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(54) **Apparatus for accessibility to drive means**

(57) An apparatus (60) for accessibility to drive means (20) inside a frame (11), which cooperates with chain-type transmission means (25) and with tensioning means (59), comprises guide means (67, 68) to allow the drive means (20) to slide between a working position, in which the transmission means (25) is in an operative condition, under tension, and an inactive position, in which the transmission means (25) is in a slack, non-operative condition, and an access wall (61) able to be moved, when said drive means (20) is in the inactive position, into an open position towards the outside of the frame (11) and comprising sliding coupling means (70) able to cooperate with said guide means (67, 68) so as to achieve the sliding of said drive means (20) and to selectively draw said drive means (20) in rotation to an accessible position at least partly outside the frame (11) when the access wall (61) is moved to the open position.

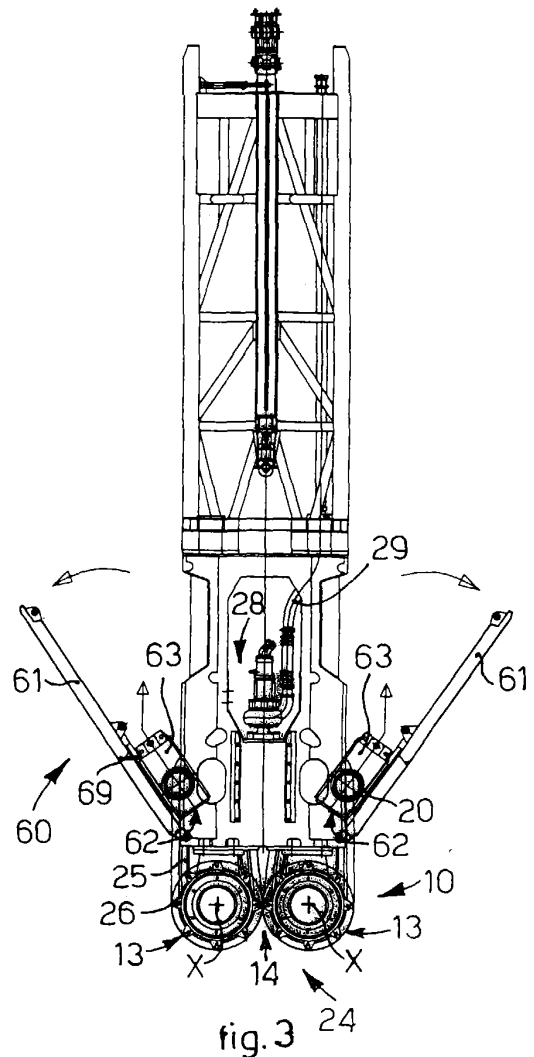


fig. 3

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**Description**

## FIELD OF THE INVENTION

**[0001]** The present invention concerns an apparatus for accessibility to drive means inside a frame, so as to allow both easy maintenance and also a rapid and effective dismantling of the drive means.

**[0002]** In particular, the present invention concerns an apparatus for accessibility to drive means which is able to slide between a working position and an inactive position in an excavation device.

## BACKGROUND OF THE INVENTION

**[0003]** It is known to make apparatuses for accessibility to drive means, usually equipped with a removable or pivoting plate which selectively allows access to the containing compartment of the drive means.

**[0004]** For example, excavation devices are known in order to excavate ditches, trenches, wells, diaphragms or other, which have two pairs of milling wheels with horizontal shafts and substantially parallel, during use, with the excavation surface; they are driven by drive means, and the motion is usually transferred to the shaft of the milling wheels by means of chain-type transmission means.

**[0005]** In these known excavation devices, access to said drive means is allowed by apparatuses for accessibility, in which bolted plates are dismantled and allow to dismantle the motors in a direction perpendicular to the plane on which said chain-type transmission means lies, or pivoting walls rotate and open in a direction substantially transverse to the plane on which said chain-type transmission means and the drive means lie.

**[0006]** These known apparatuses thus allow access and dismantling from the front with respect to the milling wheels of the drive means.

**[0007]** However, said known apparatuses do not allow the easy use of drive means with high power and great size, in particular great thickness, in the direction of their drive shaft.

**[0008]** In fact, in this case, the apparatus for accessibility to said drive means with great thickness should also have a great thickness and, in this way, would be very bulky, with a negative influence on the structure of the excavation device itself. Moreover, a known apparatus with great thickness inevitably does not allow to make the excavation of diaphragms of limited size, which are in particular demand in the market of excavation devices.

**[0009]** One purpose of the present invention is to achieve an apparatus for accessibility to drive means which allows complete access to said drive means and which is not bulky.

**[0010]** Another purpose of the present invention is to achieve a method to allow accessibility to drive means which facilitates the maintenance and/or removal of said drive means.

**[0011]** The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

## SUMMARY OF THE INVENTION

**[0012]** The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

**[0013]** In accordance with the above purposes, an apparatus according to the present invention allows accessibility to drive means disposed inside a frame, which cooperates with chain-type transmission means and with tensioning means able to tension said chain-type transmission means.

**[0014]** The apparatus according to the present invention comprises guide means able to allow the drive means to slide between a working position, in which said transmission means is in an operating condition under tension, so as to transmit motion from said drive means, and an inactive position, in which said transmission means is in a slack, non-operating condition.

**[0015]** The apparatus according to the present invention also comprises at least an access wall, which is able to be moved, when the drive means is in the inactive position, to an open position towards the outside of said frame, in which open position said access wall is able to selectively allow access at least to the drive means.

**[0016]** According to a characteristic feature of the present invention, said wall comprises sliding coupling means, able to cooperate with said guide means, so as to achieve the sliding of the drive means and to selectively draw the latter in rotation to an accessible position, at least partly outside said frame, when said access wall is moved to the open position.

**[0017]** Advantageously, the apparatus for accessibility to drive means thus achieved allows easy and complete access to said drive means, which is drawn outside the frame together with the opening of the access wall. The apparatus is thus extremely compact, not at all bulky, economical to make and has limited thickness.

**[0018]** Advantageously, by means of the apparatus according to the present invention, associated with an excavation device, it is also possible to excavate diaphragms of limited width.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0019]** These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a schematic view of an accessibility apparatus associated with a device;

- fig. 2 is a schematic view of the accessibility apparatus in fig. 1, in an open position;
- fig. 3 is a schematic view of the accessibility apparatus in fig. 1 in another open position;
- fig. 4 is a three-dimensional view of an enlarged detail of the accessibility apparatus in fig. 1;
- fig. 5 is a three-dimensional view of another enlarged detail of the accessibility apparatus in fig. 1; and
- fig. 6 is a three-dimensional view of another enlarged detail of the accessibility apparatus in fig. 1.

#### DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

**[0020]** According to the present invention, fig. 1 shows an apparatus 60 for accessibility to at least a hydraulic motor 20, in this case associated with an excavation device 10, suitable to operate in any type of ground and able to make ditches, trenches, wells, diaphragms with a structural function, like the perimeter walls of an underground car park, or with the function of foundations, such as for a building, or again with a waterproofing function, usually used in dams.

**[0021]** The excavation device 10 comprises an excavation head 11 (figs. 1-3), having a substantially box-like external shape and possibly connected in its upper part to a guide, carried by a self-propelled means.

**[0022]** From the lower part of the excavation head 11 two pairs of milling wheels 13 extend, with a substantially horizontal axis of rotation X (figs. 1-3). The milling wheels 13 define during use an excavation front 24, substantially parallel to the axis of rotation X (figs. 1 and 2).

**[0023]** The milling wheels 13 are advantageously counterrotating, so as to balance stresses during excavation and to convey and draw the debris and crushed materials produced by crushing from the excavation towards a central suction zone 14, located between the milling wheels 13 (fig. 1).

**[0024]** In the central suction zone 14, the debris is sucked in by suitable discharge means 28 (figs. 1 and 2).

**[0025]** Each milling wheel 13 is equipped on the periphery with excavation means 26, which defines said excavation front 24 (figs. 1 and 2).

**[0026]** Each pair of milling wheels 13 is also drawn in rotation by a transmission chain 25 (fig. 1).

**[0027]** Each transmission chain 25 is also provided with excavation means 26 (figs. 1 and 2), which extend on the external side, during use, of the chain 25, that is, the side able to face towards the ground to be excavated.

**[0028]** In this way, the excavation front 24 is continuous and uniform, without dead spaces and has a section that substantially coincides with the greater section of the excavation head 11 (fig. 1).

**[0029]** Each chain 25 is driven by said hydraulic motor 20, in this case disposed above the milling wheels 13 (figs. 1 and 2).

**[0030]** The hydraulic motor 20 has a fixed drive shaft 21 and a rotary casing 22, on the periphery of which there

is a toothed crown 23. The toothed crown 23 is coupled with the chain 25 and draws it into rotation (fig. 6).

**[0031]** Thus, advantageously, we obtain a reduced axial bulk of the combined hydraulic motor 20 - toothed crown 23 and consequently a reduced thickness of the excavation head 11. Moreover, we thus reduce the number of moving parts and obtain an excavation device that is all in all very robust.

**[0032]** The hydraulic motor 20 cooperates with tensioning means 59, which is able to tension said chain 25 (figs. 1 and 2).

**[0033]** The chain 25 is thus selectively tensioned, by the tensioning means 59, in an operating condition wherein the motion is transmitted by the hydraulic motor 20 in this case in order to draw in rotation said milling wheels 13.

**[0034]** When the chain 25 is not tensioned by the tensioning means 59, that is, it is slack, it is not able to transmit efficiently the rotary motion from the hydraulic motor 20, for example in those cases when the hydraulic motor 20, the chain 25, the tensioning means or other devices inside the frame 11 are subjected to maintenance and/or removed.

**[0035]** The apparatus 60 also comprises a bearing structure 62 (figs. 4 and 6), substantially box-shaped and disposed during use inside the excavation head 11, so as to support the hydraulic motor 20 (fig. 1).

**[0036]** The bearing structure 62 has a housing compartment 66 in which the hydraulic motor 20 is inserted and fixed, and is defined by a first surface 63, provided with first guide means 67, and a second surface 64, on which a second guide means 68 is disposed (fig. 6).

**[0037]** The first and second guide means 67, 68 (figs. 1, 2, 4 and 6) are thus connected with said hydraulic motor 20 and, cooperating with fixed guides 71 inside the excavation head 11 and with sliding coupling means 70 or external guides, as will be explained in detail hereafter, are able to allow the latter to slide between a working position, in which said chain 25 is in an operating condition under tension so as to transmit the motion from said hydraulic motor 20, and an inactive position (figs. 1-3) in which said chain 25 is in a non-operating, slack condition.

**[0038]** Said first surface 63 and second surface 64 are connected by connection elements 65 and are therefore solidly rotatable with the access surface 61 (fig. 6).

**[0039]** The bearing structure 62, and hence said first surface 63 and second surface 64, is connected to an access wall 61 (figs. 1, 2, 3 and 5), which is mobile with respect to the excavation head 11, advantageously pivoted to said excavation head 11 along a pivoting axis Z, substantially parallel to said axis X.

**[0040]** The access wall 61 is able to be moved, when the hydraulic motor 20 is in said inactive position, to an open position, towards the outside of the excavation head 11, in order to selectively allow access at least to said hydraulic motor 20 (fig. 2).

**[0041]** Advantageously, if the excavation device 10

has two pairs of milling wheels 13 and therefore two hydraulic motors 20, two access walls 61 are made, opening on opposite sides of the excavation head 11 (fig. 3) and each one connected to two respective bearing structures 62.

**[0042]** According to a characteristic feature of the present invention, said access wall 61 comprises sliding coupling means 70 (fig. 4), such as grooved guides, able to cooperate with said first and second guide means 67, 68 so as to achieve the sliding of said hydraulic motor 20 and to selectively draw the latter in rotation around said pivoting axis Z, to an accessible position outside the excavation head 11, when the access wall 61 is moved to the open position.

**[0043]** In particular, the first guide means 67 cooperates by means of a single plane face with the sliding coupling means 70, while the second guide means 68 cooperates with three of their plane faces with the sliding coupling means 70, thus preventing jams in the sliding of the bearing structure 62 due for example to constructional errors or deformations in the structure.

**[0044]** The same constructional strategies are applied to the coupling of the bearing structure 62 with the internal fixed guides 71, solid with the excavation head 11.

**[0045]** According to another characteristic of the present invention, the apparatus 60 comprises at least a tie rod element 69, connected to said bearing structure 62 and able to be maneuvered so as to move the hydraulic motor 20 and said access wall 61 towards the outside (fig. 2).

**[0046]** The hydraulic motor 20 can be uncoupled from the chain 25, for example once the access wall 61 is open (figs. 2 and 3) or even before this step, and from the sliding coupling means 70, raised by means of a crane or suchlike and sent for maintenance.

**[0047]** It is clear that modifications and/or additions of parts may be made to the apparatus for accessibility to drive means as described heretofore, without departing from the field and scope of the present invention.

**[0048]** It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of apparatus for accessibility to drive means, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

## Claims

1. Apparatus for accessibility to drive means (20) disposed inside a frame (11), in which said drive means (20) cooperates with chain-type transmission means (25) and with tensioning means (59), able to tension said chain-type transmission means (25), comprising:

- guide means (67, 68) able to allow said drive

means (20) to slide between a working position, in which said transmission means (25) is in an operative condition, under tension, so as to transmit motion from said drive means (20), and an inactive position, in which said transmission means (25) is in a slack, non-operative condition;

- at least an access wall (61), connected to said frame (11) and able to be moved, when said drive means (20) is in said inactive position, into an open position towards the outside of said frame (11), **characterized in that** said access wall (61) comprises sliding coupling means (70) able to cooperate with said guide means (67, 68) so as to achieve the sliding of said drive means (20) and to selectively draw said drive means (20) in rotation to an accessible position at least partly outside said frame (11) when said access wall (61) is moved to said open position.

2. Apparatus for accessibility as in claim 1, **characterized in that** said access wall (61) is able to rotate around a pivoting axis (Z) so as to selectively allow access at least to said drive means (20) and **in that** said drive means (20) is drawn in rotation around said pivoting axis (Z), when said access wall (61) is moved to said open position.

3. Apparatus for accessibility as in claim 1 or 2, **characterized in that** it comprises a bearing structure (62) connected to said access wall (61) and disposed during use inside said frame (11), said bearing structure (62) being connected to and supporting said drive means (20), said bearing structure (62) having a housing compartment (66) for said drive means (20), said compartment (66) being defined by a first surface (63) and a second surface (64), connected by connection elements (65).

4. Apparatus for accessibility as in claim 3, **characterized in that** said guide means comprises first guide means (67), disposed on said first surface (63) and second guide means (68) disposed on said second surface (64).

5. Apparatus for accessibility as in claim 3 or 4, **characterized in that** it comprises tie rod means (69) connected to said bearing structure (62) and able to be maneuvered so as to move said drive means (20) and said access surface (61) towards the outside.

6. Excavation device comprising:

- at least a pair of milling wheels (13) with a substantially horizontal axis of rotation (X), each equipped on the periphery with excavation means (26), able to define an excavation front (24) substantially parallel to said axis (X);

- chain-type transmission means (25) able to draw in rotation said milling wheel (13), said transmission means (25) being driven by drive means (20) and also being provided with excavation means (26) on the side which is external during use; 5
- tensioning means (59) able to tension said chain type transmission means (25);
- guide means (67, 68) able to allow said drive means (20) to slide between a working position, in which said transmission means (25) is in an operative condition, under tension, so as to transmit motion from said drive means (20), and an inactive position, in which said transmission means (25) is in a slack, non-operative condition; 10 15
- at least an access wall (61), connected to said frame (11) and able to be moved, when said drive means (20) is in said inactive position, into an open position towards the outside of said frame (11); 20

**characterized in that** said access wall (61) comprises sliding coupling means (70) able to cooperate with said guide means (67, 68) so as to achieve the sliding of said drive means (20) and to selectively draw said drive means (20) in rotation to an accessible position at least partly outside said frame (11) when said access wall (61) is moved to said open position. 25 30

7. Method to achieve accessibility to drive means (20) disposed inside a frame (11), wherein said drive means (20) cooperates with chain-type transmission means (25) and with tensioning means (59) able to tension said chain-type transmission means (25), **characterized in that** it comprises: 35

- a sliding step of said drive means (20) between a working position, in which said transmission means (25) is in an operative condition, under tension, so as to transmit motion from said drive means (20), and an inactive position, in which said transmission means (25) is in a slack, non-operative condition; 40 45
- a step of moving at least an access wall (61), pivoted to said frame (11), to an open position towards the outside of said frame (11), so as to selectively draw said drive means (20) in rotation to an accessible position, at least partly outside said frame (11), when said drive means (20) is in said inactive position. 50

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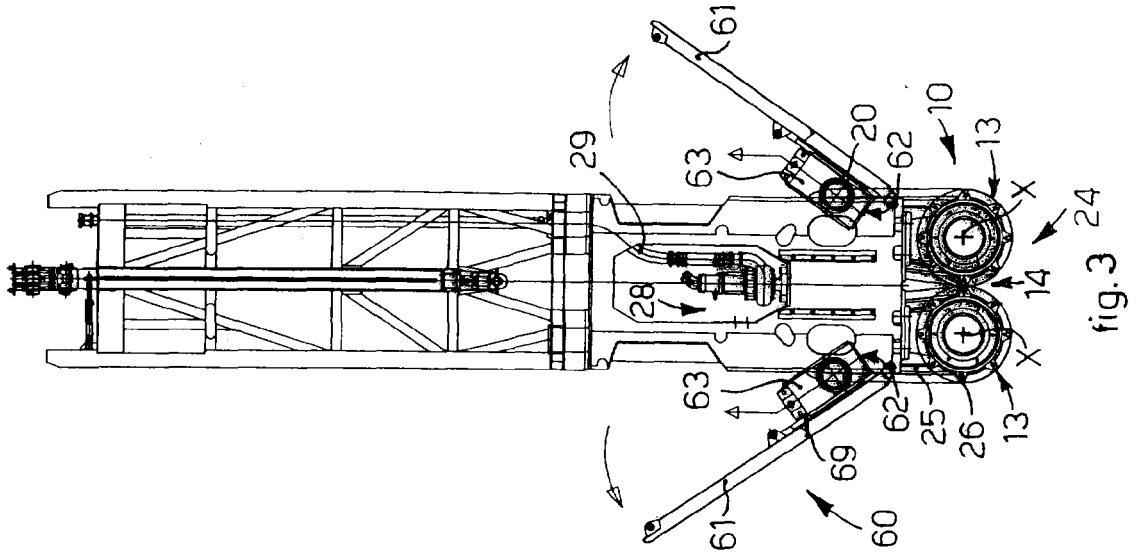


fig.3

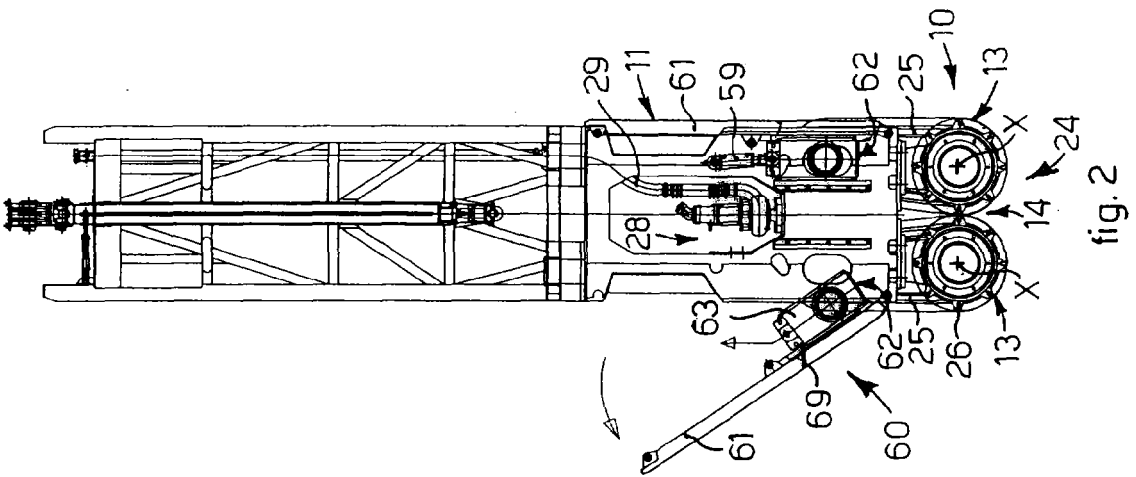


fig.2

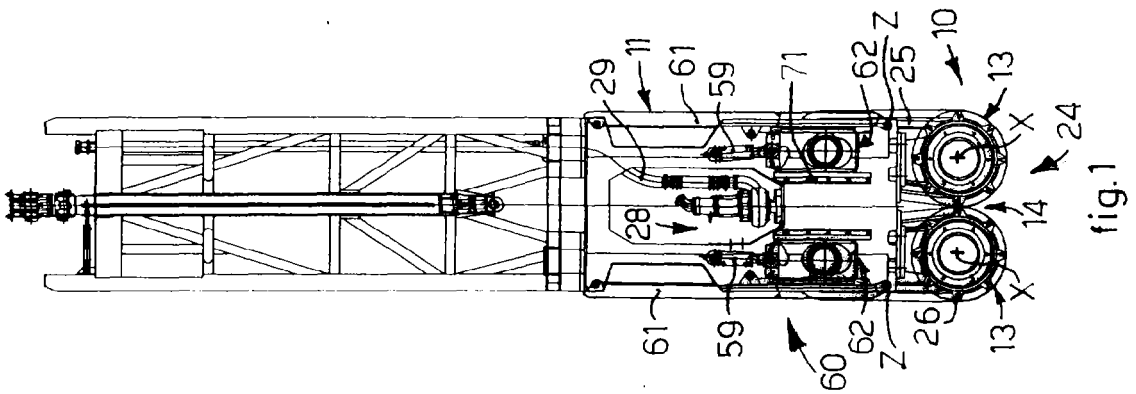


fig.1

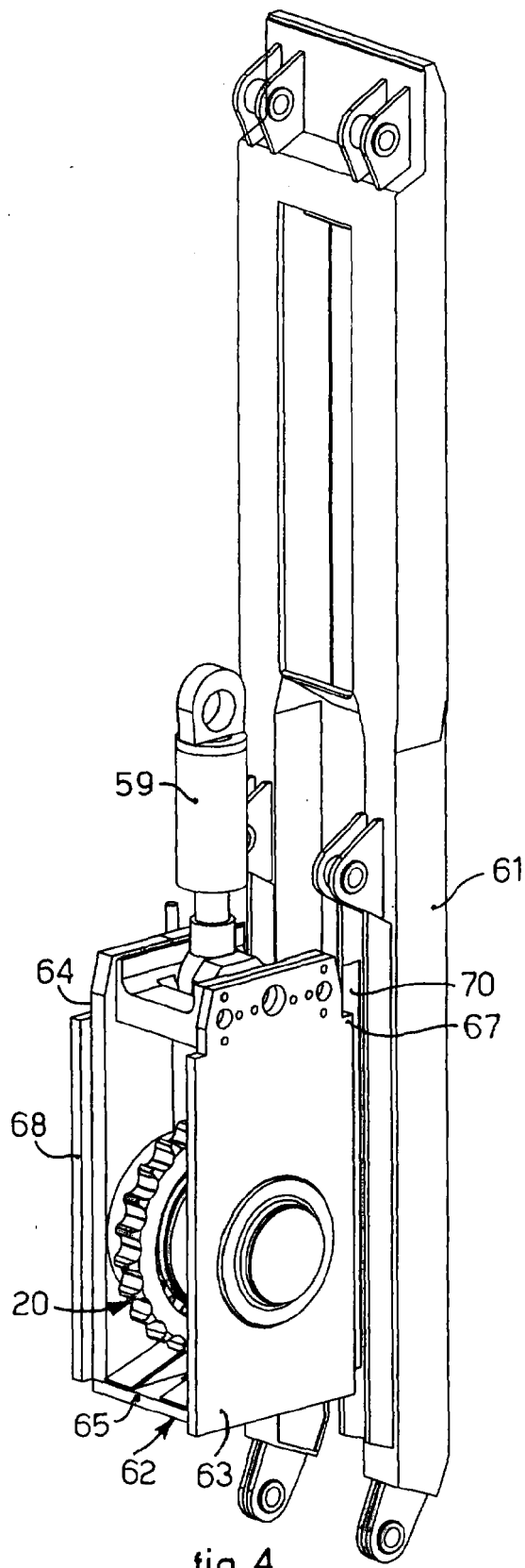


fig. 4

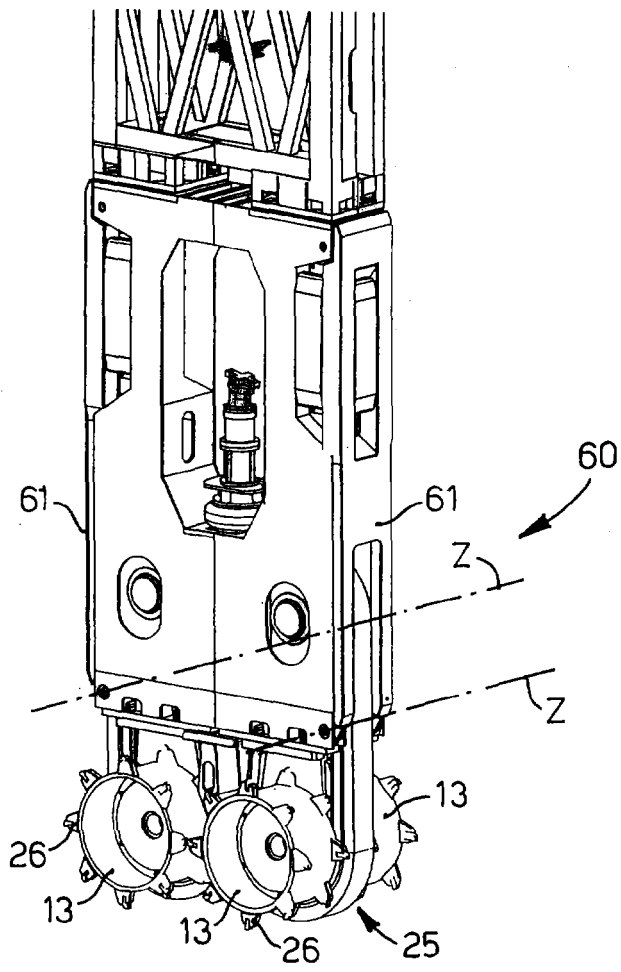


fig.5

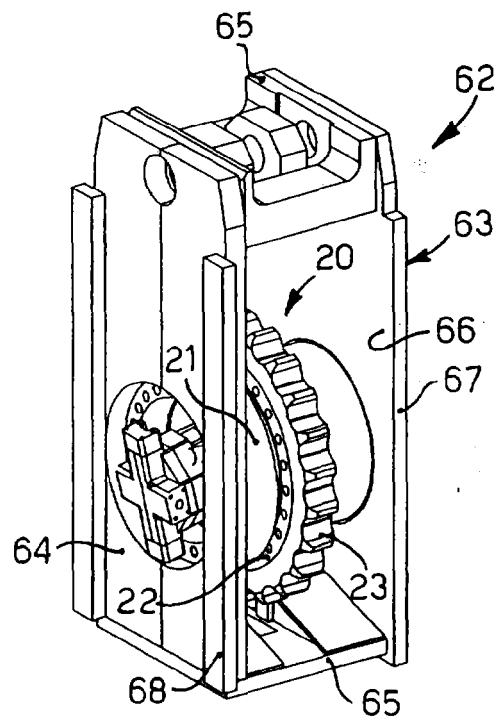


fig.6





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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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