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(54) Title: ELEVATOR ARRANGEMENT

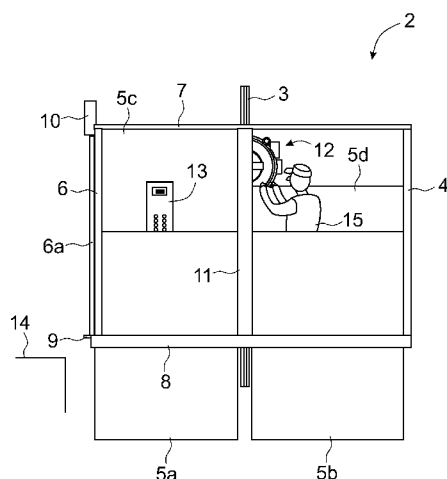


Fig. 3

(57) Abstract: The invention relates to an elevator arrangement having an elevator comprising an 5 elevator car (2) comprising a frame structure (1) and arranged to run up and down in an elevator shaft along guide rails (3), where the elevator car (2) comprises walls and at least one car door (6a), 10 wherein a working connection is formed from inside the elevator car (2) to the elevator shaft via opening a part of the elevator car (2). The working connection is formed moving at least a moving part of 15 at least one wall of the elevator car (2) vertically.

ELEVATOR ARRANGEMENT

The present invention relates to an elevator arrangement as defined in the preamble of claim 1.

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The invention in question relates particularly to an elevator where a headroom is low. The headroom in this context means the clearance between the roof of the elevator car and the ceiling of the elevator shaft in the situation when the
10 elevator car is at its uppermost position. Various tasks, such as inspections, adjustment works, maintenance or repairs, later referred in a shorter way only as "maintenance work", are often performed at the upper part of the elevator shaft. In that case, the safety of the persons performing
15 the tasks mentioned above has always to be secured. If the height of the top clearance of the elevator shaft is low, in other words the headroom is low, a sufficient safety space, which prevents injuries occurring for persons working on the roof of the elevator car, cannot always be guaranteed with-
20 out special procedures.

Usually the maintenance work is done on the roof of the elevator car. In that case, when working on the roof of the elevator car an unintentional movement of the elevator car
25 must be prevented in some other way than by the regular operating brakes of the elevator. It is known in the prior art that this kind of prevention can be done by locking the elevator car and/or the counterweight into their positions on the guide rail, for instance by means of a safety gear, a
30 latch or wedges. However, this often requires that the working persons must separately go to the elevator shaft and perform the locking. That makes safety preparation tasks awkward, laborious and time-consuming.

Another solution according to prior art for achieving an adequate safety space in the upper part of an elevator shaft is to use one or more turnable buffers that are disposed below the counterweight. The buffer is lifted upright before
5 going onto the roof of the elevator car. The length of the buffer is such that the movement of the counterweight, and at the same time the movement of the elevator car, stops before the elevator car rises too high with respect to the ceiling of the elevator shaft. One problem, among others, in
10 this solution is, however, that the shaft space might have been dimensioned so precisely that there is no proper space in the bottom part of the elevator shaft for a turnable buffer. Another problem is that the aforementioned buffer ensuring the top safety space is in the bottom part of the
15 elevator shaft, i.e. right at the other end of the elevator shaft. In that case installing the buffer into the safe position takes extra time and it may also happen that for this reason the person in charge does not remember to go down to the bottom of the elevator shaft to turn them into the safe
20 position.

In addition to the aforementioned, the safety solutions are often based on electrical supervision controls installed in the doors of the shaft, which controls must be switched to
25 the safe position before going onto the roof of the elevator car. Turning the buffers into the safe position and activation of the electrical control circuits are often such a complex combination that, particularly e.g. with small tasks, they might be left undone owing to their complexity
30 and for saving the time used. In addition, electrical supervision control systems could be susceptible to failure.

Yet one solution according to the prior art is shown in the US patent publication No. US2010/0200339 A1. The solution

according to the US publication presents an elevator safety system for elevators with a reduced upper end of the elevator shaft. In this solution, the roof of the elevator car cannot be used as a working base, because the roof of the
5 elevator car is constructed so that it does not support weight. Thus, it is not possible to be or work on the roof of the elevator car. In this case, the required free safety space is formed completely inside the elevator car when the elevator car is in its uppermost position. As the roof is
10 not designed to bear loads, in such a situation a weight on the roof may deform or even broke the roof structures. The maintenance work at the top part of the elevator shaft is done inside the elevator car. For this purpose, a part of the side wall of the car is made removable and the maintenance
15 work is done through the opening in the side wall when the part mentioned above has been removed from the side wall. However, the problem in this solution is the fact that there are only limited possibilities to make inspection, repair and maintenance work because only one certain opening
20 is used. And likewise, there are limited possibilities to place elevator appliances that require regular maintenance in the elevator shaft because the opening is only at one side wall of the car. In addition, the opening makes the wall structure more expensive, more complicated and also
25 weaker than the unbroken wall structure.

Also other solutions where an opening for maintenance work is formed to a wall of the elevator car are known in prior art. For example, there can be a maintenance hatch in a wall
30 of the elevator car and the opening for maintenance work is arranged to be formed by opening this maintenance hatch. However, these kinds of solutions have similar problems as the solution presented in the US patent publication No. US2010/0200339 A1. Another disadvantage is that a maintenance

nance hatch affects the visual appearance of the car wall and complicates cleaning of the wall.

One objective of the present invention is to eliminate drawbacks of prior art technology and to achieve an elevator arrangement where there is no need to make any kind of maintenance work on the roof of the elevator car, but that kind of maintenance work can be done from the floor of the elevator car. Another objective of the present invention is to achieve an elevator arrangement where the headroom at the upper part of the elevator shaft can be as low as possible, and the elevator shaft is completely inside the building so that there is no need to penetrate the roof of the building. Yet another objective of the present invention is to achieve an elevator arrangement where the installation of the elevator components into the elevator shaft can be safely made from the floor of the elevator car.

The elevator arrangement according to the invention is characterized by what is disclosed in the characterization part of claim 1. Other embodiments of the invention are characterized by what is disclosed in the other claims.

The inventive content of the application can also be defined differently than in the claims presented below. The inventive content may also consist of several separate inventions, especially if the invention is considered in the light of expressions or implicit sub-tasks or from the point of view of advantages or categories of advantages achieved. In this case, some of the attributes contained in the claims below may be superfluous from the point of view of separate inventive concepts. Likewise, the different details presented in connection with each embodiment can also be applied in other embodiments. In addition, it can be stated that at

least some of the subordinate claims can, in at least some situations, be deemed to be inventive in their own right.

In order to achieve the objectives mentioned above, the pre-
5 sent invention provides an elevator arrangement having an elevator comprising an elevator car arranged to run up and down in an elevator shaft along guide rails. The elevator car comprises a frame structure and at least walls, car door, a floor and a roof. The walls are connected to the
10 frame structure and at least part of at least one wall is arranged to be moved vertically downwards and upwards to form an opening for safe working connection from inside the elevator car to the elevator shaft.

15 One advantage of the solution according to the invention is that the targets requiring inspection, service, repairing or maintenance are easily accessible from a safe place in the elevator car through the openable walls and the door of the elevator car. Yet another advantage is that the elevator car
20 can be run so up in the elevator shaft that all maintenance work to also the uppermost parts can be made from the floor of the elevator car without using scaffoldings, stands or corresponding means. Thus, there is no need to access to the roof of the car during maintenance work, which makes the
25 maintenance work easier and safer.

Another advantage is that the solution is very easy and quick to use, and requires neither awkward working in the elevator shaft nor preliminary procedures at the top end or
30 bottom end of the elevator shaft. Yet another advantage is also that the solution is inexpensive and simple to implement.

Yet a further advantage of the invention is that the invention enables a safe way of providing an elevator that has an extremely low top clearance or headroom. The top clearance can even be minimized to the minimum, or close to the minimum, required only by the trajectory of the elevator car. Thus, when the elevator car is in its uppermost possible position on its trajectory, the shaft space above the elevator car is small and the height of the elevator shaft can easily be fitted inside the building, without penetrating the roof of the building.

In the following, the invention will be described in detail by the aid of example embodiments by referring to the attached simplified and diagrammatic drawings, wherein

15

Fig. 1 presents in a simplified and diagrammatic oblique top view a frame structure of an elevator car according to the invention,

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Fig. 2 presents in a simplified and diagrammatic side view an elevator car according to the invention when the walls of the car are in their normal position,

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Fig. 3 presents in a simplified and diagrammatic side view an elevator car according to Fig. 2 when three side wall panels of the car are lowered, and maintenance work is in progress, and

Fig. 4 presents in a simplified and diagrammatic side view an elevator car according to the invention when an installation of the elevator is in progress.

30 An aspect of the invention is to achieve an elevator arrangement with an elevator car having several possibilities to access maintenance and repair targets in an elevator shaft from inside the elevator car, and which also removes the need to step onto the roof of the elevator car. In addi-

tion, another aspect of the invention is to achieve an elevator arrangement that reduces the height of the elevator shaft needed.

5 Figure 1 presents in a simplified and diagrammatic oblique top view a frame structure of an elevator car. The frame structure 1 is made, for example, of metal bars, which have been connected to each other to form a rectangular frame structure, to which the walls, the floor and the roof of the
10 elevator car are arranged to be connected. Preferably, the frame structure 1 comprises four vertical corner bars, two vertical middle bars and horizontal bars to connect all the vertical bars together as a complete frame structure. The vertical corner bars at the front edge of the elevator car 2
15 act as the first corner guides 11a for the movable side walls of the elevator car 2, and the vertical corner bars at the back edge of the elevator car 2 act as the second corner guides 11b for the movable side walls of the elevator car 2. The vertical middle bars substantially in the center of both
20 the side walls act as middle guides 11 for the movable side walls of the elevator car 2. Preferably a sling for the elevator car is also arranged to be connected to the frame structure 1.

25 Figure 2 presents in a simplified and diagrammatic side view an elevator car according to one embodiment of the invention in a situation where the car walls are in their normal position. The elevator car 2 is arranged to run up and down in an elevator shaft along guide rails 3. The elevator car 2 is
30 mounted inside a sling, which is not shown in the figures for the sake of clarity. The elevator car 2 comprises among others a back wall 4, side walls 5, a front wall 6, a car door 6a, a roof 7, a floor 8, a doorstep 9 and a top track 10. In addition, the elevator car 2 comprises a frame struc-

ture, to which at least the side walls 5 are connected. The frame structure 1 comprises at least two vertical middle guides 11, which are essentially of the height of the elevator car 2 and located substantially at the center of the both sides of the elevator car 2. The side walls 5 are arranged to be moved vertically downwards and upwards at least along the middle guides 11.

Figure 3 presents in a simplified and diagrammatic side view an elevator car 2 according to Fig. 2 in a situation where the car walls are being lowered. In this embodiment of the invention, both of the side walls 5 of the elevator car 2 are composed of two separate wall panels 5a-5d, which are connected to the frame structure 1 of the elevator car 2. The height of the wall panels 5a-5d is essentially the same as the height of the elevator car 2. At one of their vertical edges, the wall panels 5a-5d are connected to the middle guides 11. In this embodiment of the invention, the second vertical edges of the wall panels 5a and 5c are connected to the first corner guides 11a and the second vertical edges of the wall panels 5b and 5d are connected to the second corner guides 11b. The corner guides 11a and 11b belong to the frame structure 1 and they are shown in Fig. 1.

Advantageously, in addition to guiding surfaces, the vertical guides 11, 11a and 11b comprise vertical sliding surfaces along which the movable wall panels 5a, 5b, 5d can be slid guided in the vertical direction.

In the situation of the Fig. 3 a maintenance task is in progress. The elevator car 2 has been run with a service run or inspection run in an appropriate location in the elevator shaft so that the working person 15 being inside the elevator car 2 can have an easy access to the elevator components

and appliances in the elevator shaft. In this case the car has been run to the upper part of the elevator shaft to the highest floor level 14. The working person 15 is standing on the floor of the elevator car 2 performing the maintenance task for the hoisting machinery 12. The two wall panels 5a and 5b of the frontmost side wall are lowered so that the upper edges of the wall panels 5a and 5b are about at the level of the vertical midpoint of the elevator car 2 forming an opening to the elevator shaft. The upper edges of the wall panels are also arranged to form a safety barrier to prevent the working person 15 to fall out of the elevator car 2.

The backmost side wall comprises two wall panels 5c and 5d. The first wall panel 5c, to which the control panel 13 of the elevator car 2 is attached, is not arranged to be moved but the second wall panel 5d has been lowered from the roof 7 of the elevator car 2 also forming an opening to the elevator shaft so that it is possible to access the hoisting machinery 12 from the elevator car 2.

The elevator comprises also locking mechanism for the slidably movable wall panels 5a, 5b and 5d, which locking mechanism is arranged to lock the wall panels at their normal positions when the elevator is in normal use. When maintenance work is to be done, the working person unlocks the needed wall panels, moves them to an appropriate height needed and locks them there. The locking mechanism can be e.g. a mechanical latch or an electrical mechanism or some other suitable mechanism.

The wall panels 5a, 5b, 5d can be moved manually, but preferably they are arranged to be moved with help of a power

unit, such as an electric motor, which the working person 15 has brought with him.

Figure 4 presents in a simplified and diagrammatic side view
5 an elevator car according to the invention in a situation where the elevator is being installed. At this phase of installation, the side walls 5 are not yet installed to the elevator car 2. Instead, there are temporary balustrades 16 at the side and/or back edges of the elevator car 2, which
10 balustrades 16 prevent the working person 15 to fall from the elevator car 2. When installing the elevator, there are also temporary toe guards 18 at the side edges of the elevator car and the actual toe guard 17 at the front edge of the elevator car is arranged to act as a transport means for
15 guide rail elements 3a and possibly also some other elements and components of the elevator. The toe guard 17 is hollow and the top edge is open so that elements to be transported can be put inside the toe guard 17. At the end of the installation, when the toe guard 17 is not needed anymore for
20 transporting elements, the toe guard 17 is turned so that the open edge is not at the top of the toe guard 17. At the end of the installation also the balustrades 16 are removed and the wall panels 5a-5d are installed to form side walls 5 of the elevator car 2.

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It is obvious to the person skilled in the art that the invention is not restricted to the examples described above but that it may be varied within the scope of the claims presented below. Thus, for instance the frame structure, the
30 guides and the structure of the elevator can be also different from what is presented above.

CLAIMS

1. Elevator arrangement having an elevator comprising an elevator car (2) comprising a frame structure (1) and arranged
5 to run up and down in an elevator shaft along guide rails (3), where the elevator car (2) also comprises walls and at least one car door (6a), wherein a working connection is formed from inside the elevator car (2) to the elevator shaft via opening a part of the wall of the elevator car
10 (2), **characterized** in that the working connection is formed by moving at least a moving part of at least one wall of the elevator car (2) vertically.
2. Elevator arrangement according to claim 1, **characterized**
15 in that when the working connection has been formed, a moving part has been moved downwards so that at least part of the moving part is at the height below the elevator car (2).
3. Elevator arrangement according to claim 1 or 2, **characterized**
20 **terized** in that the frame structure (1) comprises at least one substantially vertical guide (11, 11a, 11b), to which at least one moving part is connected.
4. Elevator arrangement according to claim 1, 2 or 3, **characterized**
25 **acterized** in that at least one of the walls of the elevator car (2) is composed of at least two wall panels (5a-5d).
5. Elevator arrangement according to any of the claims above, **characterized** in that at least one wall panel (5a,
30 5b, 5d) is arranged to be a moving part of a wall of the elevator car (2).

6. Elevator arrangement according to any of the claims above, **characterized** in that the height of the wall panels (5a-5d) is essentially the same as the height of the elevator car (2).

5

7. Elevator arrangement according to any of the claims above, **characterized** in that at least one of the wall panels (5a-5d) is connected to the guide or guides (11, 11a, 11b).

10 8. Elevator arrangement according to any of the claims above, **characterized** in that at least one of the wall panels (5a, 5b, 5d) connected to the guide or guides (11, 11a, 11b) is arranged to move vertically upwards and downwards.

15 9. Elevator arrangement according to any of the claims above, **characterized** in that the wall panels (5a, 5b, 5d) are connected to the vertical guide or guides (11, 11a, 11b) slidably.

20 10. Elevator arrangement according to any of the claims above, **characterized** in that the arrangement comprises locking mechanism that is enabled to unlock and lock wall panels of the elevator car (2) to appropriate height.

25 11. Elevator arrangement according to any of the claims above, **characterized** in that during installation of the elevator the elevator car (2) is equipped with at least one balustrade (16).

30 12. Elevator arrangement according to any of the claims above, **characterized** in that the elevator car comprises a toe guard (17), which is arranged to act as a transport

means for guide rail elements (3a) during installation of the elevator.

13. Elevator arrangement according to any of the claims
5 above, **characterized** in that during installation of the elevator the elevator car (2) comprises a temporary toe guard (18) at least at one side of the elevator car.

14. Elevator arrangement according to any of the claims
10 above, **characterized** in that the elevator arrangement comprises an access to the maintenance or repair targets in the elevator shaft from inside the elevator car (2) through one or more maintenance openings on one or more walls of the elevator car (2).

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15. Elevator arrangement according to any of the claims
above, **characterized** in that the elevator arrangement comprises and access to the maintenance or repair targets in the elevator shaft from inside the elevator car (2) through
20 the door (6a) of the elevator car (2).

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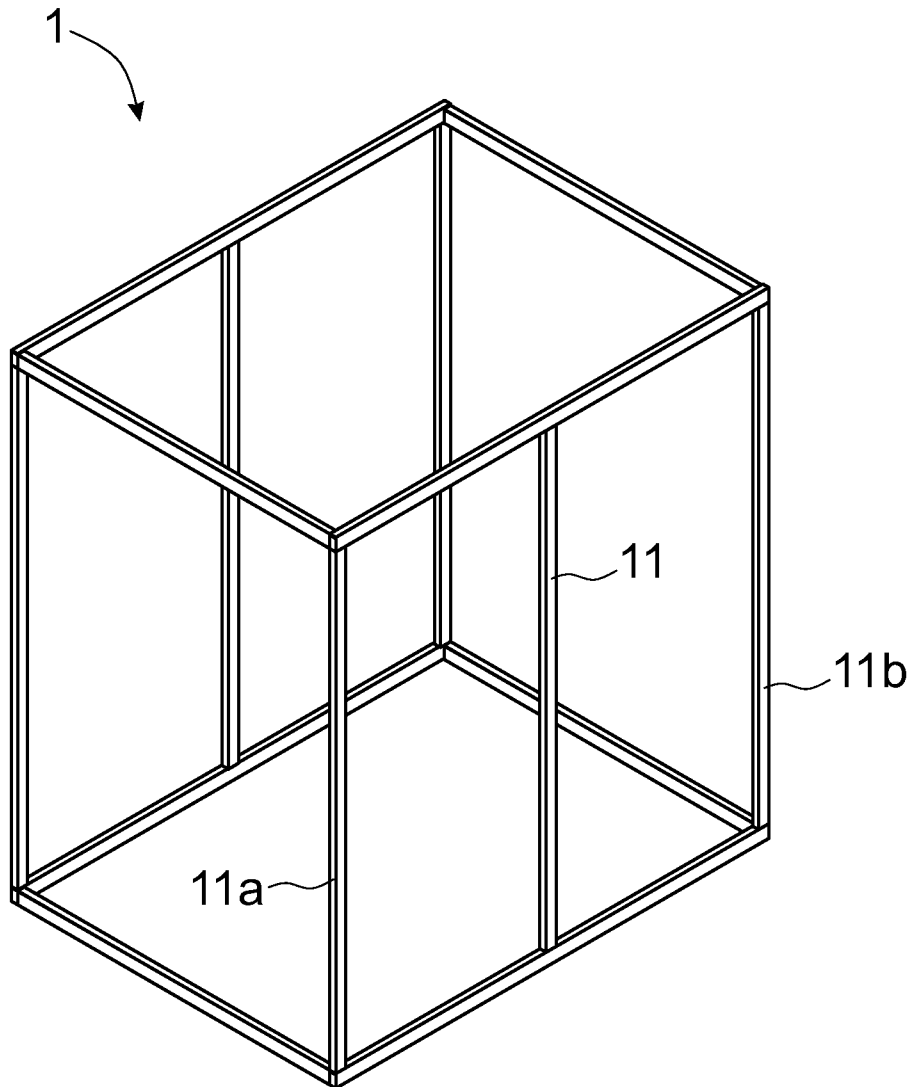


Fig. 1

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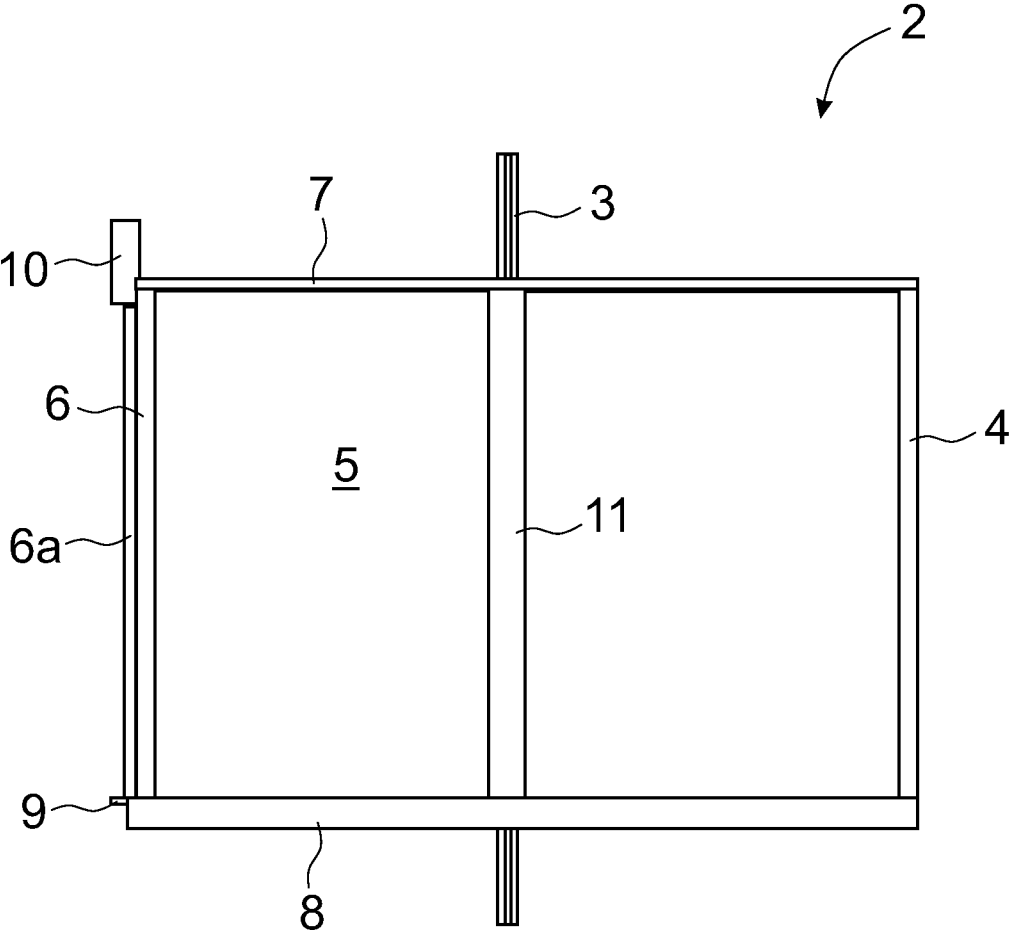


Fig. 2

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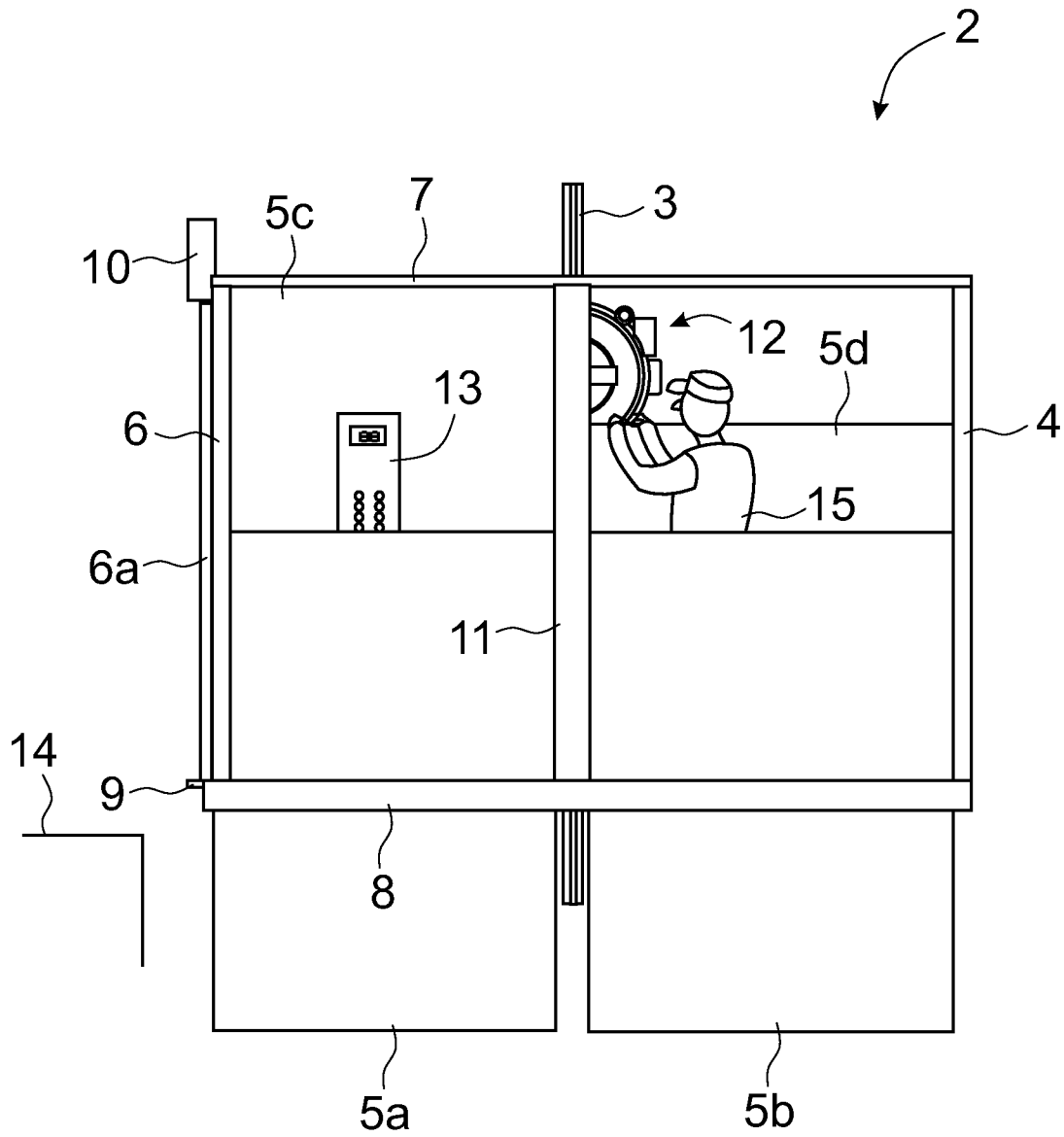


Fig. 3

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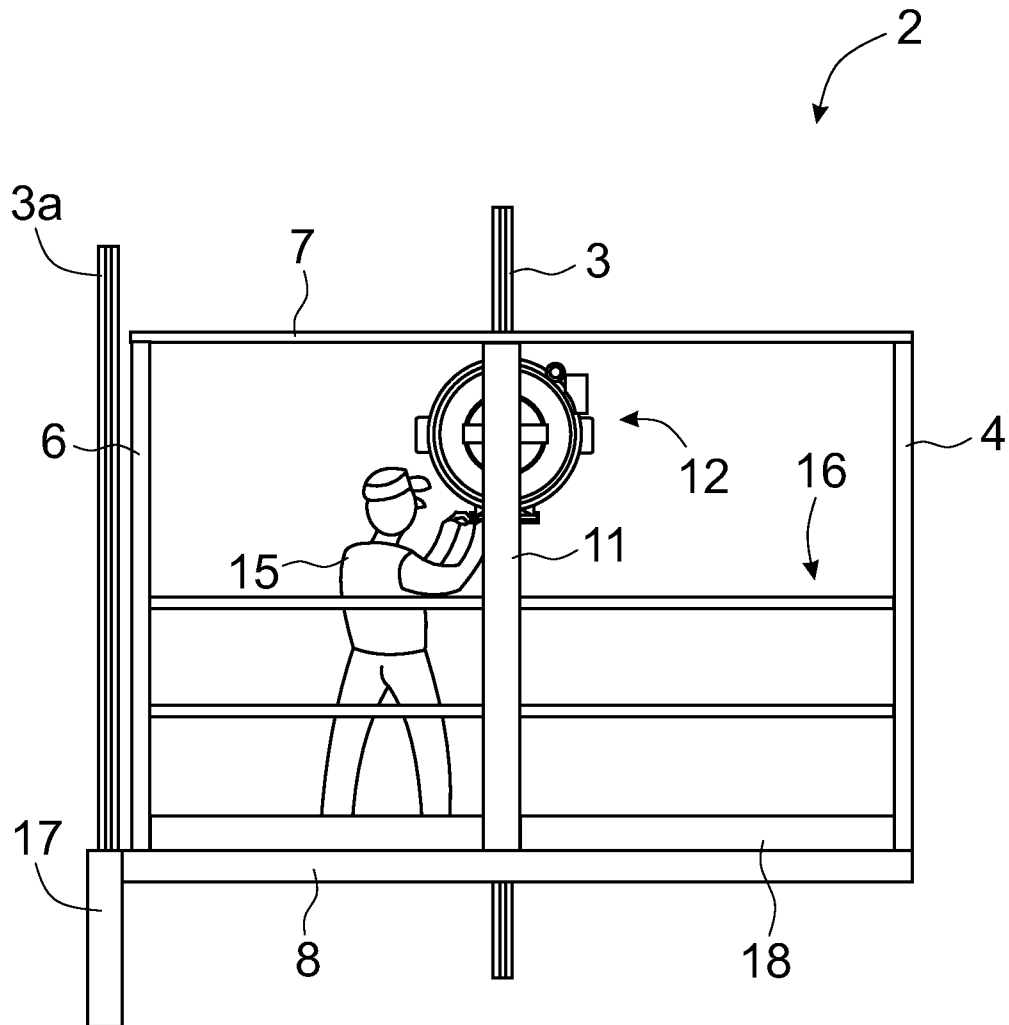


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2018/050561

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B66B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base, and, where practicable, search terms used)

EPODOC, EPO-Internal full-text databases, Full-text translation databases from Asian languages, WPIAP

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	JP 2015051815 A (HITACHI LTD) 19 March 2015 (19.03.2015) figures 1 and 2 & abstract [online] EPOQUENET EPODOC & WPI	1
X	US 2010200339 A1 (HENSELER MARKUS [CH]) 12 August 2010 (12.08.2010) mentioned in the application, figures 3 and 4	1
Y	JP H03120183 A (MITSUBISHI ELECTRIC CORP) 22 May 1991 (22.05.1991) figures 1-3 & abstract [online] EPOQUENET EPODOC	11

☒ Further documents are listed in the continuation of Box C.
☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT
Information on Patent Family Members

International application No.
PCT/FI2018/050561

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INTERNATIONAL SEARCH REPORT

International application No.

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CLASSIFICATION OF SUBJECT MATTER

IPC

B66B 11/02 (2006.01)

B66B 5/00 (2006.01)