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(54) **PROCEDURE FOR A DESCENDING ASSEMBLY OF ELEVATION SYSTEMS AND A PRE-TENSIONED MAST**

(57) Procedure for the descending assembly in descending spaces, such as pits and parts located below worksite level, of an elevator using bracing devices, characterised in that it comprises a stage of assembly of a top bracing device, a stage of pre-assembly of the sections of an elevator mast, of a rack-and-pinion elevation machine (work platform, transport platform, goods hoist or personnel and goods lift), a stage of assembly of the sections of the mast of the elevator and the elevation system, a stage of anchoring the mast with the top bracing device, one or several stages of installing new bracing devices, and one or several stages of extending the mast, which may be pre-tensioned.

The invention presented provides the main advantage that this procedure can be applied and adapted to descending spaces, working solely from the top part, at worksite level.

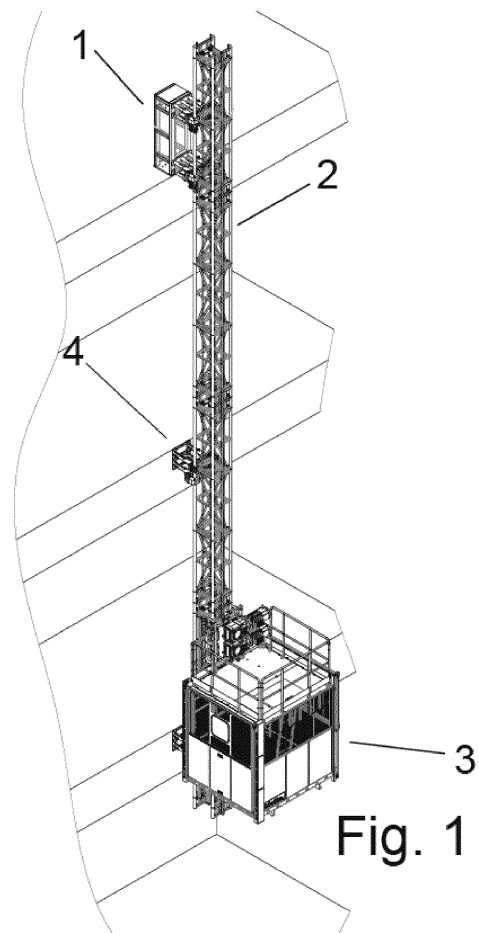


Fig. 1

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Description

[0001] This description relates, as its title indicates, to a procedure for the descending assembly of a rack-and-pinion elevation system that may be equipped with a pre-tensioned mast, of the personnel and goods lift type, goods hoist, transport platform or work platform, used as auxiliary elements to access descending spaces such as pits or any type of worksite where the machine must grow in shape.

[0002] The aforesaid procedure that is the subject matter of this invention comprises a descending installation, with the installation of a bracing device, a step of assembling sections of the elevation system and elevation elements, a step of anchoring the sections of mast and elevation elements, the elevation system at that moment being left in an operative state. When necessary, because of the depth of access required, there is a descending extension phase, which includes adding new mast sections and new bracings and, where appropriate, installing reinforcement profiles. Likewise, when required, due to the load to be moved, the masts are pre-tensioned.

[0003] The subject matter of this invention is also the pre-tensioned mast referred to in the previous paragraph.

Field of the invention

[0004] The invention relates to the field of elevation machinery with rack and pinion technology and to its installation in descending spaces such as pits or any type of worksite in which the machine has to grow downwards.

Current State of the Art

[0005] Until now elevation machinery has been developed to grow "upwards", that is, the mast is supported on the ground and, to extend it, mast sections are placed one on top of the other. Its use on worksites and in constructions is essential for the vertical movement of materials, tools and personnel. References to this type of elevators can be found in patents EP2006234 *"Modular elevator with self-propelled cabin on a mast"*, ES1055692 *"Modular elevator with self-propelled carriage"* and WO2010072848 *"Modular lift with self-propelled cage on support member"*.

[0006] However, when it is necessary to install an elevator in a pit, for example, having to carry out the assembly from the bottom poses a problem, given that access to the pit bottom may be problematic and costly, as well as being dangerous for workers because of the risk of flooding or gases and, indeed, due to the elevation system assembly procedure itself. This makes the use of elevators in pits complicated and economically very costly.

[0007] In many cases, different types of bracing devices are used to secure structures to the pit walls, as described for example, in patents ES0092450 *"Bracing tie for tubular structures"*, ES1050969 *"Perfected bracing*

device for tubular scaffolding" and ES0228761 *"Perfect-ed structure for worksite goods hoist"*, however these bracing devices and the procedures for their use only enable them to be assembled from the bottom of the pit, not allowing any other possibility.

Description of the invention

[0008] The assembly process for descending spaces, such as pits and parts located below the worksite level, differs from the conventional, in that instead of constructing from the bottom up (ascending), construction is carried out top to bottom (descending). Frequently, the length of the mast needs to be extended as the space gets deeper. The procedure for the descending assembly of an elevator that is the subject matter of the present invention, consists of adding sections of mast at the top part so that, by unlocking the bracings, it is possible to lower the whole unit to the height required, by sliding the mast along them. This solution does not require carrying out any operations from the bottom of descending spaces, such as pits and parts located below the worksite level. This invention applies to elevation machinery with rack and pinion technology.

[0009] A first step of the descending assembly process requires installing, at the top level or "0" level, a top bracing that consists of a special structure that is reinforced since it is going to be the main support for the elevator unit. On occasions it supports the total weight of the mast and the set of elevator elements.

[0010] The elevator unit is prepared on the outside. It consists of, at least, a mast or support structure, a base, a traction carriage, and a cabin and, optionally, an enclosure.

[0011] A crane, hoist or similar equipment supports the elevator-mast unit, the top bracing step is initiated by loosening the anchoring systems; once positioned on the top bracing, the elevation system unit is lowered with the crane, hoist or similar to the required position.

[0012] Once in that position, the anchorings of the top bracing are tightened. A second step is the lowering and securing to the wall and mast anchoring of all of the lower bracings that are required for the elevation system to work with the necessary efficacy and safety.

[0013] Until now, lifts and elevators have been developed to grow "upward", that is, the mast is supported on the ground and, to extend it, sections of mast are fitted one on top of the other. In this system the mast elements are made to work under compression.

[0014] On the other hand, in the process for the assembly of an elevator for pits, the mast grows downward, from top to bottom. This means that the mast must be supported by bracings without necessarily having to be supported at the lowest part. It could be considered that the mast "hangs" from the bracings. This means that the mast sections work under traction.

[0015] The mast used is a standard design, calculated to work under compression. Working under traction in

descending spaces such as pits and parts located below worksite level, as is the case in the procedure presented, produces greater forces on the joints of the mast sections than those that are permitted, and can lead to their breakage in the case of certain lengths and loads. In order to overcome this, a solution is proposed for the mast, in which the said mast is assembled in portions and the assembly of each portion is pre-tensioned. This allows the sections of the mast to be pre-compressed so that when installed in the pit, the tensile forces are neutralised, and standard masts can be used.

[0016] The pre-assembly of the sections of the mast of the elevator is carried out by pre-tensioning. It consists of placing a top pre-tensioner and a bottom pre-tensioner between several sections of the mast. Between these two pre-tensioners located at the ends, there are several cables clamped to the bottom pre-tensioner and joined to the top pre-tensioner with thread and nut devices, and the tensioning of the cables is carried out by means of a torque wrench on the thread and nut devices.

[0017] For the first metres of the mast, structural reinforcement profiles can be added with screws all along the sides, that prevent the "pendular" movement of the mast when the machine passes.

[0018] The assembly process for pits that is presented differs from the conventional, as previously mentioned. It is necessary to be able to make the length of the mast grow as the descending spaces, such as pits and parts below worksite level, get deeper. This procedure consists of adding portions of mast at the top part so that, by unlocking the bracings, it is possible to lower the whole unit to the height required, sliding the mast along them with the aid of a crane, hoist or similar. This solution, as in the case of the main assembly, means that no operation has to be carried out from the bottom of the pit.

Advantages of the invention

[0019] This procedure for the descending assembly of an elevator that is presented provides numerous advantages over the devices and procedures currently available, the most important being that it enables the whole process of assembling the elevator to be carried out from the top level of descending spaces such as pits and parts located below the worksite level, without having to carry out any operations from the bottom of the pit.

[0020] Another important advantage of using this assembly procedure is that it enables portions of mast to be added at the top part, so that, by unlocking the bracings, it is possible to lower the whole unit to the height required, sliding the mast along them.

[0021] It is noteworthy that the procedure includes a pre-tensioned assembly of the mast that allows the sections of the mast to be pre-compressed so that when it is installed in descending spaces such as pits and parts located below the worksite level, it can neutralise tensile forces, which allows standard masts to be used.

[0022] It is important to highlight the advantage that

this procedure can be applied and adapted to descending spaces, such as pits and parts located below worksite level, of any depth.

[0023] Another advantage of this invention is that the procedure presented enables the assembly process in the pit to be carried out in precise steps, maintaining safety at all times.

[0024] Another important advantage is that the procedure presented enables the assembly process to be carried out with reduced and economic assembly means.

Description of the figures

[0025] To gain a better understanding of the subject matter of the present invention, the attached drawing shows a practical preferred embodiment of a bracing device used for the procedure for the descending assembly of an elevator, that is the subject matter of the invention.

In the said drawing, figure -1- shows the elevator unit consisting of sections of mast (2) or a support structure, elevation system (3), lower bracings (4) and the top bracing (1)

Figure -2- shows how one or several new mast sections (6) are added using a crane, hoist or similar (5)

Figure -3- show the lower sections of mast (2) with structural reinforcement profiles (10)

Figure -4- shows sections of mast (2) with the pre-tensioning systems

Preferred embodiment of the invention

[0026] An elevator consists of, at least, a mast (2), or support structure, elevation system (3) and optionally, in addition, an enclosure. The mast (2) is anchored to the wall of the descending space by means of lower bracings (4). As previously described, the top bracing (1) has, preferably, a reinforced lattice structure and several clamping plates so that it can, from time to time, withstand the weight of the mast (2) complete with the set of elements of the elevator

[0027] A top bracing device (1) as described previously (or another of a similar configuration or operation) enables a characteristic procedure for the descending assembly of an elevator to be carried out, which, being the subject matter of this invention, comprises:

- a stage of assembly of the top bracing device (1),
- a stage of pre-assembly of the sections of the mast (2) of the elevator, elevation system (3),
- a stage of assembly of the sections of the mast (2) of the elevator, elevation system (3) on the top bracing (1),
- a stage of anchoring the mast (2) with the top bracing device (1),

- one or several stages of installing lower bracing devices (4), and/or one or several stages of extending the mast (2).

[0028] The stage of assembly of the top bracing device (1) comprises:

- A step of positioning the top bracing (1), on the ground of the top part of the worksite, and
- A step of anchoring the top bracing (1), on the ground of the top part of the worksite.

[0029] The stage of pre-assembly of the sections of the mast (2) of the elevator comprises

- a step of assembly of the different sections that form the first portion of masts (2),
- a step of screwing the mast (2) set to the machine and, optionally, also the assembly of the enclosure.
- a step of assembly of the structural reinforcement profiles with screws all along the sides of the first metres of the mast (2), optionally, if required, depending on the application.

[0030] Several sections of mast (2) must be joined together depending on the length that is required.

[0031] The enclosure is optional at this point since, depending on the worksite, the enclosure (19) may be installed at the bottom of the pit, in which case the enclosure is installed later, or anchored to the base, which involves installing it at that stage.

[0032] Optionally, the assembly step of the different sections that form the mast (2) in the pre-assembly stage of the sections of the mast (2) of the elevator, is carried out by pre-tensioning and, in turn, comprises:

- a first sub-step of fitting a top pre-tensioner (7) and a bottom pre-tensioner (8) between several sections of the mast (2),
- a second sub-step of joining these pre-tensioners (7,8) together with several cables (9) clamped to the bottom pre-tensioner (8) and joined to the top pre-tensioner (7) with thread and nut devices (11), and
- a third sub-step of tensioning the cables (9) by means of a torque wrench on the thread and nut devices (11).

[0033] The mast (2) used is a standard design, calculated to work under compression. Working under traction in pits, as is the case in the procedure presented, produces greater forces on the joints of sections of the mast (2) than those permitted, and can lead to their breakage depending on the lengths and loads. To avoid this, pre-tensioned assembly is carried out. This enables the sections of mast (2) to be pre-compressed so that when installed in the descending space, the tensile forces can be neutralised, and greater depths can be achieved.

[0034] Excessive displacement of the mast (2) in this

case requires having to fit, on the first metres of the mast (2), that is, on the part of the installation that will be located lowest and that may only be anchored at the top part, structural profiles (10) to prevent its curvature. Experimental tests have shown that it is particularly effective on the first metres; it will not be necessary on the rest of the mast (2), as it is braced at the top and bottom. Experimental tests carried out allow to conclude that the structural profiles greatly reduce curvature on these first metres. These structural profiles must be fitted using screws and/or flanges or plates all along the sides of the mast (2).

[0035] The stage of assembly of the sections of the mast (2) of the elevator, the elevation system (3) in the descending space comprises:

- a step of transporting the unit mounted in the previous step, formed by the mast (2), the base, the tractor carriage and the cabin and, optionally, in addition, the enclosure, using the crane to position it vertically in relation to the pit, making it coincide with the locking flanges of the top bracing (1), and
- the unit is lowered until it reaches the lower level.

[0036] It is important to highlight that in this part of the process, the whole unit is supported solely by the top bracing (1).

[0037] The stage of extending the mast (2), with top bracing (1) comprises:

- a step of loosening, from the elevation system (3), the lower bracing (4) furthest down, keeping the means for varying the width and the means for varying the separation of the locking flanges of the top bracing (1) tightened,
- the previous step is repeated as many times as necessary for each of the lower bracings (4) installed, except for the top one,
- a step of assembly of the new sections to add to the mast (2) already installed,
- an assembly step, using the crane, hoist or similar, of the new section at the top of the mast (2) already installed in the pit, both parts being joined together outside, and the whole unit being supported by the crane.
- a step of loosening the top bracing (1) until it does not anchor but it does guide,
- a step of lowering the mast (2) and the rest of its associated elements, by means of the crane, hoist or similar (5), to the required depth,
- the ascent of the tractor carriage and its cabin along the mast (2) to the ground level of the worksite,
- a step of tightening the top bracing (1) until locked,
- a step of releasing the crane from the mast (2), tractor carriage and cabin (3) unit,
- a step in which, as the operators descend, they tighten the means for varying the width and the means for varying the separation of the locking flanges on

the rest of the lower bracings (4), in descending order.

[0038] Optionally, as previously described, the step of assembly of the new section, to add to the mast (2) already installed, in the pre-assembly stage of the sections of the mast (2) of the elevator, is carried out by means of pre-tensioning and comprises:

- a first sub-step of fitting a top pre-tensioner (7) and a bottom pre-tensioner (8) between several sections of the mast (2),
- a second sub-step of joining these pre-tensioners (7,8) together with several cables (9) clamped to the bottom pre-tensioner (8) and joined to the top pre-tensioner (7) with thread and nut devices (11), and
- a third sub-step of tensioning the cables (9) by means of a torque wrench on the thread and nut devices (11).

[0039] Normally, several sections of mast (2) must be joined together depending on the desired length to be extended.

[0040] A person skilled in the art will easily comprehend that the characteristics of different embodiments can be combined with the characteristics of other possible embodiments, provided that the combination is technically possible.

[0041] All of the information referring to examples or embodiments form part of the description of the invention.

Claims

1. Procedure for the descending assembly of elevation systems (3) and pre-tensioned mast (2), **characterised in that** it comprises the following phases:

- Initial descending installation, in turn comprising

- a. a step of assembling a top bracing device (1) for anchoring a mast (2) of the elevation system (3), allowing the sliding of the sections of the mast (2), once the anchoring system is released,
- b. a step of assembling the sections of the mast (2) of the elevation system, and of the elevation elements of the system,
- c. a step of anchoring the sections of the mast (2) with the top bracing device (1) and the elevation elements of the system with the mast, the elevation system at that moment being left operative.

- Descending extension, carried out as many times as necessary, for the descent of the elevation system to the position/positions required,

in turn comprising

- a. a step of loosening the anchorings of all of the lower bracings (4) that have been installed, with the sections of the mast (2) facilitating the sliding of the masts (2), the weight of the whole elevation system and the masts (2) being supported by the top bracing (1),
- b. a step of adding the required number of new masts sections (6) at the top of the existing portion of masts (2) by means of a crane, hoist or similar (5), so that, once joined, the crane, hoist or similar (5) does not permit their descent once the first top bracing is released,
- c. a step of loosening the anchorings of the top bracing (1) with the section of mast (2) so that all the elevation system is supported by the crane, hoist or similar,
- d. a step of lowering of the elevation system unit by means of the crane, hoist or similar (5) to the position required, sliding the system along the top bracing (1) and the lower bracings (4) that may be mounted,
- e. a step of anchoring the first top bracing (1) with the mast section (6),
- f. a step of separating the crane, hoist or similar (5) so that the whole system is supported by the top bracing (1),
- g. a step of anchoring the lower bracings (4) that may be mounted, so that the system is operative again.

- Installation of lower bracings (4), descending to the position required by the operation
- Fitting of one or several profiles (10) for reinforcing the said structure of masts to limit the pendular movement of the end masts of the portion of masts (2) that are free at the bottom end,

2. Procedure for the descending assembly of elevation systems (3) and pre-tensioned mast (2), according to claim 1, wherein, to neutralise the tensile loads on the mast (2), the masts (2) are pre-tensioned by means of:

- The fitting a top pre-tensioner (7) and a bottom pre-tensioner (8) between one or several sections of the mast (2)
- The joining together of these pre-tensioners (7, 8) with one or several cables (9)
- The tensioning of the cables (9) to the calculated tension that causes the masts to work under traction.

3. Procedure for the descending assembly of elevation systems (3) and pre-tensioned mast (2), according

to claim 1, wherein the elevation system (3) is used to install lower bracings (4).

4. Procedure for the descending assembly of elevation systems (3) and pre-tensioned mast (2), according to claim 1, wherein external systems such as baskets or platforms are used to install lower bracings (4). 5
5. Pre-tensioned mast for elevator, wherein it comprises a top pre-tensioner (7) and a bottom pre-tensioner (8) between several sections of the mast, cables (9) clamped to the bottom pre-tensioner (8) and joined to the top pre-tensioner (7) with thread and nut devices (11), the said cables (9) being able to be tensioned by means of a torque wrench. 10 15

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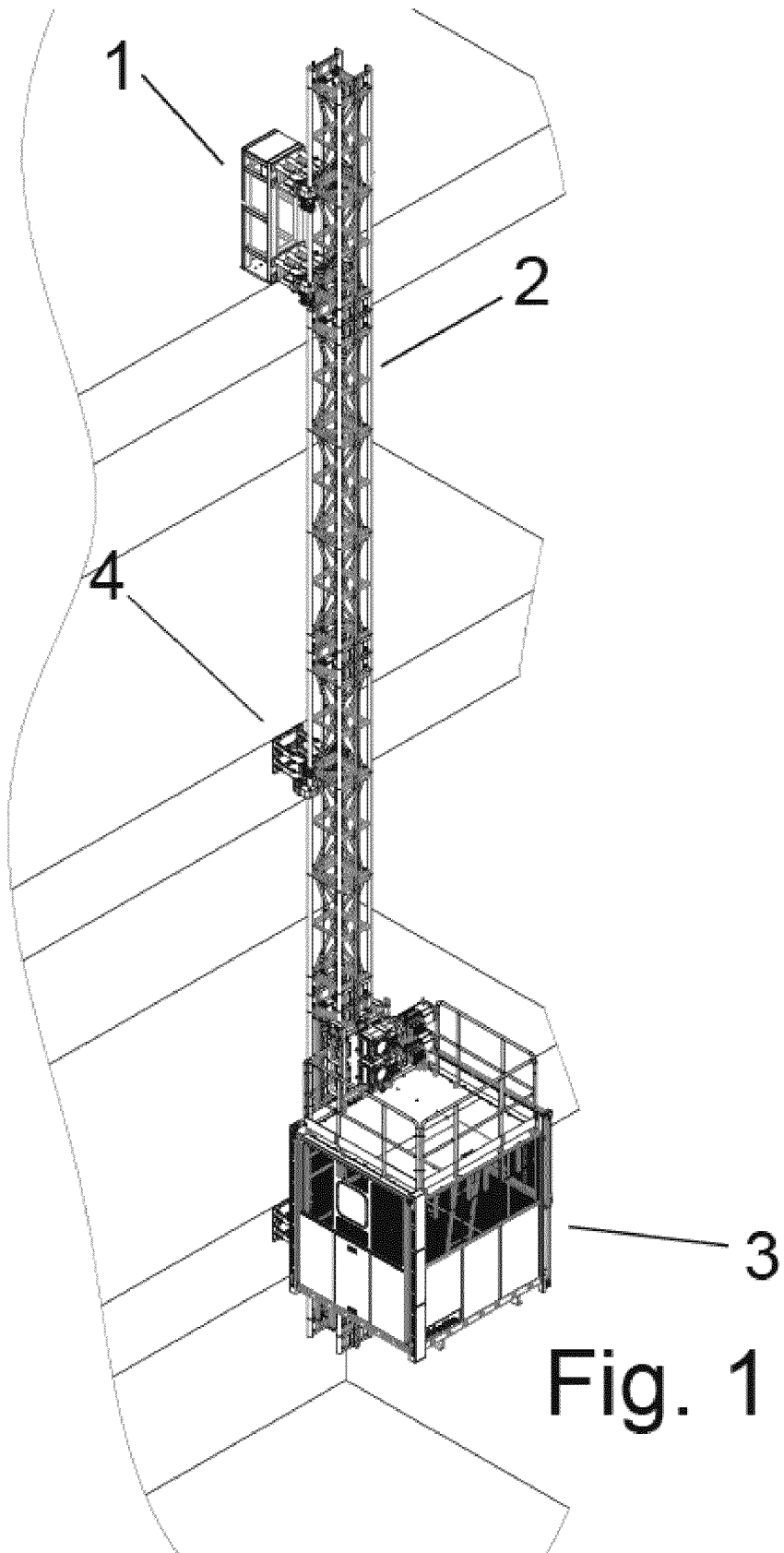
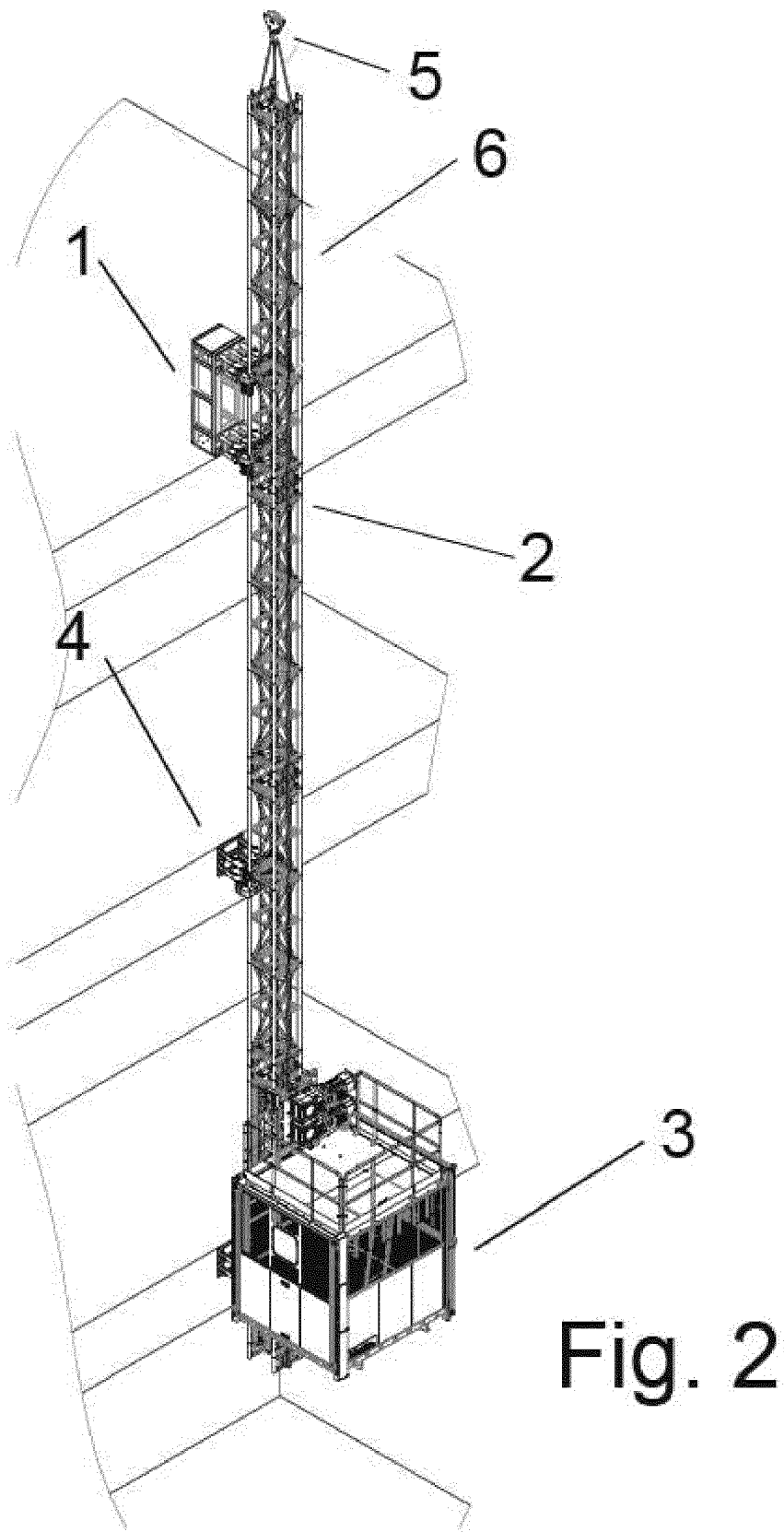


Fig. 1



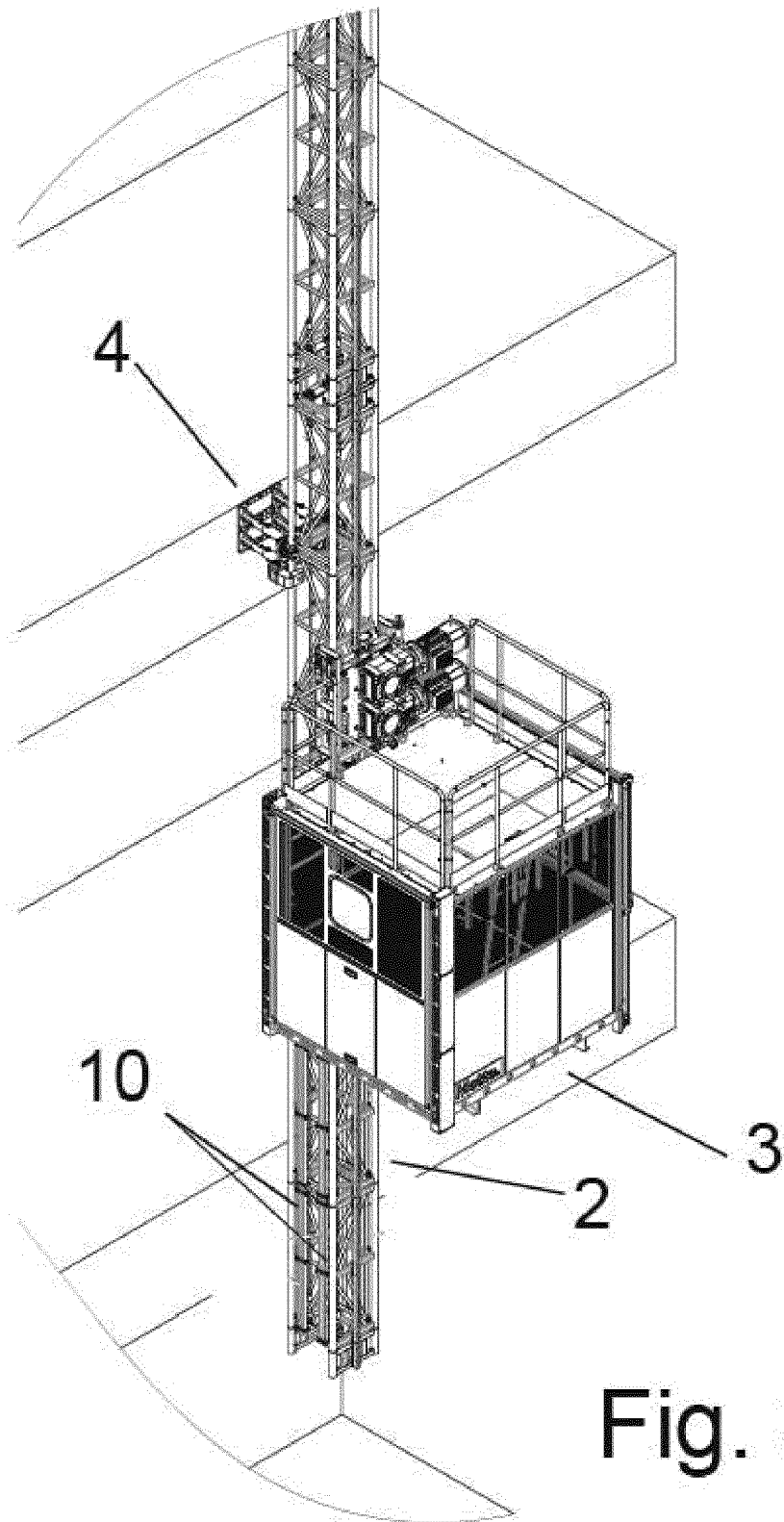


Fig. 3

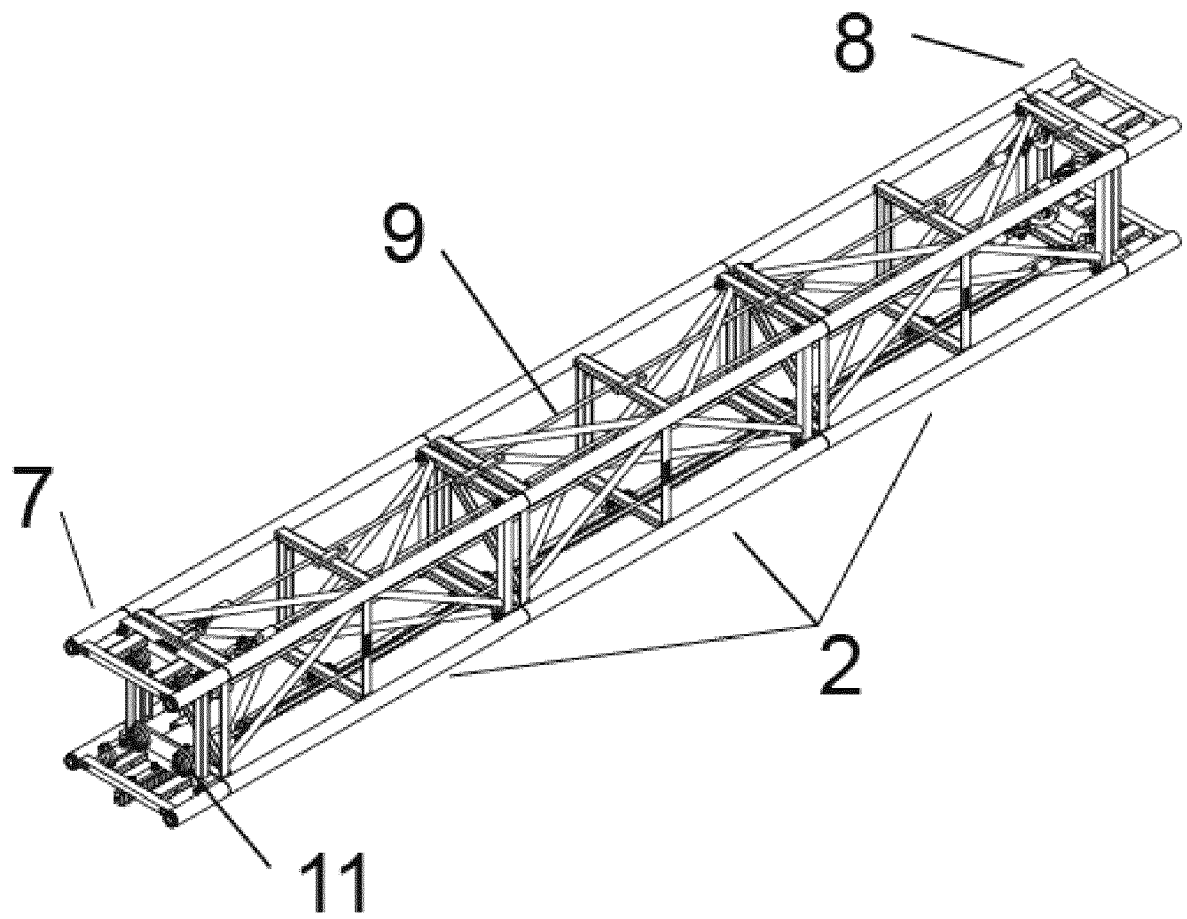


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 20 20 4161

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	SU 583 075 A1 (SP K BYURO SKB MOSSTROJ [SU]) 5 December 1977 (1977-12-05)	5	INV. B66B9/187 B66B19/00
A	* figures 1, 2 *	1-4	
X	WO 2009/033287 A1 (TEBERAH JOSEPH [CA]) 19 March 2009 (2009-03-19)	5	
A	* figure 1 *	1-4	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B66B
Place of search		Date of completion of the search	Examiner
The Hague		12 March 2021	Szován, Levente
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 20 4161

5 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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12-03-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SU 583075	A1	05-12-1977	NONE
WO 2009033287	A1	19-03-2009	CA 2602739 A1 14-03-2009
		US 2012018253 A1 26-01-2012	
		WO 2009033287 A1 19-03-2009	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2006234 A [0005]
- ES 1055692 [0005]
- WO 2010072848 A [0005]
- ES 0092450 [0007]
- ES 1050969 [0007]
- ES 0228761 [0007]