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(54) A drilling machine provided with a device for guiding the drill rods contained in a loading device

(57) A drilling machine comprising a supporting structure having a guide tower (2) provided with elements for guiding the sliding (21), upon which a rotating head (23) for sequentially moving drill rods, to which are given both the movements of rotation and the movements of advancement in the ground and of successive return, slides. The machine also comprises a loading device (3) associated with this guide tower, wherein a plurality of drill rods in battery is positioned and a guide device (4) for maintaining centered the drill rod present in battery and/or drawn from the loading device and associated to the rotating head in the desired direction of drilling.

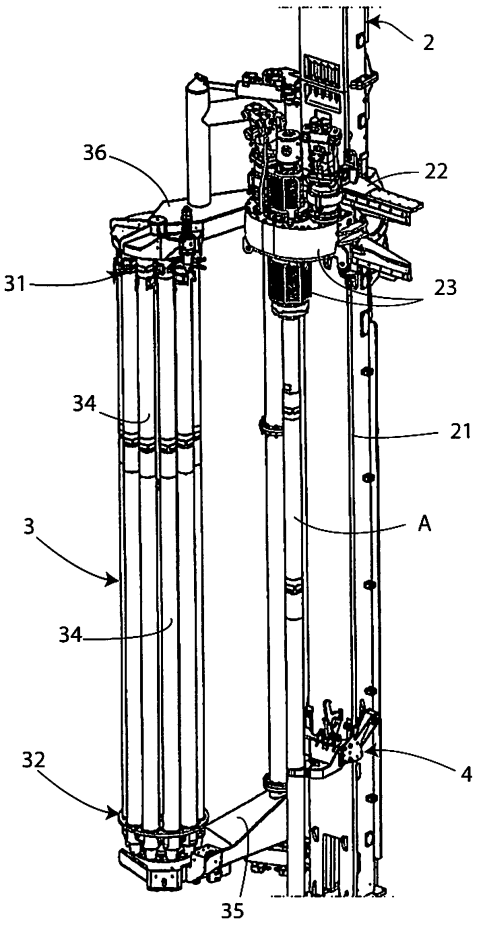


Fig. 1

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Description

[0001] The present invention refers to a drilling machine provided with a device for guiding the drill rods contained in a loading device.

[0002] In particular, the present invention relates to the characteristics of the device which allows for guiding the drill rods in their right advance direction, determined by the inclination of the drilling which has to be carried out.

[0003] Drilling machines comprise a supporting structure comprising a guide tower (called *mast*), provided with a suitable rotating head for moving the drill rods, to which are given both the movements of advance in the ground and of successive return and which is able to directly provide and transmit the movements of rotation.

[0004] When provided for, drill rods can be positioned in batteries and housed inside the loading devices associated to the supporting structure. A drilling battery is generally composed of rods with a variable length (e.g. 1m; 1,5m; 2m; 3m; 6m) which are jointed through threaded-type couplings, for obtaining increasing drilling depths.

[0005] As a matter of fact, the guide tower is normally limited in length for containing the size of the drilling machine and are common strokes comprised between 4 and 7 meters.

[0006] A common request in projects of foundations is obtaining excavation performances at 20-50 meters depths, whereas specific works in geognostic field, water wells, geothermics can require excavation depths even higher than hundred meters deep.

[0007] The vertical drilling at high depths are carried out with drilling machines which are supplied with continuity, through the use of lifting means, which favor the movements of the rods making these maneuvers safe and ergonomic.

[0008] One of the maneuvers required with this type of drilling machines is for instance the one which provides for manually centering the rod among the blocking elements (vices) positioned at the base of the guide tower, which support the rods in the hole and are used for retaining the battery hanging from the hole and for producing the unscrewing of two adjacent rods.

[0009] The loading devices called "rod loading devices" are integral with the machine and have the function of bringing the rod to be inserted into the battery in proximity of the centerline of the hole.

[0010] These devices can have different shapes, but they are generally distinguishable into two typologies: tongs-type loading systems and revolver-type loading systems.

[0011] In the first case the rod contained in a storage container, is drawn by a remote-controlled arm which brings the rod in the centre of the hole where it is then screwed to the rotating head kept in position by the same loading vices.

[0012] On the contrary, in the revolver-type loading systems, the rods are stored on a container, normally rotating, and supported by supporting elements (goblets) and centering elements (spacers or open-section springs) which keep them in guide, inside the structure of the loading device. The loading device is brought in the centre of the hole by a remote-controlled arm (generally of hydraulic type), which puts the rod during the loading step in the centre hole, and which is drawn using the movements of the rotating head itself.

[0013] These types of loading devices are generally limited in their capacities, but safe because the rod is always mechanically supported by the lower arm of the loading device, unlike the preceding ones where the rod may fall if the vices are not correctly tightened or not correctly working.

[0014] When the drillings are carried out with angular inclinations with respect to the vertical line, the revolver-type loading devices must be coupled to guide devices which keep the rod centered in the desired direction, as the weight force of the parts, would tend to cause deviations such to make it impossible the centering between two adjacent rods with the consequent non-possibility of screwing them and of continuing the drilling without the aid of manual interventions.

[0015] The centering guide is normally fixed on the guide tower, generally in fixed position, over the height corresponding to the zone interested by the movement of the lower arm of the loading device.

[0016] Therefore, the guide positioned at a height forcedly distant with respect to the base (area wherein are positioned the blocking elements of the rods, commonly named "vices") limits the effective stroke of the rotating head which cannot move down further than the minimal height, making it lose useful stroke.

[0017] This causes, as a consequence, the realization of guide towers with strokes higher than the required, because in presence of revolver-type loading devices which work in inclined conditions (up to the horizontal line or even further), it is necessary to insert the guide for centering the rods.

[0018] Obviously, this solution brings to dimensioning of the total excavation equipment much higher than the required, with proportional cost increasing.

[0019] The present invention proposes to obviate to the above mentioned inconvenients by realizing a drilling machine provided with a device for guiding the drill rods which is movable along said guide tower and whose position can be always controlled. In this way, the device can be arranged in a higher working position, when a rod has to be positioned using the loading device, and brought in a lower position of minimal dimensions on the guide tower, during the operations of drilling.

[0020] An aspect of the present invention relates to a drilling machine having the characteristics of the attached claim 1.

[0021] Other characteristics of the machine according to the present invention are contained in the attached dependent claims.

[0022] The characteristics and the advantages of the drilling machine according to the present invention will

be clearer and better highlighted by the following description, exemplificative and non-limiting, of a form of embodiment with reference to the attached figures in which:

- Figure 1 schematically shows a perspective view of a supporting structure of a drilling machine provided with guide tower, with revolver-type loading device and with guide device for the rods according to the present invention;
- Figure 2 schematically shows a perspective view of the guide device for the rods according to the present invention;
- Figure 3 shows in perspective view a particular of figure 1 wherein it is highlighted the guide device for the rods in position of upper loading according to the present invention;
- Figure 4 shows in perspective view the guide device for the rods in the lower position of minimal dimensions associated to the rotating head during the its downward movement along the guide tower according to the present invention;
- Figure 5a, 5b and 5c show respectively in as many lateral views the guide tower, the rod loading device and the guide device for the rods, during the loading operations of the rods on the tower according to the present invention;
- Figures 6a and 6b schematically show an anti-rotating group associated to the revolver-type loading device according to the present invention.

[0023] With reference to the mentioned figures the drilling machine according to the present invention comprises a guide tower 2 provided with elements for guiding sliding 21, upon which at least a carriage 22 of a rotating head 23 moves. Furthermore, preferably on the same guides at least also a guide device for the rods moves , in such a way as to aid the respect of the drilling axis X of the rod A, in the centre of the hole.

[0024] Furthermore, the machine comprises a revolver-type loading device 3 having at least a rotating container upon which the rods are stored, formed by a couple of rotating plates one upper 31 and one lower 32, between which are arranged, preferably parallel among them, the rods themselves.

[0025] Upon this lower plate is preferably provided a plurality of goblets 33 (which in figure 3 are shown more simply as a holed plate with diameters of the holes suitable for housing and guiding the rod contained) which support rods 34 and centring elements, which keep them in guide inside the structure of the loading device.

[0026] The loading device or the device of loading is movable between an open position, wherein rods 34 in the loading device are positioned at the maximum distance from rod A in the centre of the hole and a closed position wherein the drilling axis X coincides with the one of the rod contained on the rotating drum in position of loading or unloading from it. This movement is obtained through a lower 35 and an upper 36 couple of arms which make it able to rotate with respect to the guide tower.

[0027] Guide device 4 for the rods comprises preferably a supporting frame 41, provided with sliding means 42 adapted to slide upon guiding elements 21 for the sliding of tower 2, possibly provided with elements 43 for cleaning the elements themselves generally made of rubber and with guiding and centering elements 44 for the rod, advantageously removable, in order to be adapted to the different diameter rods.

[0028] The guide device for the rods is also provided with blocking means of the device itself, in a predetermined working position along the guide tower. This working position corresponds to the loading or unloading step of the rods from the loading device, wherein it is necessary to carry out the positioning and the orientation of the rod in the correct direction of drilling.

[0029] The guide device comprises, furthermore, means adapted to fasten to rotating head 23 when the latter is moving downwards during the operation of drilling with the rod and reaches the guide device in said predetermined working position. When the drilling rotating head gets in contact with the guide device, it pushes this downwards, determining the unlock of these blocking means, and contextually it hooks solidly the guide device to the rolling head. In this way, the head itself and the device move together downwards hooked the one to the other along the guide tower, till the guide device reaches a lower position of minimal overall dimensions on the tower during the drilling operations . During the successive reascending once reached again the predetermined position, contrasting means positioned between the guide tower and the movable guide, determine the release of the guide device from the head and its repositioning in the working position.

[0030] These blocking means comprise preferably at least a mechanical stop 45 contrasting with first elastic means 46 which push said stops to insert in at least a retaining seat 24 realized on guide tower 2 in said predetermined working position (upper).

[0031] These seats and elastic means are opportunely sized for supporting the weight of the guide and the working stresses.

[0032] These fastening means comprise preferably at least a hook 47 which acts in contrast with second elastic means 48 adapted to hook at least one projecting element 25 integral with carriage 22 (not shown in Fig. 2 but visible in Fig. 4) of rotating head 23 and to transmit the movements of shifting given by it along the guide tower.

[0033] The contrasting means comprise at least a cam 26 which directly acts on at least a shoulder 49 of the hook or on a roller free to rotate 49A for reducing the frictions and the consumptions between the sliding parts (cam 26 and shoulder 49), determining its rotation around the axis Y and its release from projecting element 25 fixed to carriage 22.

[0034] The operations of drilling in the drilling machine proceed as follows.

[0035] The movable guide is initially blocked in upper

working position S with stops 45 engaged into seats 24 of the guide tower.

[0036] In the step of rod loading, after having reached the maximum depth with the rods in battery, the loading device is closed and brought in the center of the hole in correspondence with the loading axis coincident with the one of the excavation X.

[0037] During the closing movement the loaded rod is supported by the lower arm of the loading device and in proximity of the excavation axis X the guide means center the rod and keep it in position through the guide elements and rod centering elements 44.

[0038] The rotating head screws the rod to be loaded and after having tightened it, it is lifted up by the loading device.

[0039] As the rod is no more inserted in goblets 33,the loading device can be moved away for returning in the rest configuration, away from the excavation axis while the rod in this step remains hanging between the rotating head and centering element 44 on the guide.

[0040] Guide 44 has an open shape for allowing the free movement of inserting and extracting the rod from and to the loading device and provided with elastic means which keep the rod tightened in position by closing itself at a diameter lower than the one of the rod to be moved.

[0041] The rotating head, while moving downwards, screws the rod to the drilling battery and makes the drilling restart. By approaching the guide, the carriage prepares to drag it in the lower position of minimal overall dimensions B.

[0042] Hook 47 is kept in the raised position by cam 26. When the carriage of the rotating head approaches the structure of the guide device and begins to push it, this action releases stops 45 from their retaining seats 24 overcoming the strength of elastic means 46 and contemporarily the hook engages projecting element 25 fixed to carriage 22 when descending from cam 26.

[0043] From this moment, the carriage solidly drags the guide device, by accompanying it from an upper position to a lower one, controlling the position in both the movement directions.

[0044] Having reached the lower position of minimal overall dimensions B the drilling is completed and a new rod can be loaded.

[0045] After having removed the drilling battery from rotating head 23, by using the vices and leaving it hanging from them, according to the standard and known practices, therefore here not described, it can be started the reloading step of a new rod.

[0046] In the movement of return or reascending, the carriage brings back the guide device toward upper position S. Stops 45 are the first to engage in retaining seats 24 and then hook 47, pushed by the cam it lifts up releasing the guide device from carriage 22.

[0047] Now the guide device is released in upper position A remaining locked in this position up to the successive loading. For the correct functioning of the mechanism it is essential to position the elements integral with the guide tower (seats and cams), in such a way that the sequence is the same as the one described.

[0048] For the steps for the unloading of the rod from the drilling battery to the loading device, all the steps described can be understood as specularly valid.

[0049] In a preferred form of embodiment hook 47 is in coupling to the cam with a rotating element 49A which reduces the frictions and the consumptions of the two elements. As a matter of fact, for being sufficiently reactive in the movement, the hook needs a very rigid return spring and this, by exerting a relevant pushing force, creates a quick wear of the sliding surfaces, which is very relevant even for the quick movements. By inserting a rolling element this inconvenient is solved.

[0050] According to another characteristics of the present invention, to the revolver-type loading device 3 is associated a unique anti-rotating plate 6 positioned on arm 35 of the loading device which keeps locked in rotation the sole rod in loading and unloading.

[0051] In this way, the anti-rotating plate can be only one for the whole loading device, instead of being one for each seat of rod and mounted in proximity of containment 33 and the whole system becomes more simplified.

[0052] Plate 6 comprises preferably a restraining tooth 61 (which can be advantageously dismantled in order to be adapted for the different types of rod) pivoted on this plate which constrains against suitable seats 34a obtained on the ending part of rod 34. The rotation of tooth 61 is barred by the action of a spring 62 preferably fixed to a wall of the plate through a clamp 63 and which favors the contact among tooth 61 and blocking stops 34a obtained on rod 34.

[0053] By using a movable guide instead of a fixed one, it is recovered the stroke necessary for the drilling and consequently the machines can be resized and cheaper. This is an enormous advantage mainly for the machines developed for working with the guide tower near to the horizontal line, wherein a higher length would influence very negatively the lateral stability and the ground view dimensions which are required.

[0054] The use of mechanical devices in contrast to the elastic means allows to carry out the loading steps in an automatic way, without having to actuate commands for giving the single maneuvers.

[0055] The whole step for moving the guide is automatic despite of the systems controlled by means of actuators (e.g. hydraulic-jacks) positioned between the movable guide and the carriage which instead would be manually actuated. In this way, even the locking of the rod does not require the manual intervention of the operator, but the rotating head itself with the sole rotation is able to unscrew the rods by acting in contrast with the anti-rotating plates.

[0056] In all the working steps and for all the containing capacity of the loading device, it is not necessary to call the operator for carrying out manual adaptations necessary for the centering, exposing him to potential risks in a very dangerous area.

[0057] Eventually, the continuous control of the position in all the movement steps between upper position S and the one of minimal overall dimensions B, in any direction, allows for operating in absolute safety without having uncontrollable movements which are typical of the movable systems which use the simple gravity (usable within a limited extent in vertical drillings or next to it, but leaving unchanged the safety risks against possible blocks during the movements and successive fallings of the objects from different heights and with dynamic impacts on the structures).

Claims

1. A drilling machine comprising:

- a supporting structure comprising a guide tower (2) provided with elements for guiding the sliding (21), upon which a rotating head (23) for sequentially moving drill rods, to which are given both the movement of rotation and the movements of advancement in the ground and of successive return, slides,
- a loading device (3) associated to said guide tower, wherein a plurality of drill rods in battery is positioned,
- a guide device (4) adapted to maintain centred the drill rod present in battery and/or drawn from the loading device and associated to the rotating head in the desired direction of drilling,

characterized in that said guide device slides along said guide tower and comprises

- blocking means of the device itself, in a predetermined working position along the guide tower,
- means for coupling to the rotating head (23) when it moves down during the operation of drilling with the rod and reaches the guide device in said predetermined position and
- contrasting means that determine the release of the guide device from the rotating head and its repositioning in the working position during the ascent of the driving head itself.

2. A machine according to claim 1, wherein said blocking means comprise at least a mechanic stop (45) contrasting with first elastic means (46), that push said stops to insert in at least a retaining seat (24) made on the guide tower in said predetermined position.

3. A machine according to claim 1, wherein said means for coupling comprise at least a hook (47) that acts in contrast with second elastic means (48), adapted to hook to at least one projecting element (25) integral with the rotating head.

4. A machine according to claim 3, wherein the contrasting means comprise at least a cam (26) that acts on at least a shoulder (49) of the hook, thus determining its release from the projecting element (25).

5. A machine according to claim 3, wherein said guide device (4) slides on the same guide elements (21) of the rotating head (23).

6. A machine according to claim 1, wherein the loading device (3) is adjustably constrained to the guide tower by means of a couple of lower arms (35) and upper arms (36) and is a revolver loading device and comprises a rotating container upon which the rods are stored, formed by a couple of rotating supports, one upper (31) and one lower (32), among which are positioned the rods themselves.

7. A machine according to claim 6, also comprising an anti-rotating plate (6) positioned on the lower arm (35) of the loading device, that blocks in rotation the rod in charging and discharging on the loading device.

8. A machine according to claim 7, wherein the plate (6) comprises a restraining tooth (61) that constrains against stops (34A) present on the rod (34), pivoted on said plate in contrast with elastic means (62) .

8. A machine according to claim 3, wherein the hook (47) is coupled with the cam by means of a rotating element (49A) .

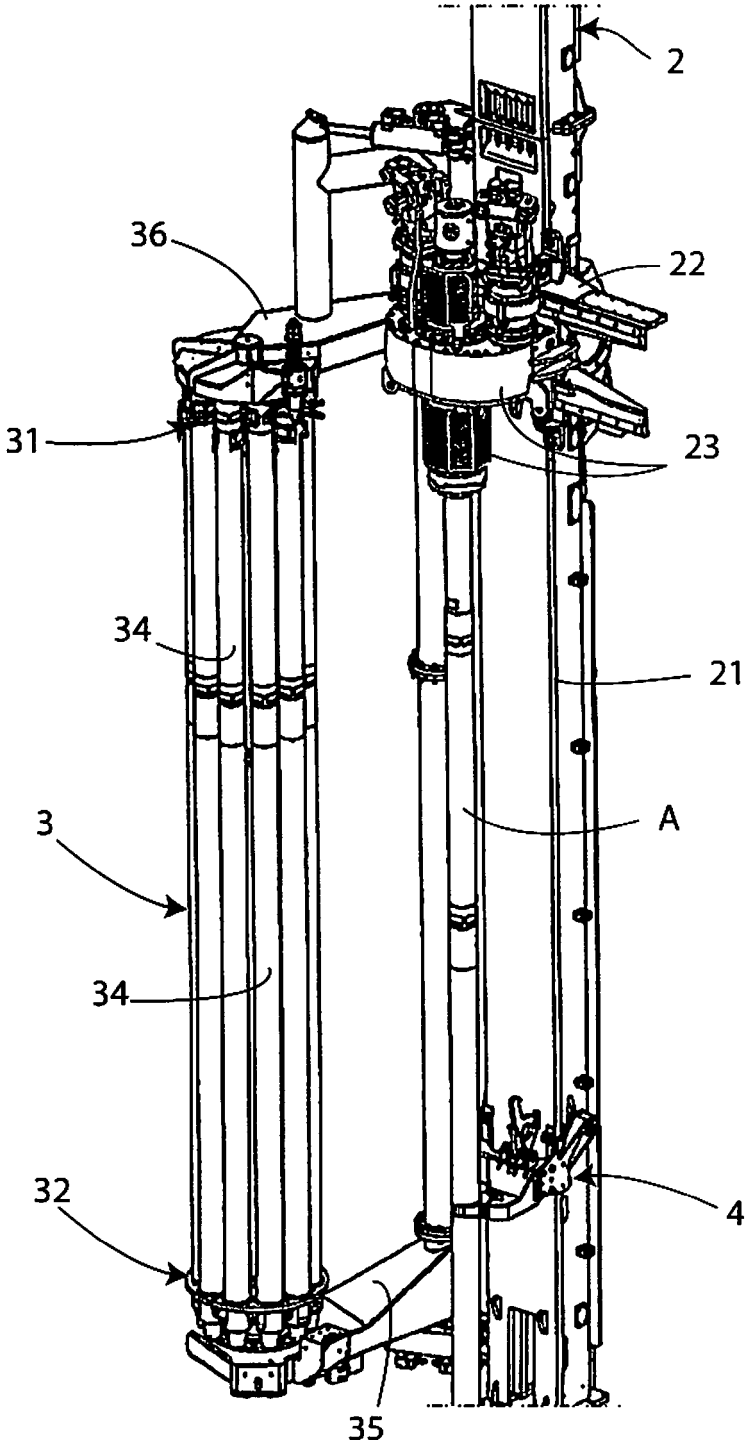


Fig. 1

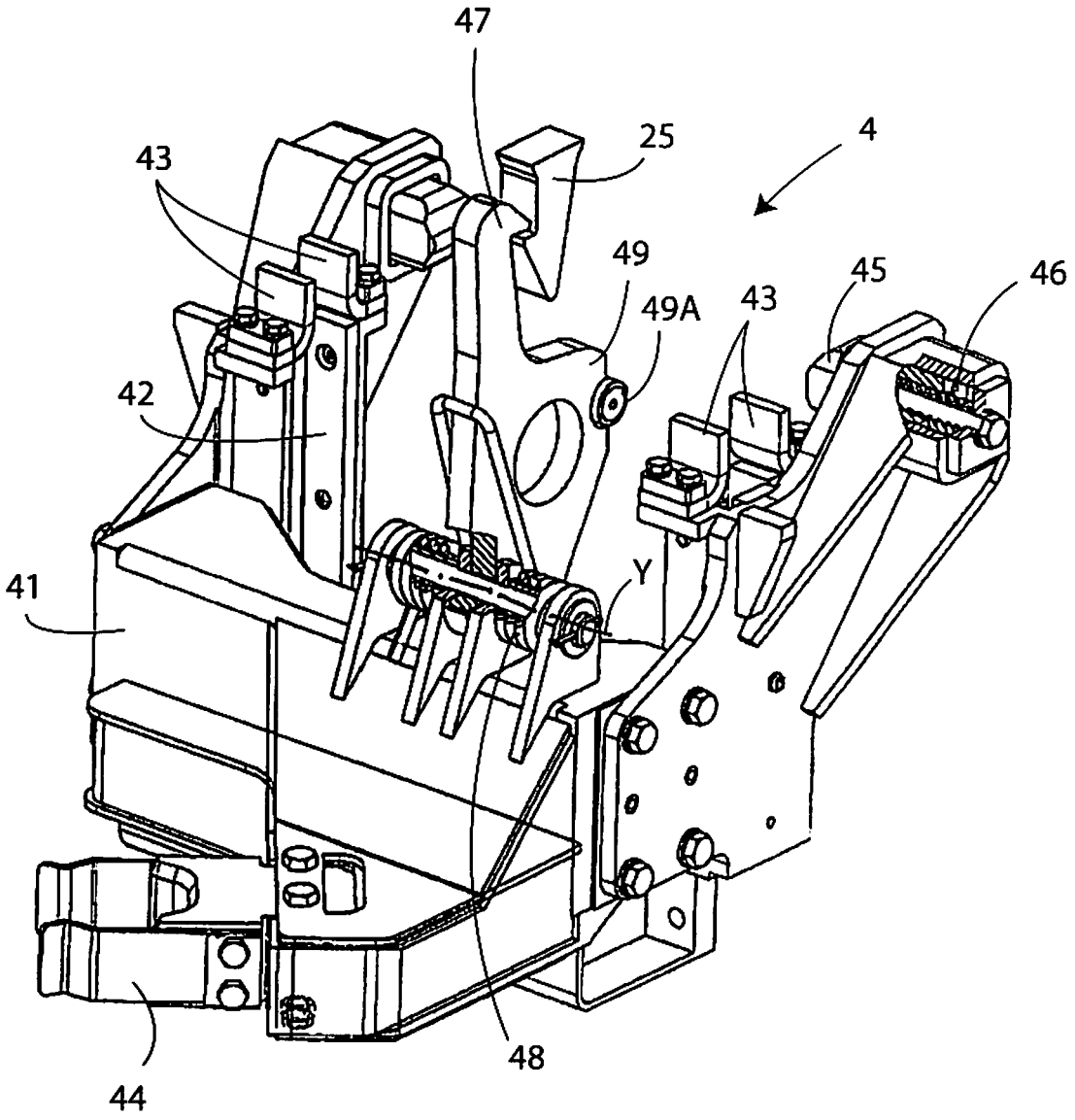


Fig. 2

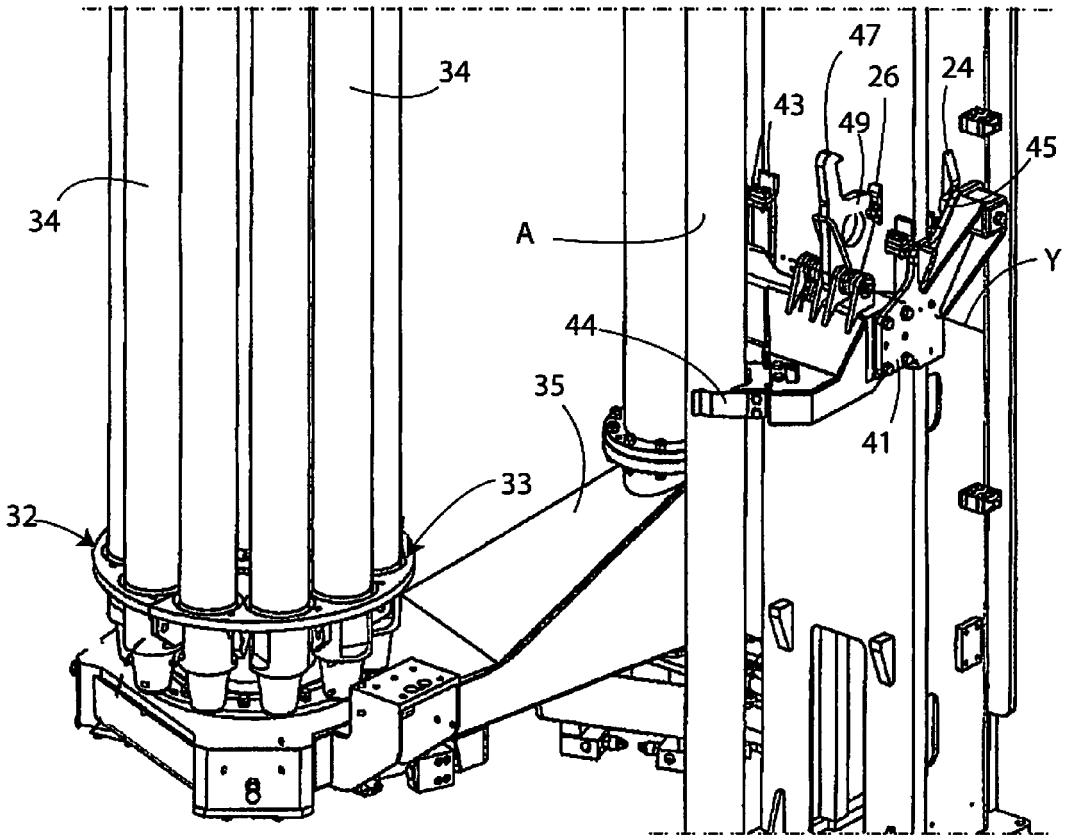


Fig. 3

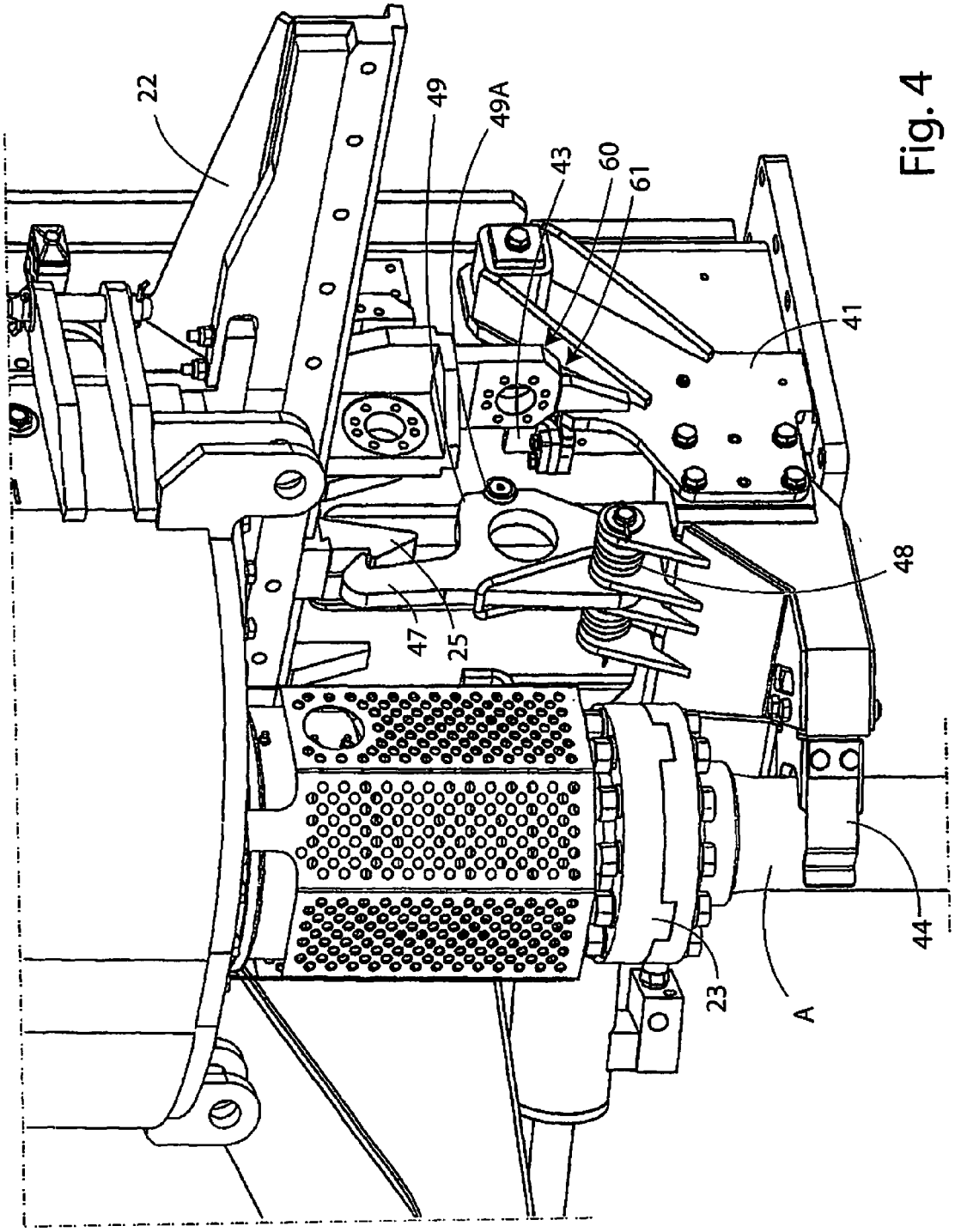


Fig. 4

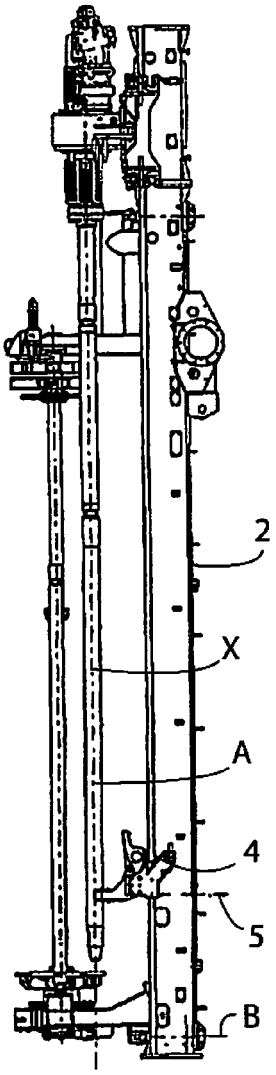


Fig. 5a

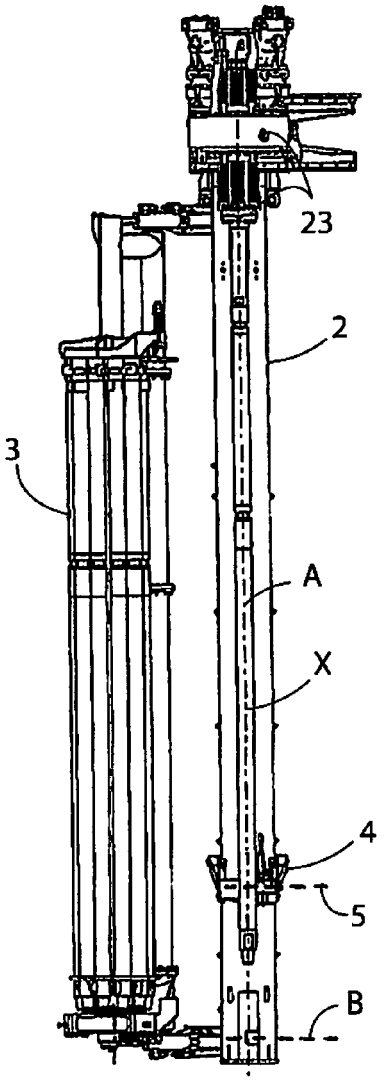


Fig. 5b

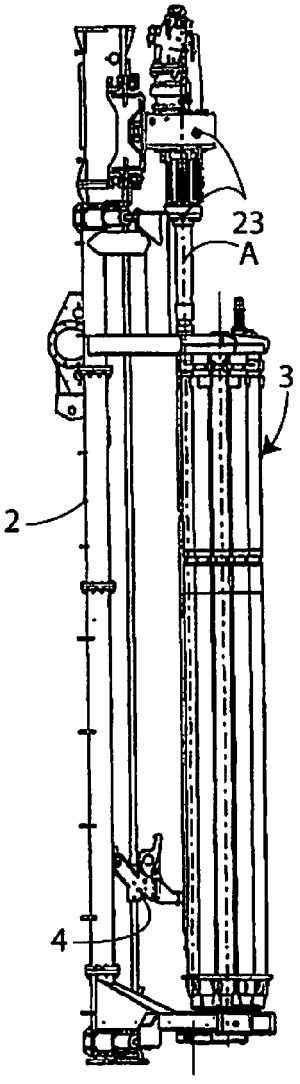


Fig. 5c

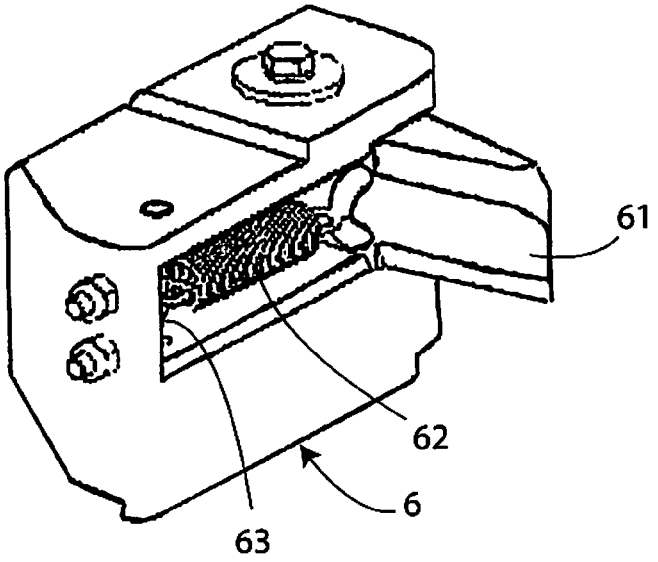


Fig. 6a

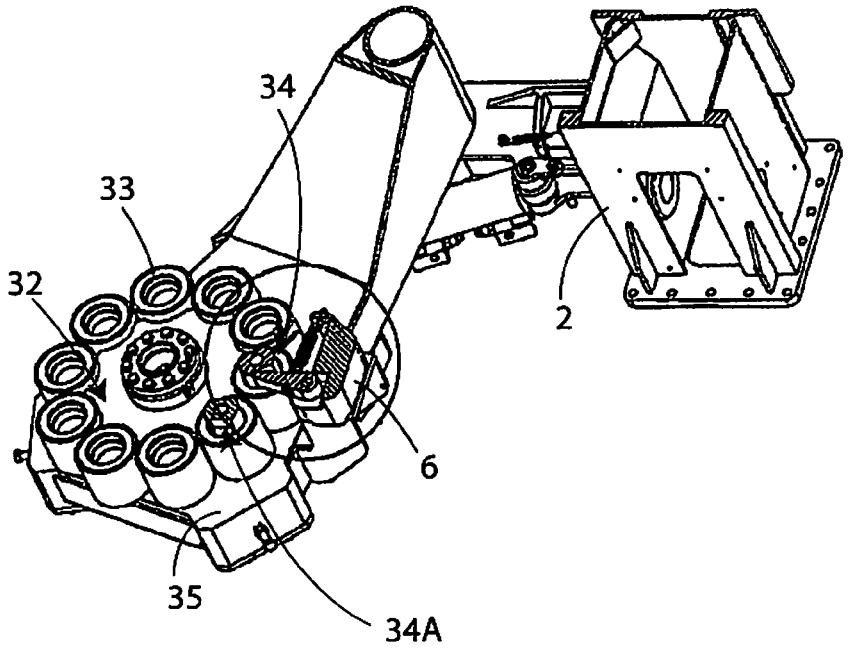


Fig. 6b

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EUROPEAN SEARCH REPORT

Application Number
EP 10 15 7458

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	DE 10 02 263 B (NUESSE & GRAEFER KOMMANDIT GES) 14 February 1957 (1957-02-14) * column 2, line 47 - column 3 * -----	1-9	INV. E21B15/04 E21B19/14 E21B19/24
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A	EP 0 387 017 A2 (TAMPELLA OY AB [FI]) 12 September 1990 (1990-09-12) * the whole document * -----	1-9	
			TECHNICAL FIELDS SEARCHED (IPC) E21F B61B E21B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 April 2010	Ott, Stéphane

CATEGORY OF CITED DOCUMENTS

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