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(54) **A method for assembling a modular lift apparatus, a method for de-assembling a modular lift apparatus, and a modular lift apparatus**

(57) The invention relates to a method for assembling a modular lift apparatus. The method comprises the step of placing a first lift shaft module including a lift shaft part and lift guiding means for guiding a lift car. Further, the invention comprises the steps of providing a lift car in the lift module, placing a second lift module on top of the first lift module, the second lift module also including a lift

shaft part and lift guiding means, the lift shaft parts of the modules forming a continuous lift shaft section, and securing the second lift module to the first lift module by an assembler person using the roof of the lift car as a working platform. Further, the invention relates to a method for de-assembling a modular lift apparatus. Furthermore, the invention relates to a modular lift apparatus.

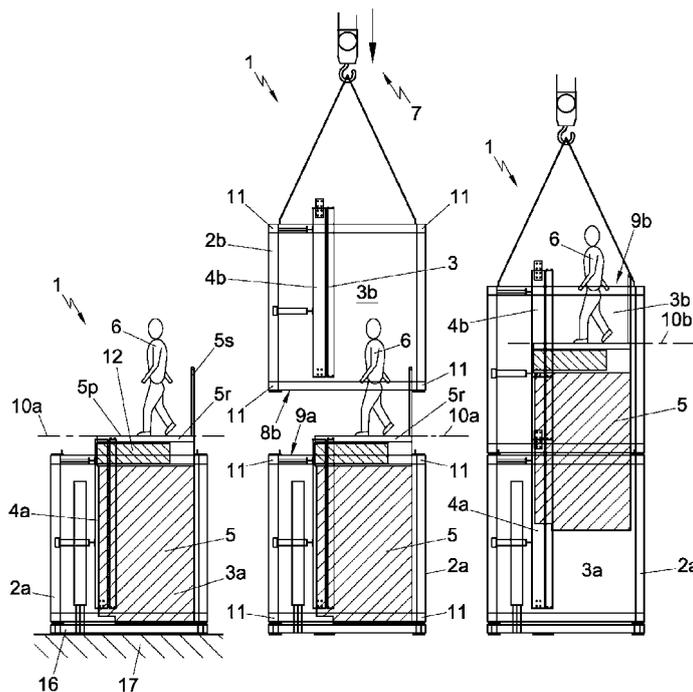


Fig. 1a

Description

[0001] The invention relates to a method for assembling a modular lift apparatus.

[0002] When constructing new buildings, or reconstructing, maintaining or renovating buildings, access to stores, and dwellings, businesses and other living areas located thereon becomes difficult if not impossible via existing staircases, lifts and the like. This may be because they have been closed off for maintenance or alteration, or are not yet or not yet fully operational. In such cases, a modular lift apparatus may be erected next to the respective building, with which persons and goods can be moved along the outside of the building. However, it is no sinecure to assemble a modular apparatus in a relatively simple, convenient, cheap and safe manner. For example, it may be hard for an assembler person to climb a ladder while carrying a lot of heavy assembling tools with him/her.

[0003] It is an object of the invention to provide a method for assembling a modular lift apparatus, with which at least one of the drawbacks mentioned or other drawbacks is/are counteracted. In particular, it is an object of the invention, to provide a relatively simple method for assembling a modular lift apparatus.

[0004] Thereto, the method for assembling a modular lift apparatus comprises the steps of: placing a first lift shaft module including a lift shaft part and lift guiding means for guiding a lift car, providing a lift car in the lift module, placing a second lift module on top of the first lift module, the second lift module also including a lift shaft part and lift guiding means, the lift shaft parts of the modules forming a continuous lift shaft section, and securing the second lift module to the first lift module by an assembler person using the roof of the lift car as a working platform.

[0005] By using the roof of the lift car as a working platform the need of using a relatively complex and/or expensive, separate working platform or a ladder or other relatively difficult, intractable and/or unsafe, temporary climbing device becomes superfluous. Thereby, the invention provides a relatively simple method for assembling a modular lift apparatus. Further, the method according to the invention is also relatively convenient, cheap and safe.

[0006] An additional advantage of using the roof of the lift car as a working platform may be that a relatively large working platform can be provided.

[0007] Therefore, relatively much space may be available for temporarily placing lift parts, spare parts, tools and/or assembling material. Besides, relatively much space may be available for providing relatively a lot of relatively neat working space.

[0008] A further additional advantage of using the roof of the lift car as a working platform may be that a height adjustable working platform can be provided which can not only be used for securing lift modules to each other, but which may also be used for e.g. providing, connect-

ing, adjusting and/or tuning the guiding means, and/or other means, preferably provided inside the lift apparatus, such as power cables.

[0009] Advantageously, the method may further comprise the step of raising the lift car to a working level. Preferably, at least one of the guiding means included in at least one of the lift modules can be used to guide the lift car during the raising of the lift car.

[0010] By raising the lift car to a working level, the working platform can temporarily be located at a desired height level.

[0011] The lift car may be raised to the working level using a separate hoisting apparatus, e.g. a hoisting crane such as a mobile hoisting crane. By using a separate hoisting apparatus it is not required that electrical power is available for the modular lift apparatus since the energy that is required for raising the lift car is delivered by the separate hoisting apparatus. Similarly, by using a separate hoisting apparatus that is an independent unit, preferably not connected to the modular lift apparatus, the process of adjusting the height of the lift car - and therewith adjusting the height of the working platform - is executed separately from other assembling activities of the modular lift apparatus, thereby rendering the assembling process more efficient.

[0012] Alternatively, the lift car can be raised to the working level using a driving mechanism provided on the modular lift apparatus. For example, the driving mechanism is provided in at least one of the lift shaft sections. An advantage of using the driving mechanism provided in at least one of the lift shaft sections may be that the height level of the lift car, and thus the working level at which the working platform is temporarily provided, can relatively easily be adjusted, even during the placing of one lift module on top of an other lift module. Preferably, the lift car is driven with the aid of a toothed rack driving technique.

[0013] Advantageously, the lift car may be raised by driving a driving mechanism provided on the lift car, the driving mechanism including at least one gear wheel cooperating with a toothed rack extending in the continuous lift shaft section. The toothed rack may be comprised along a rail part.

[0014] By providing the driving mechanism on the lift car, the height of the lift car, and therefore also the height of the working platform can be set autonomously, without any interaction with separate supporting and/or stabilizing elements. Such a modular lift apparatus can in principle be assembled and/or de-assembled free from surrounding structures such as walls and floors surrounding a vertical space wherein an elevator system is to be constructed. Due to the ability of autonomously adjusting the height of the working platform, the modular lift apparatus can, according to an aspect of the invention, be assembled outside an existing building, and even remote from such buildings.

[0015] It is noted that American patent publication US 2004/0154870 discloses a mechanical system including

a rail-climbing platform for erecting modular rail sections of an elevator.

[0016] It is also noted that Japanese patent publications JP 11209026 and JP 11209027 disclose an elevator that is built up using an internal hoist equipment.

[0017] It is further noted that American patent publication US 4 231 148 discloses an elevator system wherein the elevator car can be raised to a certain height to permit workmen to enter the pit for assembling activities.

[0018] Additionally it is noted that the Australian patent publication AU 57086/90 discloses a method of constructing a lift shaft wherein a machine unit can be raised to a new desired level.

[0019] In order to move persons and/or goods up and/or down, after finishing the assembling of the modular lift apparatus, the lift car may be driven by the same driving mechanism provided on the modular lift apparatus, e.g. the driving mechanism provided on the lift car, such as a toothed rack driving mechanism. Alternatively or additionally, during normal use of the lift apparatus, i.e. after the assembling has finished, an alternative driving mechanism may be used for driving the lift car up and/or down. Therefore, the modular lift apparatus may, for instance, be provided with a cable-born driving mechanism or with a telescoping driving mechanism.

[0020] As an alternative to raising the lift car to the working level prior to securing the second lift module to the first module, the lift car is not raised prior to the securing step. For example, the lift car may be provided at an upper part of the lift shaft part of the first module. Then, the top of the lift car may already be located at the desired working level. Especially when the first module is relatively low, e.g. substantially the same height as the lift car provided in it, probably there is no desire to raise the lift car prior to securing the modules to each other.

[0021] In an advantageous embodiment of the method according to the invention, the method comprises the steps of: placing a further lift module on top of an earlier placed lift module, raising the lift car to a further working level, and securing the further lift module to the earlier placed lift module by an assembler person using the roof of the lift car as a working platform.

[0022] If a separate hoisting apparatus is used for raising the lift car to the further working level, the same hoisting apparatus may firstly, subsequently or simultaneously be used for hoisting the further lift shaft module on top of the earlier placed lift shaft module.

[0023] The invention also relates to a method for disassembling a modular lift apparatus.

[0024] Furthermore, the invention relates to a modular lift apparatus.

[0025] Other advantageous embodiments according to the invention are described in the following claims.

[0026] By way of example only, embodiments of the present invention will now be described with reference to the accompanying figures in which

and third state of a first embodiment of a modular lift apparatus during assembling according to the invention;

Fig. 1b shows a schematic view of a fourth, fifth, sixth and seventh state of the apparatus of Fig. 1a during assembling;

Fig. 2 shows a schematic view of a first and second state of a second embodiment of a modular lift apparatus during assembling according to the invention;

Fig. 3 shows a schematic view of a first, second, third and fourth state of a third embodiment of a modular lift apparatus during assembling according to the invention;

Fig. 4 shows a flowchart of an embodiment of an assembling method according to the invention; and Fig. 5 shows a flowchart of an embodiment of a disassembling method according to the invention.

[0027] It is noted that the figures show merely preferred embodiments according to the invention. In the figures, the same reference numbers refer to equal or corresponding parts.

[0028] Figure 1a shows a schematic view of a first, second and third state of a first embodiment of a modular lift apparatus 1 during assembling according to the invention. Further, Figure 1b shows a schematic view of a fourth, fifth, sixth and seventh state of the apparatus during assembling. The method of assembling a modular lift apparatus 1 includes placing a first lift shaft module 2a, e.g. on a temporary foundation, such as a base plate 16, or directly on solid ground 17. As shown in the left hand side of Fig. 1a illustrating the first state, the first lift shaft module 2a includes a lift shaft part 3a and lift guiding means 4a for guiding a lift car 5. The lift guiding means 4a may include guiding rails. Further, the left hand side of Fig. 1 shows that a lift car 5 is provided in the lift shaft module 2a. For example, the lift car 5 is provided before the first lift shaft module 2a is placed. Alternatively, the lift car 5 is provided after the first module 2a is placed.

[0029] The roof 5r of the lift car 5 forms a working platform 5p. Here, the platform 5p is provided with a security railing 5s for counteracting that an assembler person 6 falls down from the working platform 5p. Preferably, the railing is collapsible and/or releasably connectible to the lift car 5. The lift car is at a working level 10a.

[0030] The middle side of Figure 1a illustrating the second state, shows that a second lift module 2b is placed on top of the first lift shaft module 2a, e.g. by using a hoisting crane 7. The second lift shaft module 2b also includes a lift shaft part 3b and lift guiding means 4b. The lift shaft parts 3a, 3b of the modules 2a, 2b form a continuous lift shaft section 3a, 3b.

[0031] The second lift module 2b is secured to the first lift module 2a by an assembler person 6 using the roof 5r of the lift car 5 as a working platform 5p.

[0032] In the shown embodiment the lift car 5 has substantially the same height as the first lift module 2a. How-

Fig. 1a shows a schematic view of a first, second

ever, the lift car can have a substantially different height than the first module, e.g. the module may be, for instance, two or five times higher than the lift car.

[0033] As illustrated in the middle part of Fig. 1a, the assembler person 6 may secure the first and second lift modules to each other, e.g. by connecting a bottom part 8b of the second shaft module 2b to a top part 9a of the first module 2a. Advantageously, the modules are substantially cuboid-shaped. Preferably, at least one of the corners of at least one of the modules 2, and more preferably all eight corners of it is/are provided with means 11 for stacking, connecting, locking and/or craning the module(s) 2, such as a "twistlock" fitting 11.

[0034] Until now, the lift car has not been raised yet. The assembler person 6, also called a worker 6, is located on top of the car and can guide the module 2b to be placed and/or can give instructions to another worker, e.g. a crane machinist.

[0035] After the worker 6 has secured the first module to the second module, the lift car 5 may be raised to a second working level 10b.

[0036] Advantageously, the lift car 5 is raised to the second working level 10b using a driving mechanism 12 provided on the modular lift apparatus 1. Preferably, said mechanism is suitable to be operated by a worker 6 being located in or on the apparatus, e.g. on the working platform 5p.

[0037] Here, the lift car 5 is raised by driving a driving mechanism 12 provided on the lift car 5, the driving mechanism including at least one gear wheel cooperating with a toothed rack 13 extending in the continuous lift shaft section 3. The toothed rack driving mechanism may also provide a means for temporarily securing the lift car. Additionally or alternatively, other means for temporarily securing the lift car 5 may be comprised in the lift apparatus 1.

[0038] Alternatively, another mechanism for raising the lift car during assembling and/or de-assembling is provided on the modular lift apparatus 1. For example, at least one of the modules is at least during assembling and/or de-assembling of the modular lift apparatus 1 provided with a hoist device, e.g. an overhead crane or hoisting tackle, preferably provided near an upper region 20 of the module. The hoist device may be detachable from the module and/or may be movable connected to the module. Therefore, after temporarily securing the raised lift car, the hoist device may be detached and can e.g. be re-used in another module, and/or the hoist device can be (e.g. horizontally) moved in order to make room for the lift car which - at a later stage - may be raised beyond the initial position of said hoisting means.

[0039] As yet another alternative, the lift car 5 is raised to the second working level 10b using a separate hoisting apparatus 7. For example, the separate hoisting apparatus 7 may be a hoisting crane 7, e.g. the same crane which subsequently may be used for placing the second module 2b on top of the first module 2a.

[0040] Preferably, the lift car is temporarily secured af-

ter raising it to the desired working level 10a, in order to make it possible that the hoisting apparatus 7 releases the lift car 5, without dropping the lift car 5. Therefore, securing means may be provided in at least one of the lift shaft parts and/or on the lift car.

[0041] The right hand side of Fig. 1a shows the third stage during assembling. Here, the worker 6 on top of the temporarily secured lift car can release the second module 2b from the crane.

[0042] The left hand side of Fig. 1b shows the fourth state of the apparatus 1 during assembling. Here, a further lift shaft module 2c is being placed on top of an earlier placed lift module, e.g. the second lift shaft module 2b.

[0043] Again, the further lift shaft module 2c may be secured to the earlier placed lift shaft module 2b by an assembler person 6 using the roof of the lift car as a working platform.

[0044] The left hand side in the middle of Fig. 1b shows the fifth state during assembling. Here, the lift car 5 is being raised to a further working level 10c. During the raising of the lift car, the worker may be on top of the lift car 5. Alternatively, the worker 6 may be in the lift car or may be located at a distance from the already placed module(s) of the modular lift apparatus 1. For example, at least one of the modules may be provided with a ladder and/or a stairwell, which may enable the worker to leave the lift apparatus temporarily and to climb back when desired.

[0045] The right hand side in the middle of Fig. 1b shows the sixth state during assembling. Yet a further lift module 2d is placed on top of the already placed lift shaft modules 2a, 2b, 2c. Here, the further lift shaft module 2d comprises a roof part 14. According to an aspect of the invention, the modular lift apparatus may include an additional driving mechanism for driving the lift car. In the shown embodiment, the further lift shaft module 2d comprises the additional driving mechanism 15 for driving the lift car during normal use of the apparatus 1.

[0046] The right hand side of Fig. 1b shows the seventh state during assembling. Here, the assembling is finished. The modular lift apparatus 1 comprises a multiple number of lift shaft modules 2a, 2b, 2c, 2d placed on top of each other, and a lift car 5, each module including a lift shaft part 3a, 3b, 3c, 3d and lift guiding means 4 for guiding the lift car 5 in a continuous lift shaft 3 formed by the lift shaft parts 3a, 3b, 3c, 3d, wherein the lift car 5 is provided with a driving mechanism 12 for moving the car in the continuous lift shaft, the driving mechanism including at least one gear wheel cooperating with a toothed rack 13 extending in the continuous lift shaft 3, and wherein the modular lift apparatus 1 further comprises an additional driving mechanism 15 for moving the car 5 in the continuous lift shaft 3.

[0047] By providing both a gear wheel / toothed rack driving mechanism 12 and an additional driving mechanism 15, a modular lift apparatus 1 may be provided that benefits from specific advantages of the driving mechanisms. During assembling and/or de-assembling, the

gear wheel / toothed rack driving mechanism 12 is used for driving the lift car. This is advantageous, since the additional driving mechanism 15 might not be able to operate properly during assembling / de-assembling. Further, during normal use of the lift apparatus, the additional driving mechanism 15 can be used for driving the lift car. The additional driving mechanism might be optimized for driving the lift car over a relatively long period, e.g. in terms of energy or comfort.

[0048] Advantageously, the additional driving mechanism 15 includes a hoisting mechanism. The hoisting mechanism may be more silent in use than a toothed rack driving mechanism, which may be used as the first driving mechanism 12 dedicated to drive the car during assembling / de-assembling.

[0049] It is noted that the apparatus 1 may comprise similar modules 2 of similar design and/or with similar dimensions, such as similar heights. Alternatively or additionally, the apparatus 1 may comprise modules of different design, e.g. modules with different heights. Furthermore, different lift shaft modules may be arranged for performing different functions. For example, one or a multiple number of the lift shaft modules may be provided with one or multiple number of, preferably height adjustable, doors. Further, it is noted that one or a multiple number of the modules 2 may be so-called intermediate modules or intermediate rings, being arranged to provide a proper spacing between a module beneath and a module above it.

[0050] Figure 2 shows a schematic view of a first and second state of a second embodiment of the modular lift apparatus 1 during assembling according to the invention. The modular lift apparatus 1 is now provided with a single driving mechanism for moving the car, e.g. a hoisting mechanism that is installed after all lift shaft modules have been placed and secured. During the first state, see the left hand side of Fig. 2, the lift car 5 is raised to a first working level 10a by a hoisting apparatus 7. Preferably, the lift car 5 is raised to the working level 10a prior to the placement of the second lift shaft module 2b on top of the first one 2a. In that case, the assembler person 6 can facilitate the placing of the second shaft module 2b. Here, the car 5 is temporarily secured at the desired height of the first working level 10a. A part of a frame element 18, such as a beam 18, and/or a part of a side panel 19, located at an upper region 20 of a module 2, may serve as a means for e.g. protecting the worker 6 from falling down from the platform 5p.

[0051] During the second state, see the right hand side of Fig. 2, the hoisting apparatus 7 places the second module 2b on top of the first module 2a. Further assembling steps are similar as discussed in relation with Fig. 1a,b.

[0052] When de-assembling the modular lift apparatus 1, the steps are performed in reverse order.

[0053] Figure 3 shows a schematic view of a first, second, third and fourth state of a third embodiment of a modular lift apparatus 1 during assembling according to the invention. During a first state, see the left side of Fig.

3, the second lift shaft module 2b is placed on top of the first one 2a, using module hoisting means 7a provided at the hoisting crane 7. Here, the crane 7 is further provided with a lift car hoisting means 7b, or so called forerunner 7b. At least partly before, at least partly while, and/or at least partly after the assembler person 6 secured the first 2a and second 2b modules to each other, see the second state shown on the left hand side in the middle of Fig. 3, the forerunner 7b can be connected to the lift car 5. Here, the roof 5r of the lift car 5 is provided with a forerunner connecting means 5x, to which a hook 7b' of the forerunner 7b can be connected. After the modules are connected to each other, see the third state shown on the right hand side in the middle of Fig. 3, the crane 7 can lift the car 5 to the second working level 10b, see the fourth state shown on the right side of Fig. 3, where the worker 6 can uncouple the module hoisting means 7a, which preferably are slacked to facilitate their uncoupling. It is noted that the module hoisting means 7a and/or the lift car hoisting means 7b may be provided with means (e.g. a motorized pulley) for slacking and/or stretching the distinct hoisting means, preferably independently of each other.

[0054] Advantageously, the raised lift car 5b may be temporarily secured to one of the modules prior to uncoupling the module hoisting means 7a from the second module 2b. Alternatively, the crane may keep the raised lift car 5b at the desired height, e.g. using the forerunner 7b, during uncoupling the module hoisting means 7a from the second module 2b.

[0055] Subsequently, in case the raised lift car 5b is temporally secured, the forerunner 7b may be uncoupled from the car 5b. Then, in a similar (not shown) way a further module can be lifted on top of the second module.

[0056] Alternatively, e.g. in case the raised lift car 5b is not temporally secured, the lift car 5b can be lowered to a rest position 5a in which the lift car can be safely uncoupled from the hoisting crane, e.g. a position where in the car 5 rests on the foundation 16 or on the ground 17. Subsequently, the car can be uncoupled, after which a (not shown) third module may be lifted above the second module 2b. Then, the forerunner (which then may run through the modules) can be attached to the lift car. Therefore, the lift car may subsequently be raised to the third working level by the hoisting apparatus 7, at which level the worker may facilitate placement of the third module 2c and/or can (subsequently) secure said third module 2c to the second one 2b.

[0057] It is noted that at least one lift shaft module, e.g. a module comprising a roof part 14, may comprise at least one opening allowing the forerunner 7b to pass, for instance, a sealable or lockable opening, e.g. being provided with a hatch.

[0058] Further, it is noted that the worker does not need to stay on top of the lift car during the (de-)assembly. For example, the worker 6 may temporarily stay inside the lift car 5, for instance during raising of the lift car, and/or the worker 6 may leave the lift car, for instance by climbing

down additionally provided steps 21, preferably provided inside the modules.

[0059] Figure 4 shows a flowchart of an embodiment of an assembling method 100 according to the invention.

[0060] The method 100 for assembling a modular lift apparatus comprises a step of placing 110 a first lift shaft module including a lift shaft part and lift guiding means for guiding a lift car, a step of providing 120 a lift car in the lift module, a step of placing 130 a second lift module on top of the first lift module, the second lift module also including a lift shaft part and lift guiding means, the lift shaft parts of the modules forming a continuous lift shaft section, and a step of securing 140 the second lift module to the first lift module by an assembler person using the roof of the lift car as a working platform.

[0061] It is noted that some of the method steps 110, 120, 130, 140 may in principle be executed in another order than the order presented above. As an example, the lift car can be provided in the lift module before or after placing the first lift module. Further, a single or a multiple number of the steps may be executed at least partly simultaneously.

[0062] Figure 5 shows a flowchart of an embodiment of a de-assembling method 200 according to the invention.

[0063] The method for de-assembling 200 a modular lift apparatus comprises the step of releasing 210 a second lift module from a first lift module on top which first module the second lift module has been secured, the lift modules including a respective lift shaft part and respective lift guiding means for guiding a lift car that is provided in a continuous lift shaft section formed by the lift shaft parts, and the step of removing 220 the second lift module from the first lift module, wherein the releasing step is performed by an assembler person using the roof of the lift car as a working platform, the lift car being brought to a working level.

[0064] The invention is not restricted to the embodiments described herein. It will be understood that many variants are possible. For example, more than one worker may be working together to secure two lift modules to each other.

[0065] Furthermore, it is noted that, for instance, one or a multiple number of the advantageous additions, mentioned in the above described embodiments of the assembling and the de-assembling method, and the lift apparatus, may be incorporated, mutatis mutandis, in the assembling method, in the de-assembling method, and/or in the lift apparatus.

[0066] These and other variants will be apparent for the person skilled in the art and are considered to fall within the scope of the invention as defined in the following claims.

Claims

1. A method for assembling a modular lift apparatus,

comprising the steps of:

- placing a first lift shaft module including a lift shaft part and lift guiding means for guiding a lift car;
- providing a lift car in the lift module;
- placing a second lift module on top of the first lift module, the second lift module also including a lift shaft part and lift guiding means, the lift shaft parts of the modules forming a continuous lift shaft section; and
- securing the second lift module to the first lift module by an assembler person using the roof of the lift car as a working platform,

further comprising the step of:

- raising the lift car to a working level,

wherein the lift car is raised to the working level using

- a separate hoisting apparatus, or
- a driving mechanism provided on the modular lift apparatus, wherein the lift car is raised by driving a driving mechanism provided on the lift car, the driving mechanism including at least one gear wheel cooperating with a toothed rack extending in the continuous lift shaft section.

2. A method according to claim 1, wherein the separate hoisting apparatus is a hoisting crane such as a mobile hoisting crane.

3. A method according to any of the preceding claims, further including the steps of:

- placing a further lift module on top of an earlier placed lift module;
- raising the lift car to a further working level, and
- securing the further lift module to the earlier placed lift module by an assembler person using the roof of the lift car as a working platform.

4. A method for de-assembling a modular lift apparatus, comprising the steps of:

- releasing a second lift module from a first lift module on top which first module the second lift module has been secured, the lift modules including a respective lift shaft part and respective lift guiding means for guiding a lift car that is provided in a continuous lift shaft section formed by the lift shaft parts, and
 - removing the second lift module from the first lift module,
- wherein the releasing step is performed by an assembler person using the roof of the lift car as a working platform, the lift car being brought

to a working level,

wherein the lift car is raised to the working level using

- a separate hoisting apparatus, or 5
- a driving mechanism provided on the modular lift apparatus, wherein the lift car is raised by driving a driving mechanism provided on the lift car, the driving mechanism including at least one gear wheel cooperating with a toothed rack extending in the continuous lift shaft section. 10

5. A modular lift apparatus, comprising a multiple number of lift shaft modules placed on top of each other, and a lift car, each module including a lift shaft part and lift guiding means for guiding the lift car in a continuous lift shaft formed by the lift shaft parts, wherein the lift car is provided with a driving mechanism for moving the car in the continuous lift shaft, the driving mechanism including at least one gear wheel cooperating with a toothed rack extending in the continuous lift shaft, and wherein the modular lift apparatus further comprises an additional driving mechanism for moving the car in the continuous lift shaft. 15 20 25

6. A modular lift apparatus according to claim 5, wherein the additional driving mechanism includes a hoisting mechanism. 30

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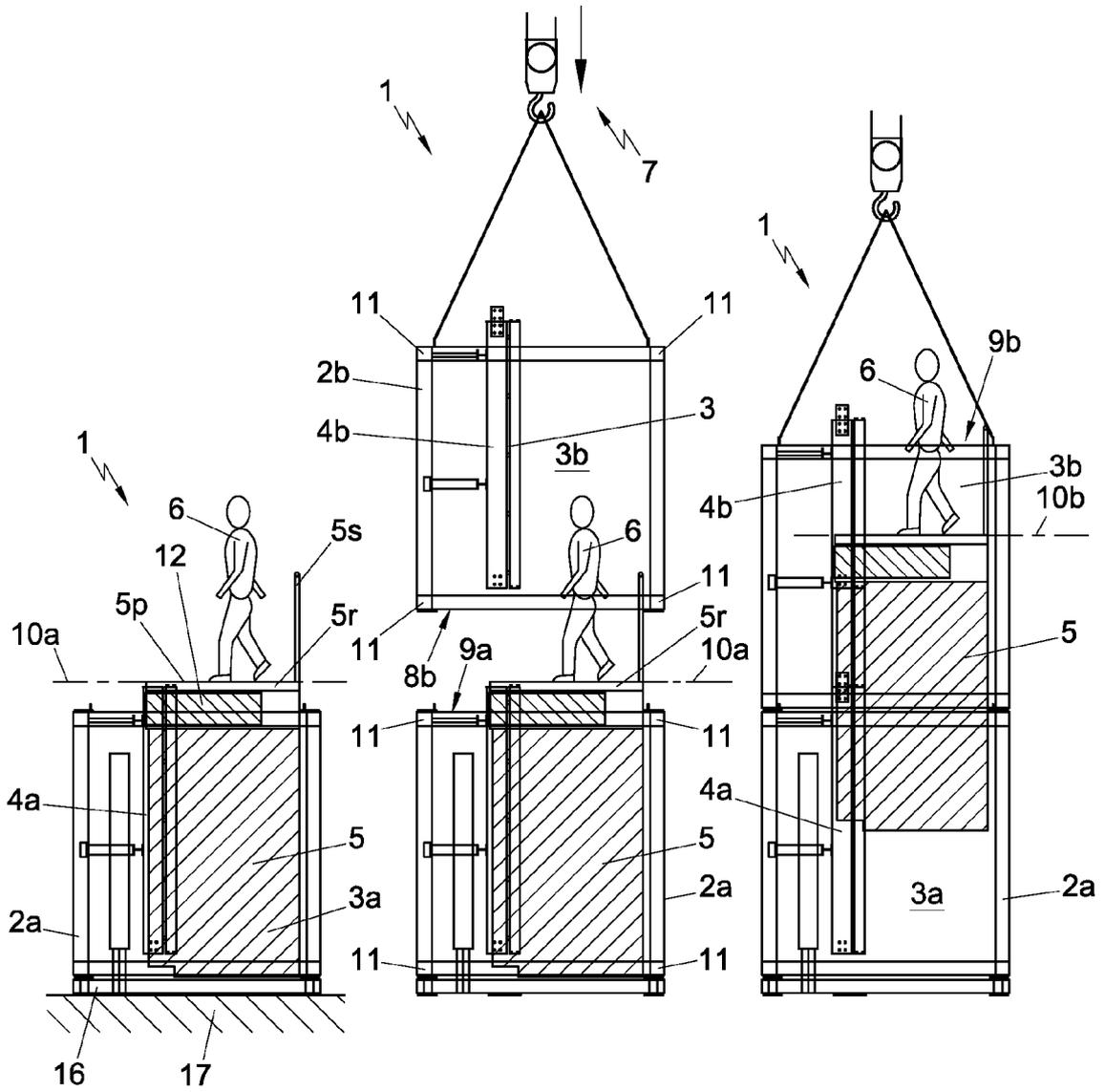


Fig. 1a

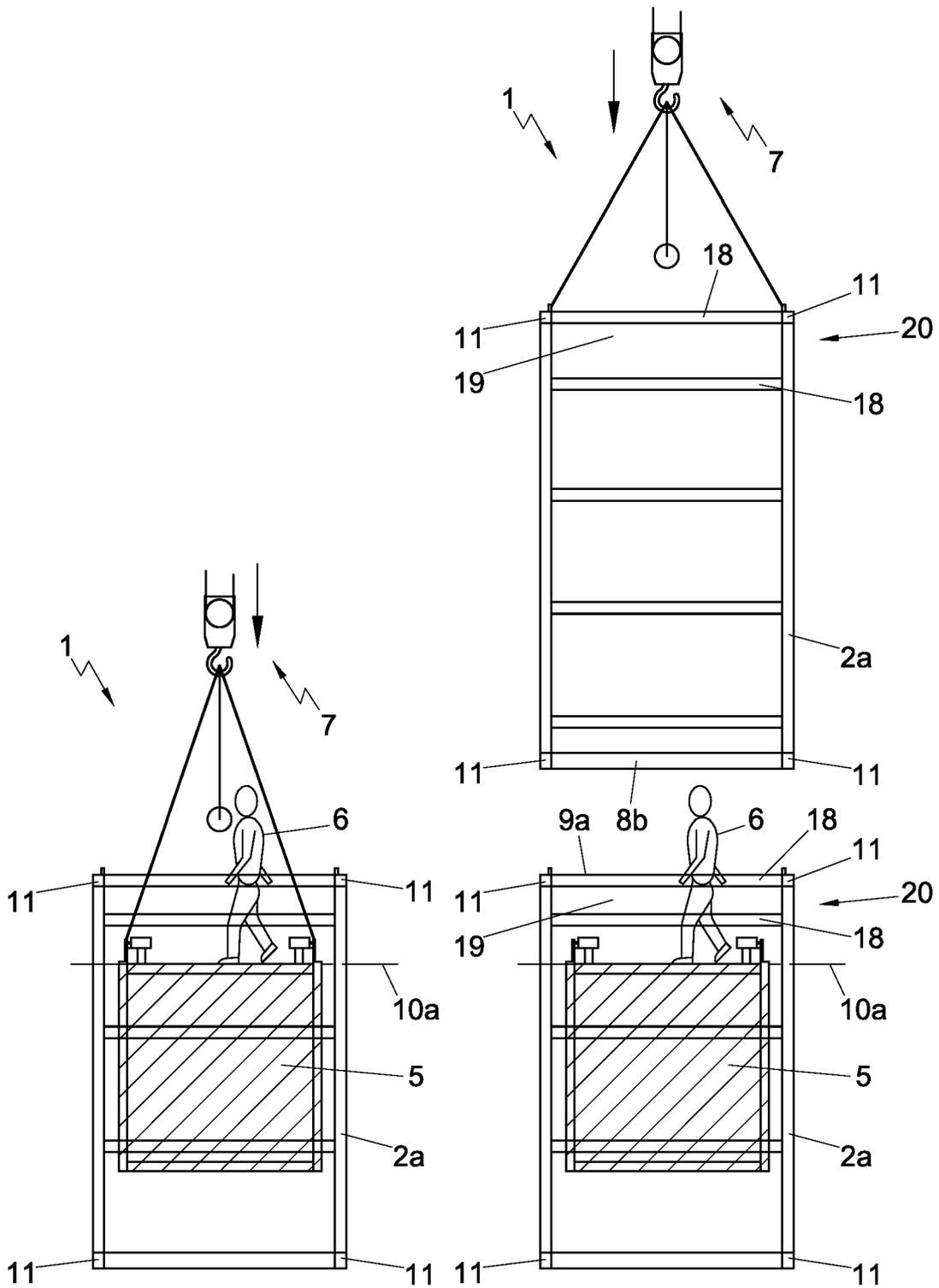


Fig. 2

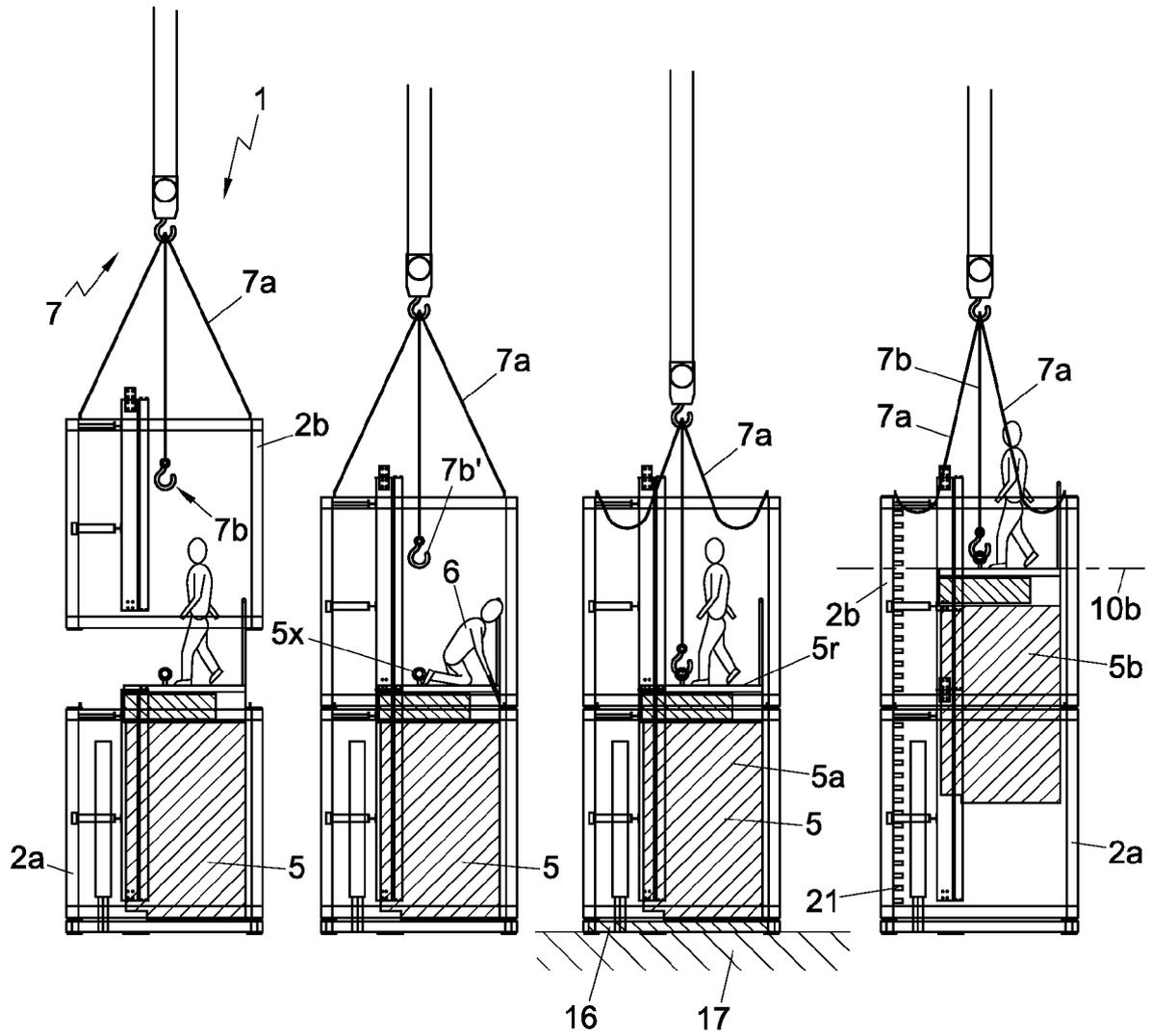


Fig. 3

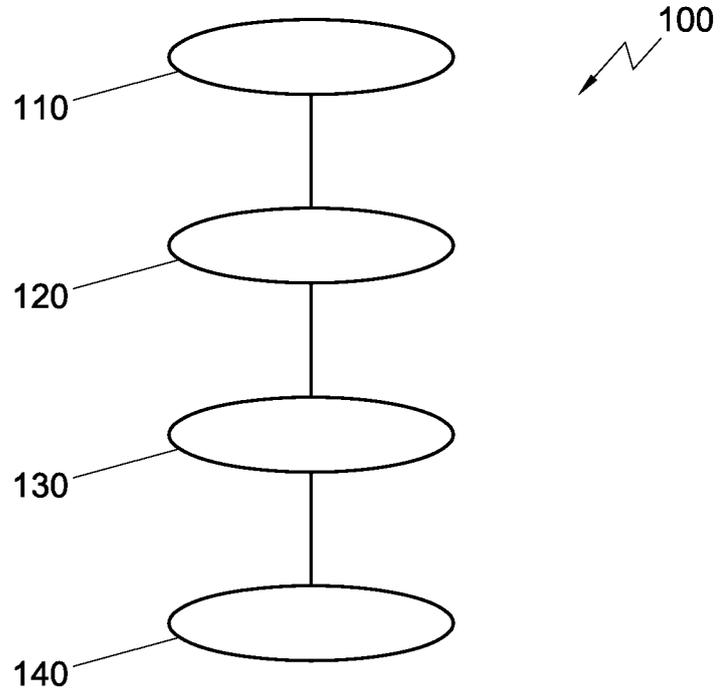


Fig. 4

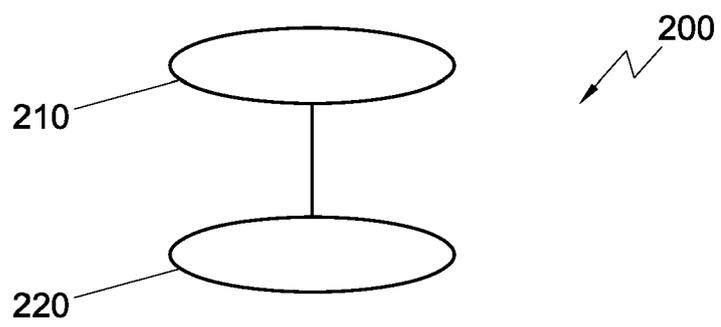


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 12 18 0783

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	US 2004/154870 A1 (THYSSEN ELEVATOR CAPITAL CORP) 12 August 2004 (2004-08-12) * abstract; figures 2,10,14 * -----	1-6	INV. B66B19/00
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