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(54) **Device for moving a tool for excavating soil suspended vertically**

Vorrichtung zum Bewegen eines vertikal hängenden Werkzeugs zum Aushub von Erde

Dispositif de déplacement d'un outil pour l'excavation du sol suspendu verticalement

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Description

[0001] The present invention relates to the field of earth-drilling and to devices for carrying out drilling operations; in detail, the present invention relates to a device for moving a tool for excavating soil suspended vertically.

[0002] There is known equipment for digging buried walls which has leaves or valves or else one or more bottom rotary drums; this equipment is known by the term of boring or drilling mill.

[0003] In general, said digging equipment consists of very heavy structures that are lowered into a digging with block-and-tackle systems acting on a plurality of with-holding ropes.

[0004] As described in the patent No. EP 0826835 one of the problems of said drilling mills consists in the orientation of the drilling mill itself, substantially constituted by a parallelepiped. Said problem is common to all equipment for digging diaphragms.

[0005] In the document referred to above, a digging device is described, equipped with a system for orientation or rotation about a vertical axis of a motor-driven type, which requires at least two additional ducts for transmission of hydraulic fluid, which are necessary for enabling operation of said engine.

[0006] The digging device described therein can moreover incorporate also rotatable passages for piping for conveying debris and for hydraulic operation of digging members, electrical cables for measurements and controls of the direction of digging, and much more still.

[0007] Consequently, said system necessarily renders increasingly complex, sophisticated, and heavy the structure of the drilling mill, which on the other hand works constantly immersed in sludge and at depths also of the order of a hundred metres.

[0008] There is moreover known the patent No. EP 0592325, which describes an apparatus for carrying out excavation in the earth, which is designed to advance vertically and in which the excavating equipment comprises means that enable rotation thereof about a vertical axis by moving the equipment manually.

[0009] For carrying out rotation of an excavating tool manually in a safe way it is necessary for it to be first of all positioned at some distance away from the excavation hole. Otherwise, there arises an absolutely unacceptable risk of the user responsible for rotation of the drilling mill falling down the shaft.

[0010] Said solution is unacceptable for drilling mills of large dimensions, the weight and friction of which cause a stress that cannot be managed by human beings.

[0011] Furthermore, the use of a motor-driven orientation device is affected by the fact that motors are present for movement into an area that is very exposed to external agents, various types of impact, and liquids that can cause failure thereof.

[0012] The documents DE 15 56 344 A1 and JP 56 048439 A both disclose a device for moving a tool for

excavating soil suspended vertically, comprising a first body, fixed to the equipment for supporting said tool, and a second body, which rotates with respect to said first body; the device moreover comprising constraint means, fixed to said second body and designed to fix said device to suspension means. Whereby, the first body is mobile along a vertical axis with respect to the second body between two end positions. There being provided means designed to convert said vertical movement of the first body into a movement of rototranslation along and about a vertical axis.

[0013] The purpose of the present invention is to provide a device for moving a tool for excavating soil that is suspended vertically that will enable turning of the excavating equipment itself in an initial step of the digging and that will free from the drawbacks illustrated previously.

[0014] According to the present invention a device is provided for moving a tool for excavating soil suspended vertically, as claimed in the first claim.

[0015] The invention will now be described with reference to the annexed drawings, which illustrate a non-limiting example of embodiment thereof and in which:

- Figure 1 illustrates a first embodiment of a device for moving a tool for excavating soil suspended vertically according to the present invention;
- Figure 2 illustrates a further three-dimensional view of the device illustrated in Figure 1;
- Figure 3 illustrates a second embodiment of a device for moving a tool for excavating soil suspended vertically according to the present invention; and
- Figure 4 illustrates a cross section of the device of Figure 3.

[0016] With reference to Figure 1, designated as a whole by 1 is the equipment for supporting an excavating tool, which can consist of a pair of valves or a plurality of drums (not illustrated in so far as it is of a known type), which are arranged in a bottom terminal part of the equipment 1 and which are the first to come into contact with the earth at the start of the drilling step.

[0017] The excavating equipment 1 has a vertical axis 1a and is equipped with a movement device 3 that enables the equipment 1 and the corresponding excavating tool to turn about its vertical axis 1a when it is outside the digging hanging from a plurality of hoisting ropes or equivalent suspension devices 30.

[0018] In detail, the rotation device 3 comprises a first cylindrical body or drum 3a with vertical axis, which has one or more spiralled, or in any case inclined, grooves 4 arranged on at least part of its lateral surface.

[0019] In detail, the drum 3a is an at least partially hollow body and has an axis of its own substantially coinciding with the vertical axis 1a of the excavating equipment 1.

[0020] The drum 3a is preferably made of metal material in order to be able to withstand the marked mechanical stresses deriving from the use of the equipment

1.

[0021] Sliding within the grooves 4 is at least one member 5 (such as preferably a pin or key), fixed to a second top body or element 6, having a widened top terminal 6a, on which detents 6b are present for fixing to the suspension devices 30 that are designed to raise or lower the excavating equipment 1 in the hole in the ground.

[0022] The top terminal 6a has a substantially annular shape with a cylindrical surface and, as illustrated in Figure 1 and 2, can have a through hole 6c centred on the axis 1a for evacuation of digging fluids.

[0023] The top element 6 has a diameter, the dimension of which is smaller than the dimension of the inner diameter of the drum 3a in such a way that it can be inserted therein.

[0024] For reasons of clarity, in Figures 1 and 2 the groove 4 is represented in the outer drum 3a, and the member in relief 5 that slides therein is connected to the inner member 6, but the arrangement could be indifferently reversed, the inventive idea remaining unvaried.

[0025] In the case where the excavating equipment 1 is raised from the ground and the elements 6 and 3a are free with respect to one another, with sliding of the members 5, the top element 6 comes out of the drum 3a at least partially as illustrated in Figure 2, thus causing a rotation of the excavating equipment 1 by the force of gravity. Given that the top element 6 is fixed with respect to the suspension devices 30, the rotation of the drum 3a causes a rotation of the excavating tool 1, which turns on itself turning about the axis 1a and sliding vertically. The rotation of the excavating tool 1 is in detail limited by the travel of the members 5.

[0026] If, instead, the equipment 1 is resting on the ground it is the weight of the top terminal 6a and what is fixed thereto that causes the inner cylinder 6 to slide through the members 5 engaged in the grooves 4, in the opposite direction obtaining reverse rotation that will again arrest at the opposite end-of-travel. If all the equipment is now raised by the hoisting means 30, the latter tend to bring the component 6a back into the original position, causing the effective reverse rotation of the excavating equipment 1.

[0027] The desired working positions are in any case to be kept blocked during the operations of digging for obtaining a dig with a constant orientation.

[0028] According to what is illustrated in Figures 1 and 2, the device 3 thus comprises means designed to block said positions and reduce the rate at which the members 5 slide within the grooves 4. The action of release of the braking means 8 is at least temporary during a step of use of the excavating equipment 1.

[0029] In detail, said braking means 8 comprise one or more brake blocks 8a that are arranged on L-shaped side brackets 9, which each have a vertical wall 9a and are equipped with reinforcement walls, which are fixed to the body of the excavating equipment 1 and turn fixedly therewith.

[0030] The brake blocks 8a act via brake linings on a

brake disk 8b fixed to the top element 6 and having a diameter substantially larger than that of the latter. Said brake disk 8b lies in a plane that is orthogonal to the axis 1a.

[0031] Said side brackets 9, external to the drum 3a, extend substantially in a vertical direction parallel to the axis 1a of the equipment 1, whilst the brake blocks 8a extend therefrom in a direction substantially orthogonal to the aforesaid axis 1a towards an area internal thereto and are mounted on a respective guide 8c in such a way that following upon rototranslation of the top element 6 deriving from the displacement of the members 5 on the inclined grooves 4, they can follow the displacement of the brake disk 8b during its movement along the axis 1a, sliding along its length.

[0032] Each of the guides 8c is set on a vertical wall 9a of the brackets 9 and extends - in its direction of maximum extension - in a direction substantially parallel to that of the axis 1a.

[0033] Alternatively, the brake blocks 8a can be fixed to the side brackets 9, and the brake disk 8b can present a grooved coupling between its inner part and the outer part of the element 6 so as to transfer the braking torque and be able to translate vertically and follow the movement of the brake blocks during rototranslation of the excavating equipment 1.

[0034] The members 5 can slide along the grooves 4 so as to start from a first end 4a of the groove 4 and arrive at the opposite end 4b or, alternatively, be arrested in an intermediate point 4c of the groove 4 following upon intervention of the braking means 8. The excavating equipment 1 can consequently be rotated not only through an angle of rotation corresponding to the difference of position of the members 5 between one end and the other of the groove 4, but also through intermediate angles of rotation.

[0035] In order to guarantee safety of operation of the device 3 during movement of the excavating equipment 1, the braking means 8 are constantly activated; namely, they brake the disk 6b, by means of a spring; the braking of the disk 6b ceases when a hydraulic piston (not illustrated) counters the action exerted by the spring on the brake blocks 8a. Consequently, by modulating the pressure of the hydraulic fluid for supplying the piston it is possible to regulate the speed of rotation of the excavating equipment 1 and possibly stop it.

[0036] Since at least one of the two orientations described of the excavating equipment 1 has to be performed with it out of the excavation, the device 3 has to be actuated whilst it is at a distance from the earth sufficient not to cause it to interfere therewith, a distance that is preferably at least 10 m.

[0037] For practical purposes and safety of use it is possible to resort to any remote-control device for operation of the piston, for example by means of a manual pump to be connected by means of fast-block couplings to two pipes that run along the frame of the excavating equipment 1 from the device 3 up to a conveniently reach-

able height, or else by connecting up temporarily to a power source available on the excavating equipment on board the machine or on site, or again through systems of levers that can be operated manually.

[0038] Alternatively, the braking means 8 may not be present and be replaced by a means for blocking travel of the members 5, for example comprising an end-of-travel screw, designed to block the position of said members, or else it is possible to use pins, keys or shims to fix the mutual position of the drum 3a and of the top element 6.

[0039] A second non-binding embodiment of the device 3' is illustrated in Figure 3. In this embodiment, the device 3' has a first body 33 designed to be fixed to excavating equipment or an excavating tool and a second top body or element 36, which can turn with respect to one another and are connected to one another by means of a rotation member preferably of the type constituted by a ballscrew 10.

[0040] The top element 36 has a plurality of detents 6b for fixing to suspension means (ropes or the like of the same type as the ones 30 illustrated in Figure 1 and 2).

[0041] The ballscrew 10 has an external structure 10a of a substantially cylindrical shape, which is hollow and extends in a direction substantially parallel to the axis 1a. Present on the outer surface 10a is a toothing 11, which extends over part of the lateral surface of the structure 10a extending vertically in a direction substantially parallel to that of the axis 1a.

[0042] The ballscrew 10 moreover comprises a second inner part 10b, technically referred to as "spiral raceway", coaxial to the external structure 10a, which is screwed within the latter.

[0043] The device 3' moreover comprises systems for isolating and protecting the ballscrew 10 from the external environment (said systems are not represented in the figure for simplicity of reading); amongst these there may be present, for example, gaskets, oil scrapers, or other equivalent systems.

[0044] In detail, on the toothing 11 there mesh one or more braking shafts 22, connected to a respective brake 16 that can be of a hydraulic type or indifferently of some other type (electrical, magnetic, etc.).

[0045] This embodiment is particularly suited to incorporating a hydraulic swivel joint 12a, designed for passage of some hydraulic supply lines of the excavating equipment.

[0046] As illustrated in Figure 4, the braking shaft 22 has an axis of its own 22a substantially parallel to the axis 1a and moreover comprises a first, top, terminal part and a second, bottom, terminal part; the top terminal part has a toothing that meshes with the toothing 11, whilst the bottom terminal part is constrained to the brake 16.

[0047] Both the brake 16 and the braking shafts 22 are mounted on the cylinder 3a, which is rigidly fixed to the excavating equipment; for this reason, the cylinder 3a turns fixedly with the excavating equipment.

[0048] Preferably, the device 3' comprises a second

shaft 22 connected to an encoder 18 for establishing precisely an angle of rotation of the excavating equipment and such as to enable precise determination of the position of the excavating equipment 1 also remotely.

[0049] The body 33 has a first part external to the ballscrew and a second part 34 that extends within the outer structure 10a of the screw until it connects with the inner part 10b of the ballscrew 10.

[0050] The brake 16 keeps the device 3' blocked until it is released; at this point, the weight of the excavating tool 1, by acting on the inner part 10b of the ballscrew 10 as a load parallel to the axis of rotation thereof, generates a rototranslatory movement of the inner part 10b with respect to the outer part 10a thereof.

[0051] The spiral raceway 10b of the ballscrew 10 is hence substantially cylindrical and is able to turn with respect to the outer part 10a and is also centred on the axis 1a of the excavating equipment; the inner part 10b is moreover fixed with respect to the inner part 34 of the body 33, and consequently turns fixedly therewith. Present between the inner part 10b and the outer part 10a of the ballscrew 10 is a plurality of spiral-shaped grooves 10c for balls; during rotation, on account of the inclination of the grooves 10c, the inner part 10b of the ballscrew 10, the body 33 (both in its outer part and in its inner part 34), the hydraulic brake 16, and the braking shafts 22 are pushed towards the outside, along the axis 1a, moving away from the top element 36, which is, instead, fixed to the suspension members.

[0052] Precisely owing to this translation along the axis 1a, the toothing 11 must extend for a length sufficient to guarantee meshing of the toothings of the braking shafts 22 both when the body 33 is completely retracted towards the top element 36 and when the body 33 is instead completely translated in an opposite direction.

[0053] The toothing 11 is mounted in a removable way on the outer part 10a of the ball screw 10, in such a way that in the case of wear it can be easily replaced.

[0054] The device 3' moreover comprises rigid hydraulic ducts 17, the purpose of which is to enable passage of hydraulic fluids designed to supply the different loads of the excavating equipment. These hydraulic ducts 17 passing through the component 20 arrive at an inner part 12b of the hydraulic swivel 12a necessary for enabling distribution of hydraulic power to the loads of the excavating equipment that require it. During rototranslation of the excavating equipment, the inner part 12b of the hydraulic swivel, the support 20, and the hydraulic ducts 17 have only translatory motion along the axis 1a. The counter-rotation for these components is guaranteed by one or more cylindrical guide components 14, which are arranged vertically so as to be substantially parallel to the axis 1a and extend above the top element 36.

[0055] It is hence necessary to interpose a bearing 21 between the support 20 and the body 33.

[0056] The outer part 12a of the hydraulic swivel can turn together with the excavating tool and thus enables connection of the various hydraulic tubes to the different

loads.

[0057] In detail, the hydraulic ducts 17 pass within the top element 36 and extend vertically within the cavity of the second part 10b of the ballscrew 10.

[0058] Moreover present within the device 3' is a rectilinear duct 23 for evacuation of debris, having a substantially cylindrical shape and centred on the axis 1a. Said duct is fixed with respect to the inner part 12b of the hydraulic swivel 12a of the device 3'. In this way, during rototranslation of the body 33 and likewise of the excavating equipment 1, the duct 23 has only translatory motion and moreover remains guided within a coating duct or sleeve 23a, which is directly connected to a flexible pipe (not represented) for evacuation of the digging fluids.

[0059] Present between the duct 23 and the coating duct or sleeve 23a are appropriate guide elements and gaskets (not represented) to prevent exit of the fluids.

[0060] Basically, the groove 4 and the contrast elements 4a and 4b described in the first embodiment (Figures 1 and 2) of the present invention, are here replaced in this second embodiment by the ballscrew 10, which can be appropriately sized to obtain different performance (angles, helical developments, speed of rotation, etc.). The rotation of the excavating equipment can be in either direction according to whether it is or not resting on the ground.

[0061] The advantages of the device are known in the light of the foregoing description. In particular, it enables rotation of the excavating equipment without the aid of motors.

[0062] In detail, rotation of the excavating equipment 1 takes place by gravity, on account of its weight, and the possible control members inserted in the device 3, 3' are for braking of the travel of rototranslation of the excavating equipment 1 itself. In this way, the device, in both embodiments, is simple and largely immune from failure given that no rotation motor is necessary to get the device to function.

[0063] In addition, in the second embodiment the device described so far enables plenty of free space inside and hence makes it possible to house some accessories that could be useful during digging of the hole in the ground.

[0064] Some variations may be made to the device described so far. In greater detail, the grooves can be dismantled in such a way that they can be replaced with others of a different size and/or inclination so as to obtain a different performance seeing that linked to the pitch of the groove are the speed and the loads that are generated in the system.

[0065] The supporting brackets of the brake blocks illustrated in the first embodiment of the device 3 can be in larger number and arranged radially about the entire circumference of the disk in the case where the dimensions and the weight of the excavating equipment 1 render it necessary.

[0066] Even though in the attached figures there have

been illustrated suspension means 30 of the rope type, it is clear that said means can be replaced for example by a rigid drilling pipe (technically known as "kelly").

[0067] Finally, it should be pointed out that the device 3, 3' according to the present invention can be suitable for enabling rotation of any equipment that may be used for digging or for carrying out accessory operations in the digging of substantially vertical diaphragms using vertical suspension tools, such as, by way of non-limiting example, buckets or drilling mills.

[0068] The device 3' might not contain the hydraulic swivel 12a and 12b and/or the passage for excavating debris, constituted by the duct 23. In fact, in some embodiments, said hydraulic piping and piping for discharging debris are fixed to the lateral ends and do not pass through the central axis of the excavating equipment 1. In this case, the point of suspension of the equipment is a simple swivel that does not require internal passages unconstrained in rotation for enabling flow of fluids and/or debris, and consequently enabling a considerable simplification of the entire structure of the device described.

[0069] Finally, as for the first embodiment also in the case of this second embodiment, even though the device 3' has been represented and described with braking devices, said devices can be removed and replaced by means for blocking the travel, such as for example pins, keys or shims for fixing the mutual position of the body 33 and of the top element 36.

Claims

1. A device (3, 3') for moving a tool for excavating soil suspended vertically, comprising a first body (3a, 33), fixed to the equipment (1) for supporting said tool, and a second body (6, 36), which rotates with respect to said first body (3a, 33); the device (3, 3') moreover comprising constraint means (6b), fixed to said second body (6, 36) and designed to fix said device (3, 3') to suspension means (30); the device being **characterized in that** said second body (6, 36) is mobile along a vertical axis (1a) with respect to said first body (3a, 33) between two end positions of mutual approach and recession, in which said vertical movement in recession is caused by the force of gravity that acts on the masses of the second body (6, 36), and said vertical movement in approach is consequent upon resting of the tool on the ground and upon lowering of the device; there being provided means (4, 5, 10) designed to convert said vertical movement of the second body (6, 36) both in recession and in approach to the first body (3a, 33) into a movement of rototranslation along and about a vertical axis (1a).
2. The device (3) according to Claim 1, in which said means (4, 5) designed to convert said vertical movement into a movement of rototranslation comprise:

- at least one groove (4) having a first end (4a) and a second end (4b); and
- at least one element (5) designed to slide within said groove (4) between said first end (4a) and said second end (4b);

said at least one groove (4) and said at least one element (5) being respectively associated to said first body (3a) and said second body (6).

3. The device (3') according to Claim 1, in which said means (10) designed to convert said vertical movement into a movement of rototranslation comprise a ball screw constituted by a hollow outer body (10a) and an inner body (10b), which can turn with respect to said outer body (10a); said outer body (10a) and said inner body (10b) being of a substantially cylindrical type.
4. The device (3, 3') according to Claim 1, moreover comprising at least one braking means, designed to enable at least temporarily, slow down, and/or stop rotation of said equipment (1).
5. The device (3) according to Claim 4, in which said braking means comprise:
 - at least one disk (8b) fixed to said second body (6); and
 - at least one brake pad (8a) acting on said disk (8b), which is integral with said first body (3a); and in which:
 - said disk (8b) turns within said brake pad (8a); and
 - said brake pad (8a) is released by an actuator that counters the action of a closing means; said actuator exerting an action of contrast of said closing means for releasing said brake pad (8a) and enabling rotation of said disk (8b).
6. The device (3) according to Claim 4, moreover comprising a plurality of supporting means (9), which are integral with said first body (3a) and with said excavating equipment (1) and are fixed to said excavating equipment (1), and comprising a respective vertical wall (9a), which extends along a plane parallel to the direction identified by said axis (1a), housed on which is a respective guide (8c) designed to enable sliding of said brake pad (8a) during rototranslation of said equipment (1).
7. The device (3') according to Claim 3, in which said outer body (10a) of said ball screw (10) is fixed with respect to said second body (36) of said device (3'), whilst said inner body (10b) of said ball screw (10) turns integrally with respect to said first body (33) of said device (3'); said rotation having a first direction and a second direction opposite to the first, in which

in said second direction said inner body (10b) translates, moving towards the outside of said outer body (10a) of said screw (10).

8. The device (3') according to Claim 4, in which said braking means comprise an actuator (16) acting on one or more toothed shafts (22), which mesh on a plurality of teeth (11); said teeth (11) being positioned radially on said outer body (10a) of said ball screw (10).
9. The device (3') according to Claim 8, in which:
 - said teeth (11) are oriented vertically and have a length sufficient to maintain meshing of said toothed shafts (22) during translation of said inner body (10b) of the ball screw (10); and
 - one of said shafts (22) is moreover connected to a position-transducer means (18), designed to identify an angle of rotation of said first body (33) of the device (3') with respect to said second body (36).
10. The device (3') according to Claim 3, in which present in said second body (36) is a drilled hole (24) of a through type, fixed on which is a duct (23) for removal of excavating debris; said duct (23) having a substantially cylindrical shape and being centred on said axis (1a).
11. The device (3) according to Claim 2, in which said second body (6) is inserted, except for a top terminal part thereof (6a) fixed thereto, within said first body (3a).
12. The device (3) according to Claim 2, in which said second body (6) is external to said first body (3a).
13. The device (3) according to Claim 4, in which said braking means comprise: at least one disk (8b), which can slide by means of a grooved coupling along said second body (6), and at least one brake pad (8a) fixed to said first body (3a); said disk (8b) translating vertically to follow the movement of said pad (8a) during the rototranslational motion of the excavating equipment (1).

Patentansprüche

1. Eine Vorrichtung (3, 3') zur Bewegung eines senkrecht aufgehängten Werkzeugs zum Ausheben von Erde, aufweisend einen ersten Körper (3a, 33), welcher an der Einrichtung (1) zur Unterstützung des Werkzeugs befestigt ist, und einen zweiten Körper (6, 36), welcher hinsichtlich des ersten Körpers (3a, 33) rotiert; die Vorrichtung (3, 3') weiterhin aufweisend Zwangsmittel (6b), welche an dem zweiten Kör-

per (6, 36) befestigt sind und welche ausgeführt sind, die Vorrichtung (3, 3') an Aufhängungen (30) zu befestigen;

dadurch gekennzeichnet, dass der zweite Körper (6, 36) entlang einer senkrechten Achse (1a) hinsichtlich des ersten Körpers (3a, 33) zwischen zwei Endpositionen wechselseitiger Annäherung und Rückgangs bewegbar ist, die senkrechte Bewegung des Rückgangs von der Schwerkraft verursacht wird, welche auf die Masse des zweiten Körpers (6, 36) wirkt, und die senkrechte Bewegung der Annäherung Folge der Auflage des Werkzeugs auf dem Grund und des Absenkens der Vorrichtung ist; wobei Mittel (4, 5, 10) bereitgestellt werden, die ausgeführt sind, die senkrechte Bewegung des zweiten Körpers (6, 36) beim Rückgang vom und bei der Annäherung an den ersten Körper (3a, 33) in eine rotationstranslatorische Bewegung entlang und um die senkrechte Achse (1a) umzusetzen.

2. Vorrichtung (3) nach Anspruch 1, wobei die Mittel (4, 5), welche ausgeführt sind, die senkrechte Bewegung in eine rotationstranslatorische Bewegung umzusetzen, aufweisen:

- zumindest eine Nut (4) mit einem ersten Ende (4a) und einem zweiten Ende (4b); und
- zumindest einem Element (5), welches ausgeführt ist, in der Nut (4) zwischen dem ersten Ende (4a) und dem zweiten Ende (4b) zu gleiten;

wobei die zumindest eine Nut (4) und das zumindest eine Element (5) dem ersten Körper (3a) beziehungsweise dem zweiten Körper (6) zugeordnet sind.

3. Vorrichtung (3') nach Anspruch 1, wobei die Mittel (10), welche ausgeführt sind, die senkrechte Bewegung in eine rotationstranslatorische Bewegung umzusetzen, ein Kugelgewinde aufweisen, welches von einem hohlen Außenkörper (10a) und einem Innenkörper (10b) gebildet wird, und welches sich hinsichtlich des Außenkörpers (10a) drehen kann; wobei der Außenkörper (10a) und der Innenkörper (10b) im Wesentlichen zylindrisch sind.

4. Vorrichtung (3, 3') nach Anspruch 1, weiterhin aufweisend zumindest ein Bremsmittel, welches ausgeführt ist, die Drehung der Einrichtung (1) zumindest zeitweise zu ermöglichen, zu verlangsamen, und/oder zu beenden.

5. Vorrichtung (3) nach Anspruch 4, die Bremsmittel aufweisend:

- zumindest eine Scheibe (8b), welche an dem zweiten Körper (6) angebracht ist; und
- zumindest einen Bremsbelag (8a), welcher auf

die Scheibe (8b) einwirkt und welcher einstückig mit dem ersten Körper (3a) ausgeführt ist; und in der:

- die Scheibe (8b) sich in dem Bremsbelag (8a) dreht; und
- der Bremsbelag (8a) von einem Aktuator ausgelöst wird, der der Aktion eines Schließmittels entgegenwirkt; wobei der Aktuator eine Gegenaktion zu den Schließmitteln zur Lösung des Bremsbelags (8a) und zur Ermöglichung der Drehung der Scheibe (8b) auslöst.

6. Vorrichtung (3) nach Anspruch 4, weiterhin aufweisend eine Vielzahl von Trägermitteln (9), welche mit dem ersten Körper (3a) und mit der Aushebungseinrichtung (1) einstückig ausgeführt sind und mit der Aushebungseinrichtung (1) verbunden sind, und eine zugehörige senkrechte Wand (9a) aufweisen, welche sich entlang einer Ebene parallel zu der Richtung erstrecken, welche von der Achse (1a) **gekennzeichnet** wird, und an welchen eine zugehörige Führung (8c) angeordnet ist, welche ausgeführt ist, Gleiten des Bremsbelags (8a) während der rotations-translatorischen Bewegung der Einrichtung (1) zu ermöglichen.

7. Vorrichtung (3') nach Anspruch 3, wobei der Außenkörper (10a) des Kugelgewindes (10) hinsichtlich des zweiten Körpers (36) der Vorrichtung (3') befestigt ist, während der Innenkörper (10b) des Kugelgewindes (10) sich ganzheitlich hinsichtlich des ersten Körpers (33) der Vorrichtung (3') dreht; wobei die Drehung eine erste Richtung und eine zweite Richtung entgegengesetzt zu der ersten hat, wobei sich der Innenkörper (10b) in der zweiten Richtung verschiebt und entgegen der Außenseite des Außenkörpers (10a) des Gewindes (10) bewegt.

8. Vorrichtung (3') nach Anspruch 4, wobei die Bremsmittel einen Aktuator (16) aufweisen, welcher auf eine oder mehrere gezahnte Wellen (22) wirkt, welche in eine Vielzahl von Zähnen (11) eingreifen; wobei die Zähne (11) radial an dem Außenkörper (10a) des Kugelgewindes (10) angeordnet sind.

9. Vorrichtung (3') nach Anspruch 8, wobei:

- die Zähne (11) vertikal verlaufen und eine ausreichende Länge haben, um das Eingreifen der gezahnten Wellen (22) während der Translationsbewegung des Innenkörpers (10b) des Kugelgewindes (10) aufrecht zu erhalten; und
- eine der Wellen (22) weiterhin verbunden ist mit einem Mittel zur Positionsmessung (18), welches ausgeführt ist, einen Drehwinkel des ersten Körpers (33) der Vorrichtung (3') hinsichtlich des zweiten Körpers (36) zu ermitteln.

10. Vorrichtung (3') nach Anspruch 3, wobei in dem zweiten Körper (36) ein durchlaufendes Bohrloch (24) ist, in welchem eine Durchführung (23) zur Abfuhr von Aushubgeröll befestigt ist; wobei die Durchführung (23) eine im Wesentlichen zylindrische Form hat und auf der Achse (1a) zentriert ist. 5
11. Vorrichtung (3) nach Anspruch 2, wobei der zweite Körper (6) mit Ausnahme eines hieran befestigten oberen Abschlussteils (6a) in den ersten Körper (3a) eingefügt ist. 10
12. Vorrichtung (3) nach Anspruch 2, wobei der zweite Körper (6) außerhalb des ersten Körpers (3a) ist. 15
13. Vorrichtung (3) nach Anspruch 4, wobei die Bremsmittel aufweisen: zumindest eine Scheibe (8b), welche mittels einer gerieften Kupplung entlang des zweiten Körpers (6) gleiten kann, und zumindest einen Bremsbelag (8a), welcher an dem ersten Körper (3a) befestigt ist; wobei die Scheibe (8b) senkrecht verschoben wird um der Bewegung des Bremsbelags (8a) während der rotationstranslatorischen Bewegung der Aushebungseinrichtung (1) zu folgen. 20 25
3. Dispositif (3') selon la revendication 1, dans lequel ledit moyen (10) conçu pour convertir ledit mouvement vertical en un mouvement de roto-translation comprend une vis à billes constituée par un corps extérieur creux (10a) et un corps intérieur (10b), qui peut tourner par rapport audit corps extérieur (10a); ledit corps extérieur (10a) et ledit corps intérieur (10b) étant d'un type globalement cylindrique.
4. Dispositif (3, 3') selon la revendication 1, comprenant de plus au moins un moyen de freinage, conçu pour permettre au moins temporairement, ralentir et/ou arrêter la rotation dudit équipement (1).
5. Dispositif (3) selon la revendication 4, dans lequel ledit moyen de freinage comprend :

- au moins une gorge (4) ayant une première extrémité (4a) et une deuxième extrémité (4b); et
- au moins un élément (5) conçu pour coulisser à l'intérieur de ladite gorge (4) entre ladite première extrémité (4a) et ladite deuxième extrémité (4b);

au moins une gorge (4) et au moins un élément (5) étant respectivement associés audit premier corps (3a) et audit deuxième corps (6).

Revendications

1. Dispositif (3, 3') destiné à déplacer un outil suspendu verticalement pour creuser le sol, comprenant un premier corps (3a, 33), fixé à l'équipement (1) destiné à supporter ledit outil, et un deuxième corps (6, 36), qui tourne par rapport audit premier corps (3a, 33); le dispositif (3, 3') comprenant de plus un moyen de contrainte (6b), fixé audit deuxième corps (6, 36) et conçu pour fixer ledit dispositif (3, 3') à un moyen de suspension (30); le dispositif étant **caractérisé en ce que** ledit deuxième corps (6, 36) est mobile le long d'un axe vertical (1a) par rapport audit premier corps (3a, 33) entre deux positions finales d'une approche et d'un recul mutuels, où ledit mouvement vertical de recul est provoqué par la force de gravité qui agit sur les masses du deuxième corps (6, 36), et ledit mouvement vertical d'approche est conséquent lors de la dépose de l'outil sur le sol et lors de l'abaissement du dispositif; il est prévu un moyen (4, 5, 10) conçu pour convertir ledit mouvement vertical du deuxième corps (6, 36) à la fois lors d'un recul et d'une approche vis-à-vis du premier corps (3a, 33) en un mouvement de roto-translation le long et autour d'un axe vertical (1a). 30 35 40 45 50
2. Dispositif (3) selon la revendication 1, dans lequel ledit moyen (4, 5) conçu pour convertir ledit mouvement vertical en un mouvement de roto-translation comprend :
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- au moins un disque (8b) fixé audit deuxième corps (6); et
- au moins une plaquette de frein (8a) agissant sur ledit disque (8b), qui est solidaire dudit premier corps (3a); et dans lequel :
- ledit disque (8b) tourne à l'intérieur de ladite plaquette de frein (8a); et
- ladite plaquette de frein (8a) est relâchée par un actionneur qui contre l'action d'un moyen de fermeture; ledit actionneur exerçant une action d'opposition vis-à-vis dudit moyen de fermeture en vue de relâcher ladite plaquette de frein (8a) et de permettre la rotation dudit disque (8b).
6. Dispositif (3) selon la revendication 4, comprenant une pluralité de moyens de support (9), qui sont solidaires dudit premier corps (3a) et dudit équipement de fouille (1), et sont fixés audit équipement de fouille (1), et comprenant une paroi verticale respective (9a), qui s'étend le long d'un plan parallèle à la direction identifiée par ledit axe (1a), sur laquelle est reçu un guide respectif (8c) conçu pour permettre le coulisement de ladite plaquette de frein (8a) au cours d'une roto-translation dudit équipement (1).
7. Dispositif (3') selon la revendication 3, dans lequel ledit corps extérieur (10a) de ladite vis à billes (10) est fixé par rapport audit deuxième corps (36) dudit

dispositif (3'), alors que ledit corps intérieur (10b) de ladite vis à billes (10) tourne de façon solidaire par rapport audit premier corps (33) dudit dispositif (3') ; ladite rotation présentant une première direction et une deuxième direction opposée à la première, où dans ladite deuxième direction, ledit corps intérieur (10b) effectue un mouvement de translation, se déplaçant vers l'extérieur dudit corps extérieur (10a) de ladite vis (10).

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8. Dispositif (3') selon la revendication (4), dans lequel ledit moyen de freinage comprend un actionneur (16) agissant sur un ou plusieurs arbres dentés (22), qui s'engrènent sur une pluralité de dents (12), lesdites dents (11) étant positionnées radialement sur ledit corps extérieur (10a) de ladite vis à billes (10).

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9. Dispositif (3') selon la revendication 8, dans lequel :

- lesdites dents (11) sont orientées verticalement et ont une longueur suffisante pour maintenir un engrènement desdits arbres dentés (22) au cours d'un mouvement de translation dudit corps intérieur (10b) de la vis à billes (10) ; et
- un desdits arbres (22) est par ailleurs relié à un moyen de capteur de position (18), conçu pour identifier un angle de rotation dudit premier corps (33) du dispositif (3') par rapport audit deuxième corps (36).

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10. Dispositif (3') selon la revendication 3, dans lequel est présent dans ledit deuxième corps (36) un trou foré (24) d'un type traversant, sur lequel est fixé un conduit (23) pour le retrait des débris d'excavation ; ledit conduit (23) ayant une forme globalement cylindrique et étant centré sur ledit axe (1a).

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11. Dispositif (3) selon la revendication 2, dans lequel ledit deuxième corps (6) est inséré, à l'exception d'une partie terminale supérieure de celui-ci (6a) fixée à celui-ci, à l'intérieur dudit premier corps (3a).

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12. Dispositif (3) selon la revendication 2, dans lequel ledit deuxième corps (6) est externe audit premier corps (3a).

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13. Dispositif (3) selon la revendication 4, dans lequel ledit moyen de freinage comprend : au moins un disque (8b), qui peut coulisser au moyen d'un accouplement rainuré le long du deuxième corps (6), et au moins une plaquette de frein (8a) fixée audit premier corps (3a) ; ledit disque (8b) effectuant un mouvement de translation vertical pour suivre le mouvement de ladite plaquette (8a) au cours du mouvement de roto-translation de l'équipement de fouille (1).

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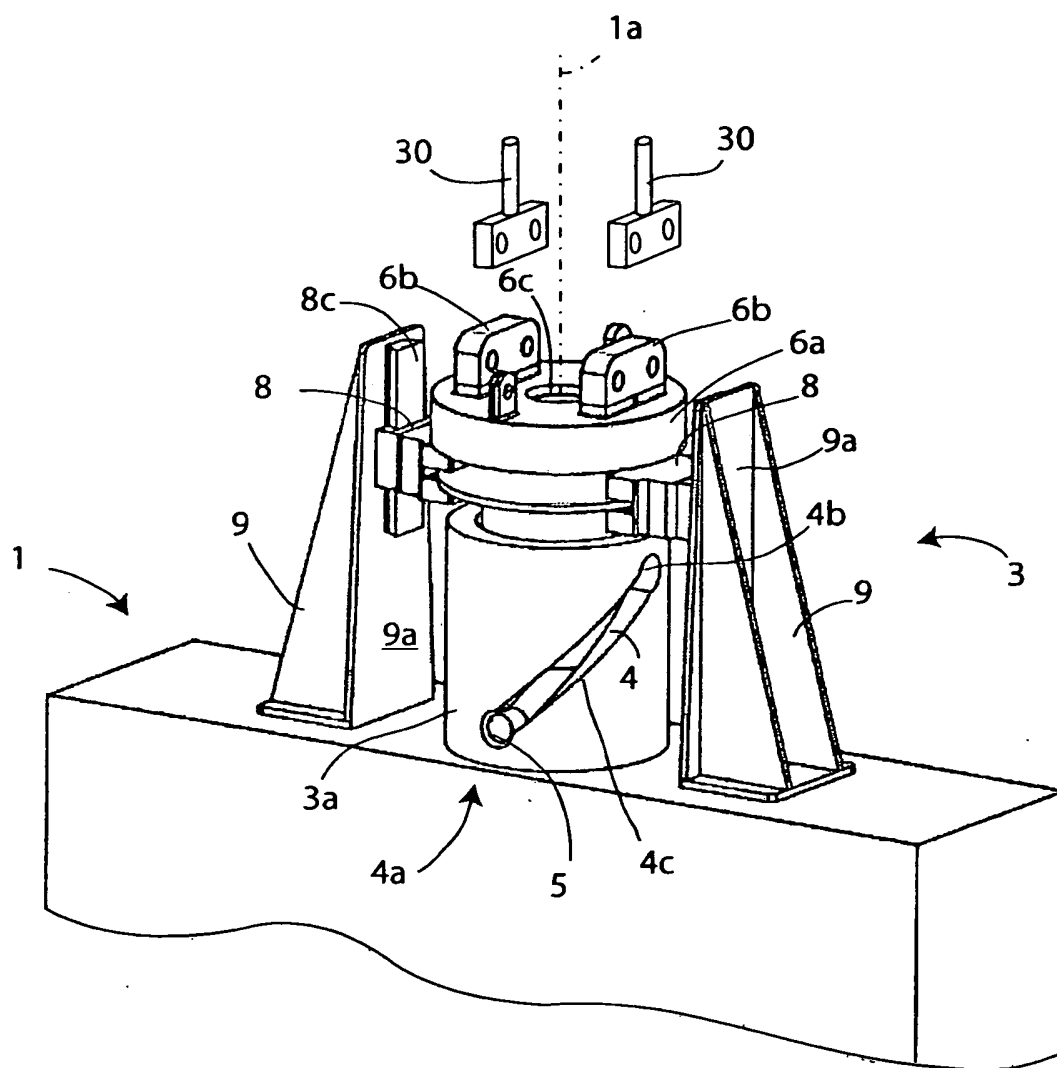


Fig. 1

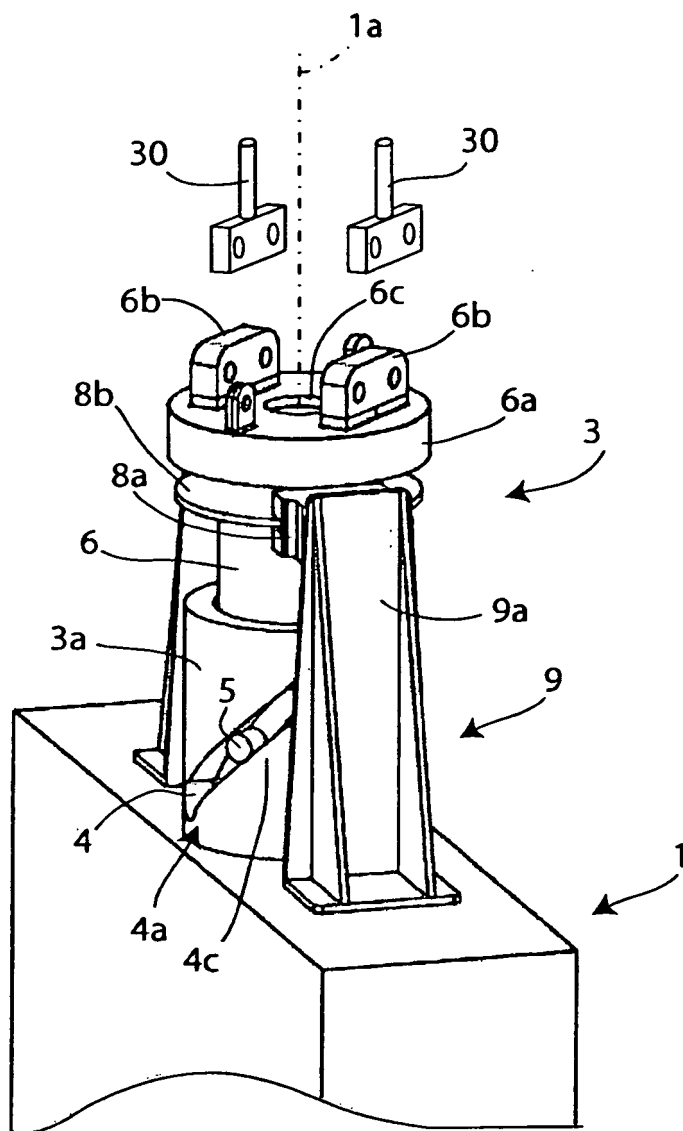


Fig. 2

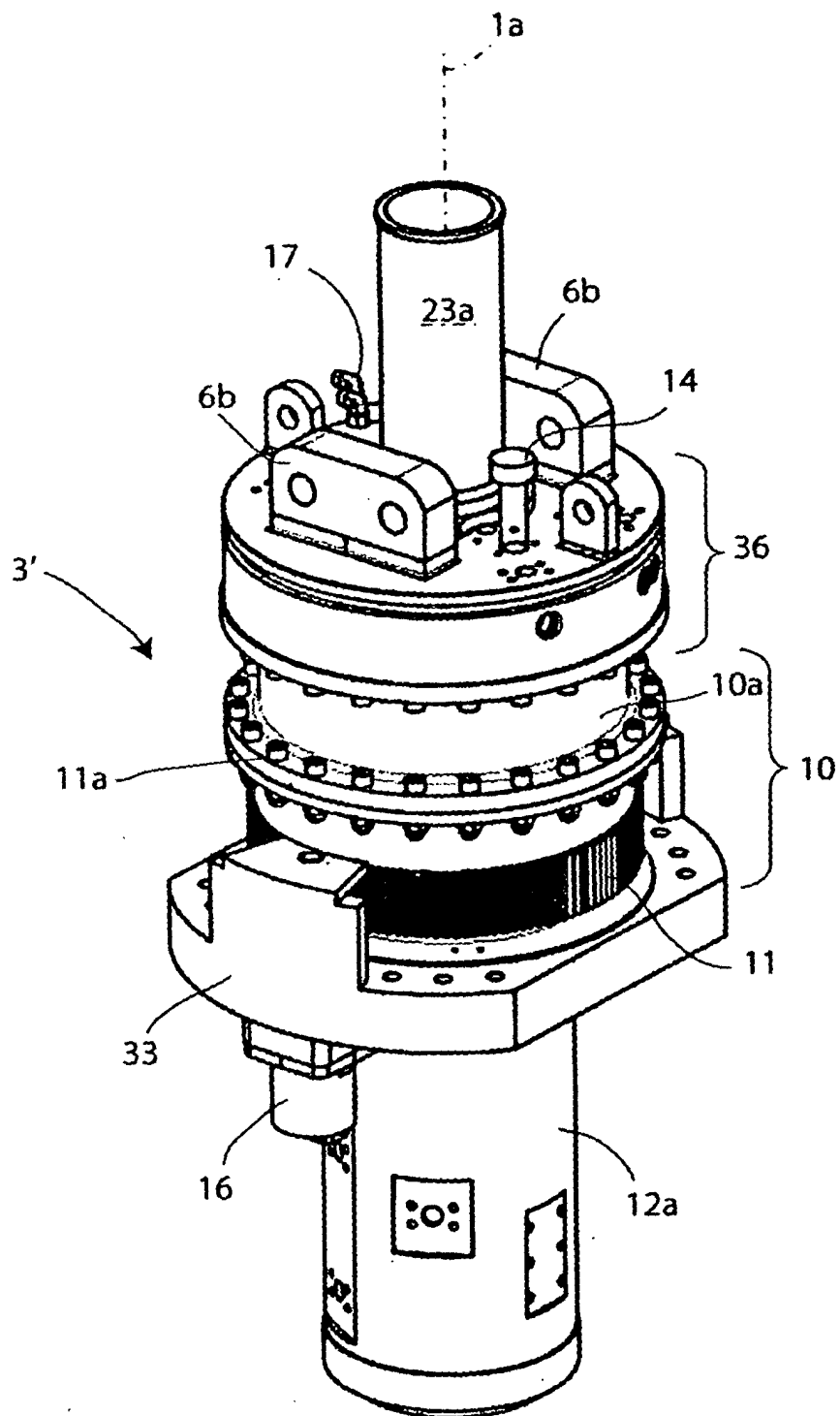


Fig. 3

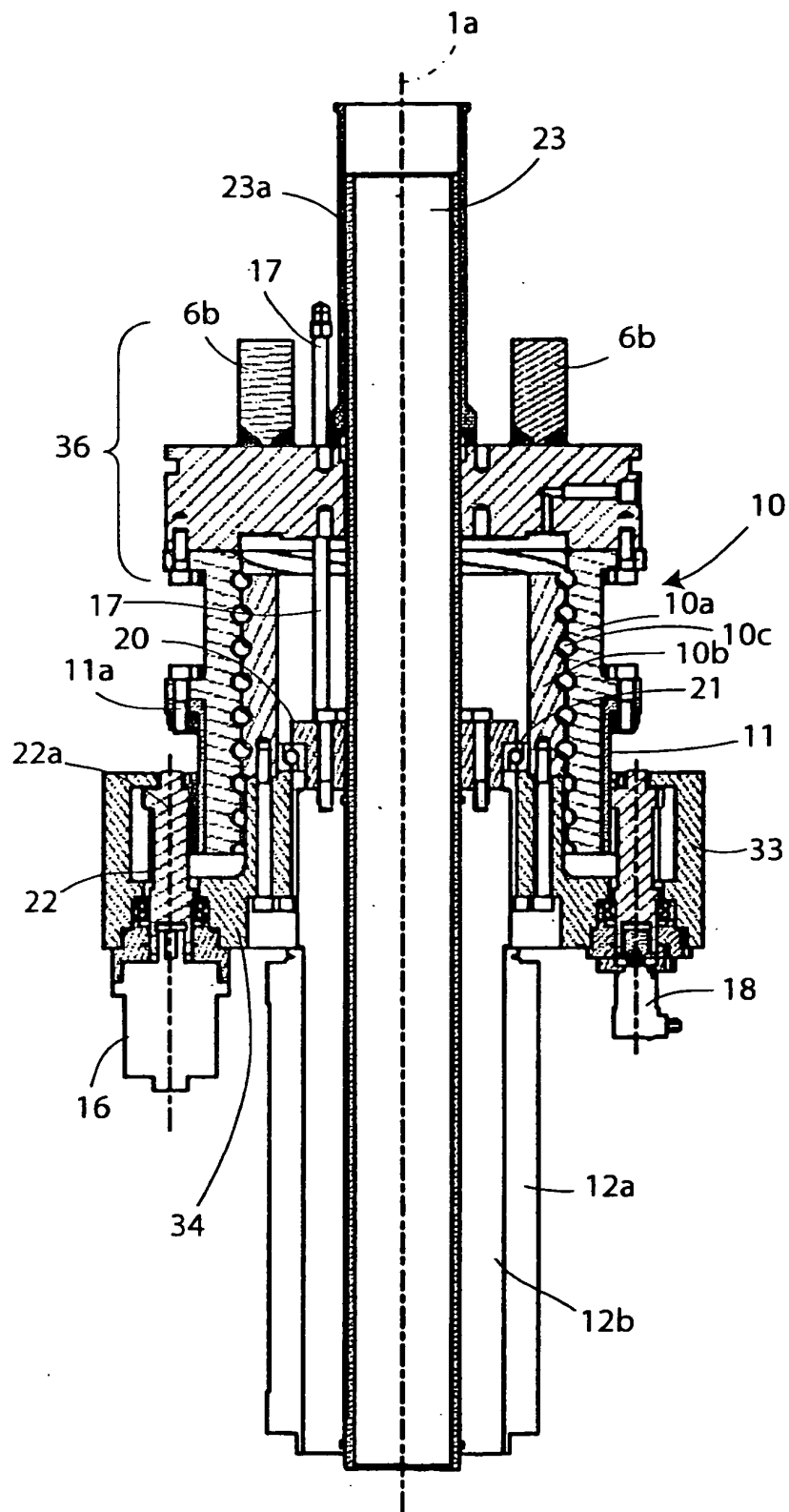


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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