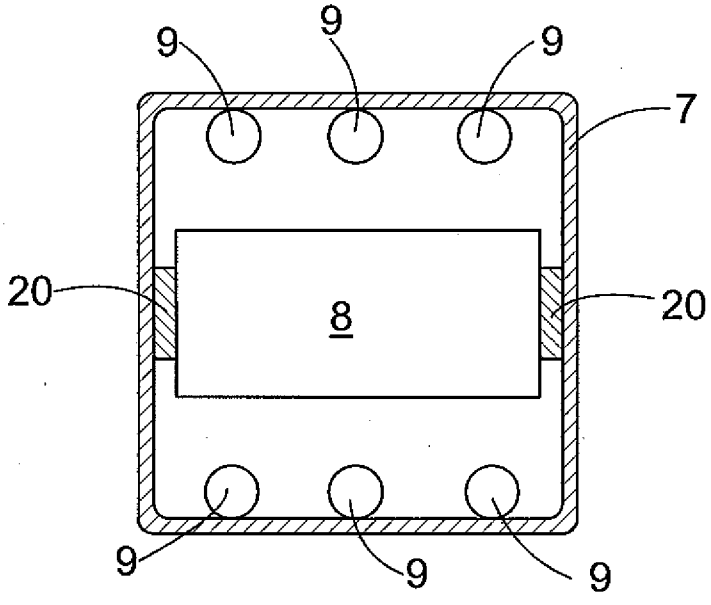


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2010/050682

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E21B, B25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2008142270 A1 (HAGLUND JAN) 19 June 2008 (19.06.2008)	1-22
A	US 3741320 A (HILFING K) 26 June 1973 (26.06.1973)	1-22
A	GB 2030492 A (SECOMA) 10 April 1980 (10.04.1980)	1-22

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 December 2010 (08.12.2010)	21 December 2010 (21.12.2010)

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2010/050682

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
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GB 2030492 A	10/04/1980	None	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2010/050682

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.
E21B 19/14 (2006.01)
B25D 17/11 (2006.01)