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(54) **Lifting system for a stairway**

(57) The invention relates to a lifting system for a stairway comprising a first section (A) including lifting means (4a). Further, it comprises a second section (B)

including a number of steps (2), step controlling means (3, 5, 11) and sliding means (4b, 9), and at least one flexible connection (C) connecting said first (A) and second sections (B).

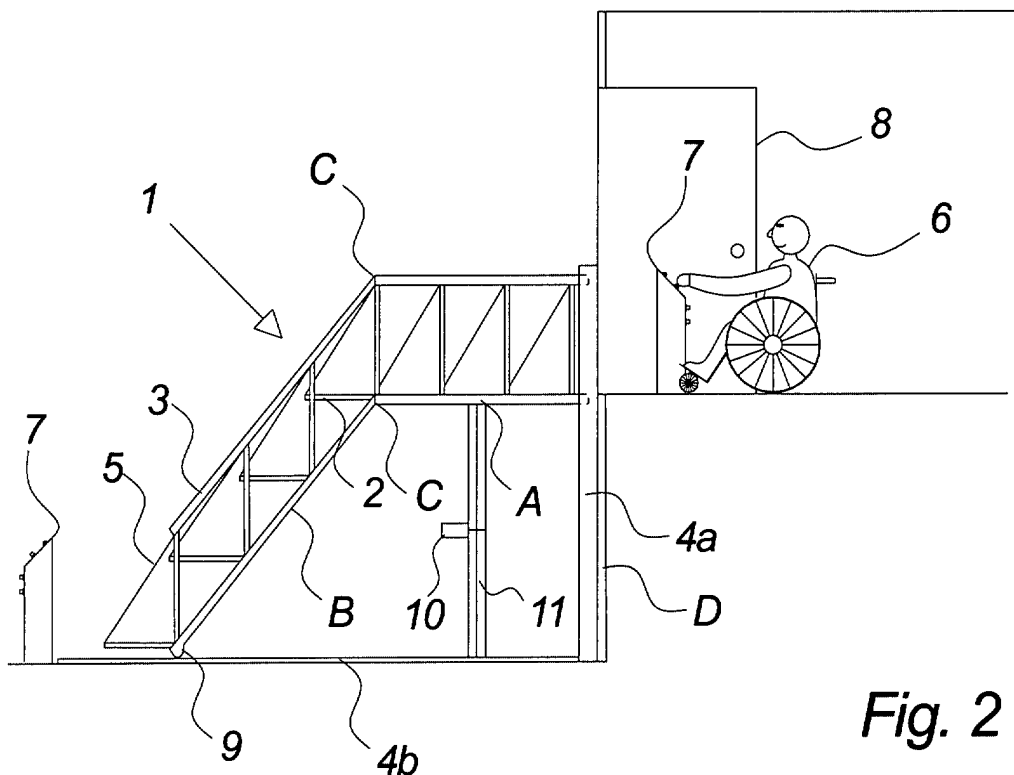


Fig. 2

Description

Background of the invention

[0001] The present invention relates to a lifting system for a stairway and a method of lifting cargo by means of a lifting system.

[0002] In modern buildings, a significant problem posing a challenge to an architect is the connection between different levels in the building. The connections have to facilitate transportation of people that are not able to use regular stairways or only with great difficulty, e.g. physically impaired people using wheelchairs or parents with children in perambulators. The number of possibilities of lifting people is many but they all involve considerable drawbacks.

[0003] A first solution is the use of an elevator which has the advantage of being capable of transporting all kinds of persons and their goods and chattels. Further, it does not take up as much space as some of the other solutions. The disadvantages of elevators include the fact that they have to be combined with stairs to ensure safety and that they are very expensive to establish in new buildings as well as in existing buildings.

[0004] A second solution is to combine stairs with a lifting system where the system includes a platform and rails following the stairs. The platform is held in a horizontal position as it slides up and down on the rails just above the stairs. When the platform is not in use, it is raised to a vertical storage position. One of the disadvantages is the unattractive and bulky look that this kind of system adds to the overall appearance of the stairs and the building.

[0005] A third solution is illustrated in US-A 5,234,078. The solution combines the functionality of stairways with the ones of elevators which create the possibility of stairway types that may be used as regular stairways as well as for lifting an impaired person in a wheelchair from one level to another. The lifting system involves lifting of a platform connected to the lower end of the stairway by raising the platform and the stairway itself to a higher level. The movement is established by a motor means lifting the lower end of the stairway along two posts which is a problem since they, among other things, disturb the esthetic appearance of the system and require an area below the stairs to facilitate the motor means. A further problem is the fact that a user of the platform is lifted in an open area and usually several meters away from walls etc. which often makes the user feel unsafe.

[0006] The object of the invention is to create a lifting system without the above-mentioned problems.

The invention

[0007] When, as stated in claim 1, a lifting system for a stairway comprises a first section including lifting means, a second section including a number of steps, step controlling means and sliding means, and at least

one flexible connection connecting said first (A) and second sections (B), it is possible to combine the functionality of a stairway with that of a lifting system in an advantageous manner.

[0008] The lifting system is especially advantageous in connection with limited distances such as e.g. between two levels in a building only separated by a few meters. Usually, the lifting system is used as a single unit but a number of lifting systems may also be used together so as to form e.g. a staircase in a building with a number of floors. In the latter example, the lifting system may connect a floor with a landing and continue to the next floor with a new lifting system. Hereby, it is possible to e.g. establish a lifting system in existing buildings with no elevators in an inexpensive way.

[0009] When, as stated in claim 2, said lifting means comprises a number of substantially vertical guide rails, and preferably two, secure and stable lifting of the cargo is established.

[0010] When, as stated in claim 3, said substantially vertical guide rails are mounted on a wall or a similar vertical surface, a lifting system is easily established. Further, it is possible to establish a lifting system where only the stairway parts are visible which creates a more esthetic system compared with the known systems. In particular, the positioning of the rails on a wall will help conceal the rails or even hide them by mounting into the wall.

[0011] When, as stated in claim 4, said lifting means comprises drive means such as electric or hydraulic motors, a further advantageous embodiment of the invention has been obtained. Especially, the size of the drive means is important in relation to hiding or concealing this part of the lifting system which takes place by means of an electric or hydraulic motor construction.

[0012] At the same time, the mentioned types may be controlled in a precise and fast manner with standard control systems. Other systems well-known by skilled persons within the art may also be used.

[0013] When, as stated in claim 5, said step controlling means comprises one or more banisters and connection means connecting said banisters with said steps, it is possible to use the necessary safety measures of a stairway as part of the lifting system. The step controlling means further has the advantage of controlling the steps from the top side which allows the underside of the steps to be flat. Hereby, the lifting system may be constructed without any means under the steps which ensures an elegant, esthetic and slim look of the lifting system. The lifting system will also provide a wheelchair user with easy entrance to the lifting system because the step is the only elevating element.

[0014] When, as stated in claim 6, said connection means is connected to said steps in close proximity to the front and rear edges of said steps, respectively, the control means allows for an altogether light-weight construction.

[0015] When, as stated in claim 7, said sliding means

comprises a number of substantially horizontal guide rails, and preferably two, it is possible to control the movement of the lifting system when moving it from one level to another. In particular, it is possible to avoid malfunction by keeping the rails clear of obstacles and detecting any obstacles by detectors placed along the rails. However, the lifting system may be constructed without the rails and allow the system to move freely in a simple form.

[0016] When, as stated in claim 8, said second section has guides for entering into said sliding means, it is possible to create a preferred slide by coating the guides with e.g. a material having a low friction coefficient or with a wear-resistant material.

[0017] When, as stated in claim 9, said first section further includes a door, a bar or another access controlling means, access to the lifting system is restricted to the periods during which the system is ready for use.

[0018] When, as stated in claim 10, the number of steps is between 1 and 15, a preferred relation between the elevation and the size of the system has been obtained.

The figures

[0019] The invention will now be described in detail with reference to the drawings, in which

- | | |
|-----------------|---|
| fig. 1a | shows a perspective view of the lifting system with a stairway designed for lifting according to the invention, |
| fig. 1b | shows details of the lifting system, |
| figs. 2 to 7 | show a preferred embodiment of the invention in which a wheelchair user is lifted from one level to another, |
| figs. 8a and 8b | show sections of a vertical guiding rail, |
| figs. 9a and 9b | show different examples of detector means, and |
| fig. 10 | shows an activation header according to the invention. |

Detailed description

[0020] Fig. 1a shows a lifting system 1 according to the invention in which a stairway includes the functionality of elevating cargo or person(s) from one level to another. The persons may be persons perpetually or momentarily impaired such as elderly persons with walking disabilities, persons in wheelchairs or persons with broken extremities. The persons may also be parents with children in perambulators or persons with heavy or extensive goods and chattels.

[0021] The lifting system 1 comprises a number of steps 2 between two parallel side members E where the number of steps determines the elevation of cargo/person(s) and the height of the stairway.

[0022] In a preferred embodiment of the invention, the number of steps is maximal 15 allowing elevation of 1.5 to 2 metres.

[0023] Further, the lifting system 1 comprises two banisters 3a, two vertical guide rails 4a and two horizontal guide rails 4b which control the lifting system 1 when lifting cargo in vertical and horizontal directions. The system also comprises a number of vertical banister rods 5b each connecting the banister 3a with the rear edge of a step 2. To keep the steps 2 in horizontal position a further banister rod or wire 5a connects the front edge of each step with the banister. Usually, the lifting system 1 comprises two banisters 3a connected to each side of the steps 2 with two identical sets of banister rods or wires 5a, 5b. During lifting of cargo/person(s), the steps 2 will remain essentially horizontal.

[0024] Even further, the lifting system 1 comprises a lifting control 3b with a number of buttons controlling the direction of elevation. The person wishing to be elevated has to push the right button to activate the lifting system.

[0025] In a preferred embodiment, the buttons are dead man's handles ensuring that elevation will be stopped in case the person stops pushing the button e. g. because of an indisposition. The button may, however, also be a standard button requiring only a single non-continuous push.

[0026] The lifting system 1 also includes drive means 10 (shown on figs. 2 to 7) to facilitate the upwards and downwards lifting and end stops informing the control system of the lifting system when it has reach its end position.

[0027] Fig. 1b shows a section of the lifting system in detail. Especially, the figure shows the flexible connection F between the step 2 and the side member E allowing the step to be horizontal during elevation.

[0028] Figs. 2 to 7 show a preferred embodiment of the invention.

The preferred embodiment involves the following steps during elevation:

Downwards lifting

[0029]

1. The person requests the lifting service
2. The person activates an automatic door opening mechanism
3. The door opens
4. The person enters the platform (the first section) of the lifting system
5. Any safety leafs is in place
6. The person pushes the "down" button on the lifting control

7. The lifting system stops automatically when reaching the "down" position

8. When leaving the lifting system, the person moves through a photocell area and the system may return to normal position.

Upwards lifting

[0030]

1. The person requests the lifting service
2. The person moves through a photocell area and other persons cannot activate the system.
3. The person enters the platform (the first section) of the lifting system by moving over the steps.
4. The "up" button is pressed
5. Any safety leaf is in place
6. The lifting system stops automatically when the "up" position is reached and the door opens.

[0031] Fig. 2 shows the lifting system 1 when used as a stairway in the normal sense. The figure shows a wheelchair user 6 activating the lifting system 1 by pushing a button at an activation header 7 indicating that a wheelchair user 6 wishes to be transported to a lower level. The door 8 is open since the lifting system 1 is used as a stairway in the normal sense. However, the door acts as a part of the safety system in relation to the lifting system 1 and a lifting manoeuvre may consequently only take place when the door is locked.

[0032] A system including a bar that may be up or down for passage may replace the door.

[0033] Fig. 3 shows the situation after the wheelchair user 6 has pushed the button on the activation header 7. The lifting system is divided into a first A and second section B where the first section A forms a platform onto which the wheelchair user 6 may push his wheelchair when the door is opened either manually or automatically. The second section B of the lifting system 1 comprises the part forming the steps when the lifting system acts as a stairway in the normal sense. When the wheelchair user 6 has positioned him or herself right onto the lifting system 1, the wheelchair user 6 needs to continuously push a safety device (a dead man's control) while he or she is transported down. The safety device may be a control panel on the platform of the stairway or a separate unit such as a remote control. When the safety device is pushed, the door is automatically locked which prevents other people from falling down from the upper floor.

[0034] Fig. 4 shows the wheelchair user 6 on his way down where the user is pushing the safety button all the way down. In case the button is no longer pushed or a malfunction in the system is detected, the lifting system 1 will stop at once. A malfunction may e.g. be another person entering the safety area around the lifting system when in use.

[0035] At one end, the second section B ends in a flex-

ible connection with the first section A. The first section A is lifted up or down by lifting means 10, 11 and the second section B is lifted by means of the flexible connection by the lifting means 10, 11.

5 [0036] The second section B of the lifting system further ends in a sliding guide 9 such as a wheel that slides within the horizontal guide rail 4b during movement of the lifting system 1.

[0037] Fig. 5 shows a situation where the wheelchair user 6 has reached the lower level by means of the lifting system 1. When the lifting system 1 is down, the wheelchair user 6 may stop pushing the safety device and push himself away from the lifting system 1. The door 8 will still be locked until the lifting system 1 is back in the position of a regular stairway.

15 [0038] Fig. 6 shows the wheelchair user 6 after leaving the lifting system 1 and the system returning to the position of a stairway in the normal sense. During movement, the door is locked and prevents any dangerous situations from emerging so that no person can fall out of an open door before the stairway reaches normal use position. The lifting system 1 may automatically return to the position of a regular stairway when no persons are detected on the steps 2 or a person using the system manually requests the functionality he or she needs.

20 [0039] Fig. 7 shows the embodiment of fig. 2 with the wheelchair user 6 at the bottom of the lifting system 1 and in the direction away from the lifting system 1. Now, the door is open at the top because the functionality of the lifting system is now a stairway in the normal sense. The stairway remains in position until someone pushes the activation header 7 once again in order to be lifted up or down by means of the lifting system 1.

30 [0040] It should be noted that this procedure may also take place in reverse order in accordance with the invention meaning that it would also be possible for a wheelchair user 6 to push the activation header 7 from the bottom of the lifting system 1. When the lifting system 1 is down, the wheelchair user 6 may drive onto the first section A constituting a platform and push the safety device to initiate elevation to another level.

35 [0041] Figs. 2 to 7 also show lifting means 11 including the driving means 10. The lifting means is shown as a jaw tong mechanism and a screw spindle connected to an electric motor e.g. through a gearing. However, a large number of different lifting and driving means is possible such as systems involving electric motors, hydraulic pumps/cylinders, racks, wires or actuators such as telescopic actuators. The means may be integrated in the vertical or horizontal rails 4a, 4b or be a part of a freestanding column/tower construction.

40 [0042] Figs. 8a and 8b show sections of a vertical guide rail 4a. The guide rail 4a comprises one sliding wagon 14a with one or more wheels 13 rolling on the inner surface of the rail. The wagon has connections 14b to the lifting system 1 and the connections may be hinges or similar mechanical connections.

45 [0043] Figs. 9a and 9b show different kinds of detec-

tion means detecting people or any type of cargo underneath the lifting system during lifting. The detection means reports to a control system controlling the functionality of the lifting system.

[0044] Fig. 9a shows a squared frame e.g. made of a metal tube. The frame is substantially identical in size with the first section A and is connected to the first section by means of springs and switching means 12b. The switching means detects any compression of the springs during movement of the lifting system 1 indicating that something is underneath the frame 12a e.g. a foot of a person and the control system automatically stops the lifting system 1.

[0045] Fig. 9a shows an electric detector system comprising a detector 12c transmitting light and determining whether something is underneath the lifting system or not by the reflection of the light. The detector system may be calibrated to detecting any visible area underneath the lifting system.

[0046] An alternative would be a CCD camera securing the area below the stairway 1 from obstacles. If the CCD camera should detect something, the control system would automatically stop the lifting system 1.

[0047] Another way of holding the area beneath the lifting system 1 free from people or any type of cargo may be by attaching a shield of e.g. a fabric to each side of the lifting system 1. This prevents anyone from crawling under or placing cargo underneath the lifting system 1.

[0048] The lifting system 1 may also be provided with different light or sound signalling means warning people when the system is in use.

[0049] Fig. 10 shows a preferred embodiment of the activation header 7 comprising a lamp 15 indicating whether the lifting system 1 is active or not. Moreover, the activation header 7 may comprise a button 16 for opening the door 8. It includes two buttons for choice of transportation direction, one button 17 for lifting up and one button 18 to for lifting down. Furthermore the activation header 7 comprises a photoelectric cell 19 which detects if a person crosses the photocell area. With the detection, it is possible to let the control system of the lifting system 1 know whether the lifting system is empty or not.

[0050] An activation header 7 is positioned at each level of the lifting system 1 allowing persons at any level to activate the system. The activation header 7 positioned at the low level, having no door or bar, does not have the button 16 for opening of the door 8.

[0051] Together with other security measures, the photocells 19 and the detector means are all serially connected with the driving means 10 allowing any one of them to stop the lifting system in case of malfunction of any kind.

List of reference number for the figures

[0052]

- | | | |
|----|----------|---------------------------------------|
| 5 | 1. | Lifting system |
| | 2. | Steps |
| | 3a. | Banisters |
| | 3b. | Lifting control |
| | 4a. | Vertical guide rail |
| 10 | 4b. | Horizontal guide rail |
| | 5a. | Banister wire or rod |
| | 5b. | Vertical banister wire or rod |
| | 6. | Wheelchair user |
| | 7. | Activation header |
| 15 | 8. | Door: Locked/unlocked or bar: Up/down |
| | 9. | Sliding guide such as a wheel |
| | 10. | Drive means |
| | 11. | Lifting means |
| | 12a. | Frame |
| 20 | 12b-12c. | Detector means |
| | 13. | Wheel for sliding wagon |
| | 14. | Sliding wagon |
| | 15-19. | Buttons on activation header |
| | A. | First section including lifting means |
| 25 | B. | Second section |
| | C. | Flexible connection |
| | D. | Wall or a similar vertical surface |
| | E. | Side members |
| | F. | Flexible connection |

Claims

- | | | |
|----|----|---|
| 35 | 1. | Lifting system for a stairway comprising |
| | | a first section (A) including lifting means (10, 11), |
| | | a second section (B) including |
| 40 | | a number of steps (2), |
| | | step controlling means (3, 5a, 5b) and |
| 45 | | sliding means (4b, 9), |
| | | and |
| 50 | | at least one flexible connection (C) connecting said first (A) and second sections (B). |
| 55 | 2. | Lifting system according to claim 1, wherein said lifting means (10, 11) further comprises a number of substantially vertical guide rails (4a), and preferably two. |
| | 3. | Lifting system according to claim 1 or 2, wherein said substantially vertical guide rails (4a) are |

mounted on a wall (D) or a similar vertical surface.

4. Lifting system according to any of claims 1 to 3,
wherein said lifting means (10, 11) comprises drive
means (10) such as electric or hydraulic motors. 5
5. Lifting system according to any of claims 1 to 4,
wherein said step controlling means (3, 5a, 5b)
comprises one or more banisters (3) and connec-
tion means (5a, 5b) connecting said banisters to 10
said steps (2).
6. Lifting system according to any of claims 1 to 5,
wherein said connection means (5a, 5b) is connect-
ed to said steps (2) in close proximity to the front 15
and rear edges of said steps (2), respectively.
7. Lifting system according to any of claims 1 to 6,
wherein said sliding means (4b, 9) comprises a
number of substantially horizontal guide rails (4b), 20
and preferably two.
8. Lifting system according to any of claims 1 to 7,
wherein said sliding means (4b, 9) comprises slid-
ing guides (9) for entering into said horizontal guide 25
rails (4b).
9. Lifting system according to any of claims 1 to 8,
wherein said first section (A) further includes a door
(8), a bar or another access controlling means. 30
10. Lifting system according to any of claims 1 to 9,
wherein the number of steps is between 1 and 15.
11. Method of lifting cargo/person(s) by means of a lift- 35
ing system from one level to another, said method
comprising the steps of
 - lifting a first section (A) by means of lifting
means (10, 11), 40
 - lifting a second section (B) including a number
of steps (s),
 - said lifting of said second section (B) being per- 45
formed through a flexible connection (C) to said
first section (A), and
 - said at least one sliding guide (9) of said second
section (B) sliding in a horizontal guide rail dur- 50
ing said lifting.
12. Method of lifting cargo/person(s) according to claim
11, whereby step controlling means (3, 5a, 5b) con- 55
trols said number of steps.

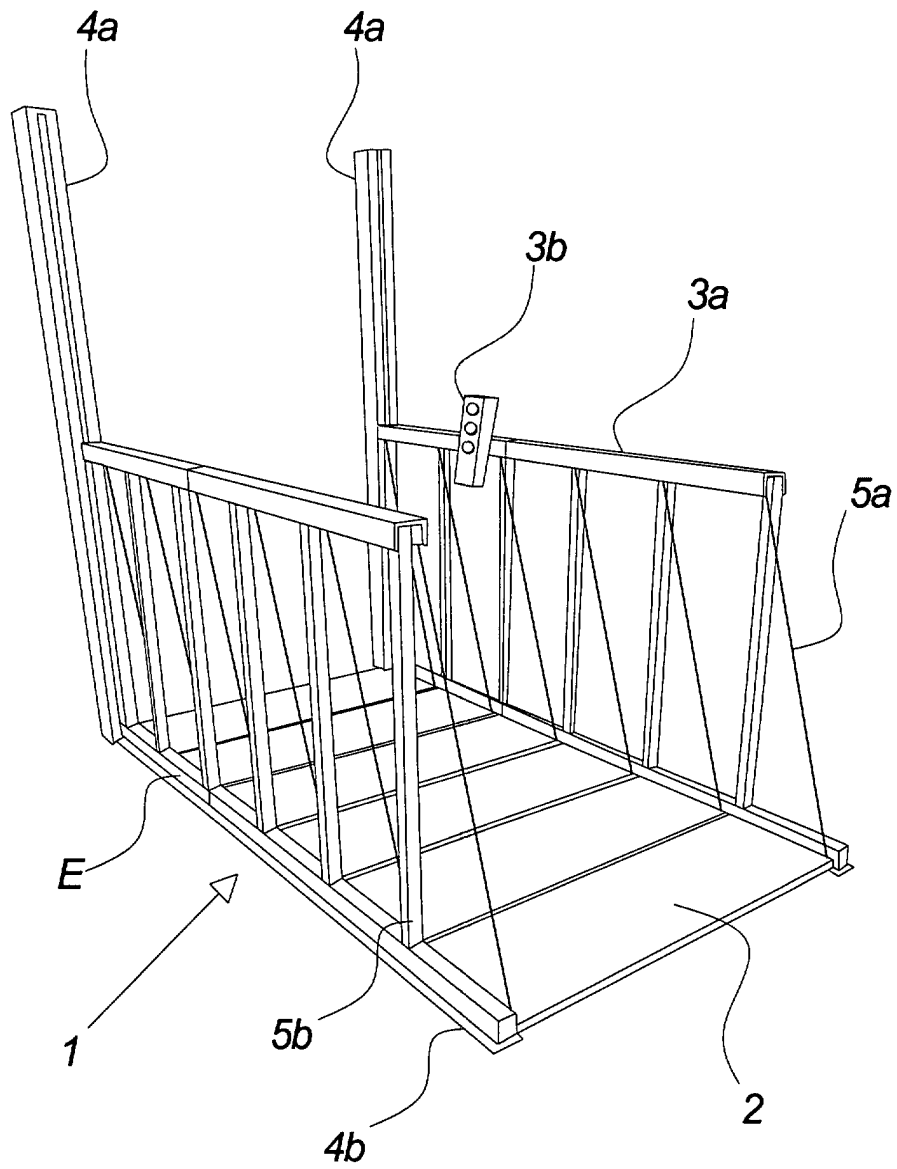


Fig. 1a

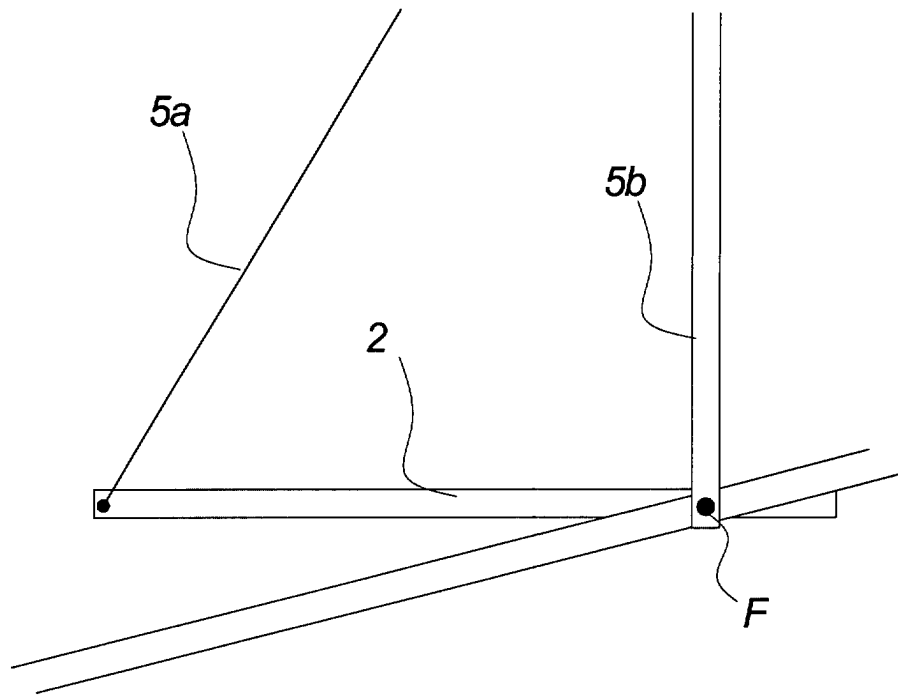
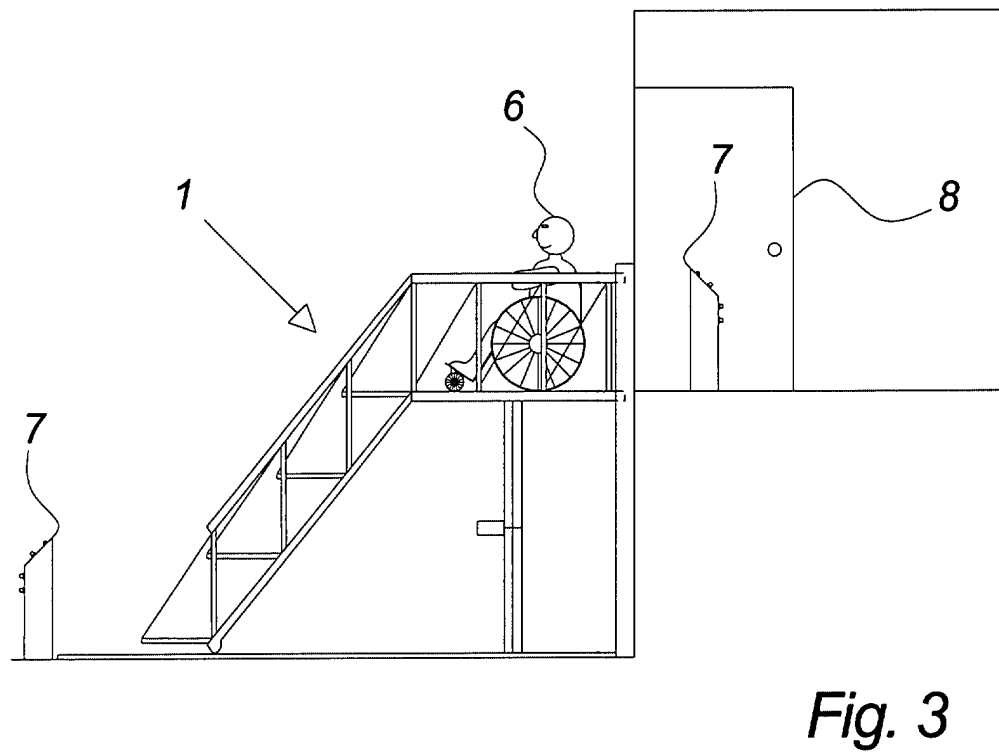
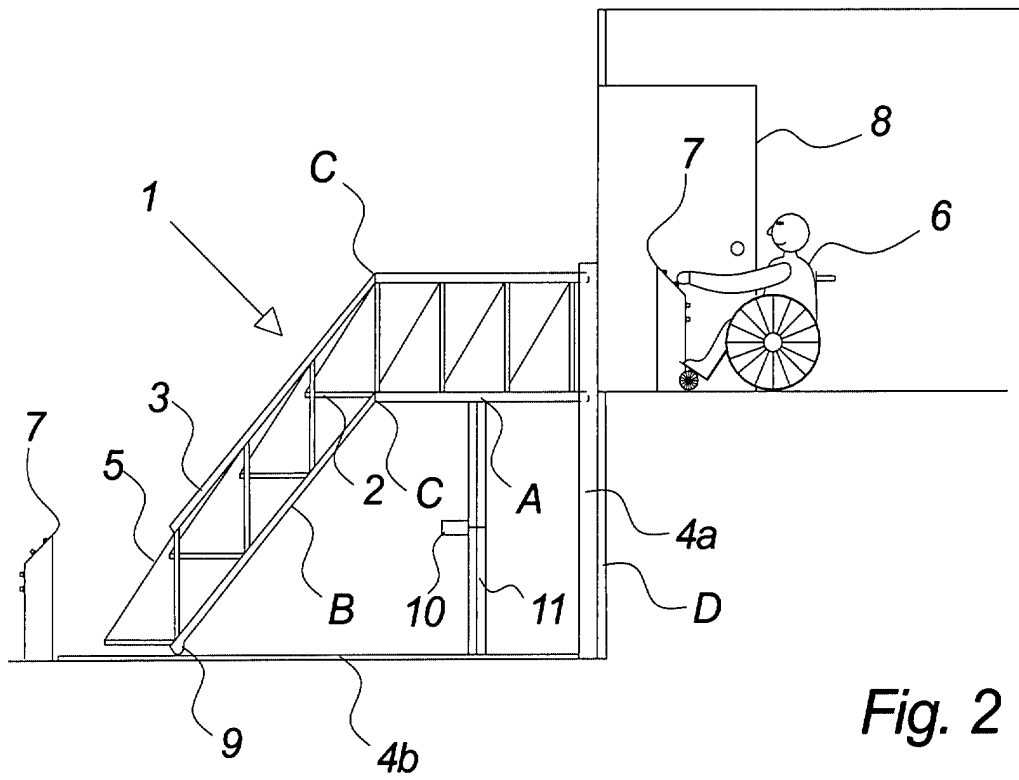


Fig. 1b



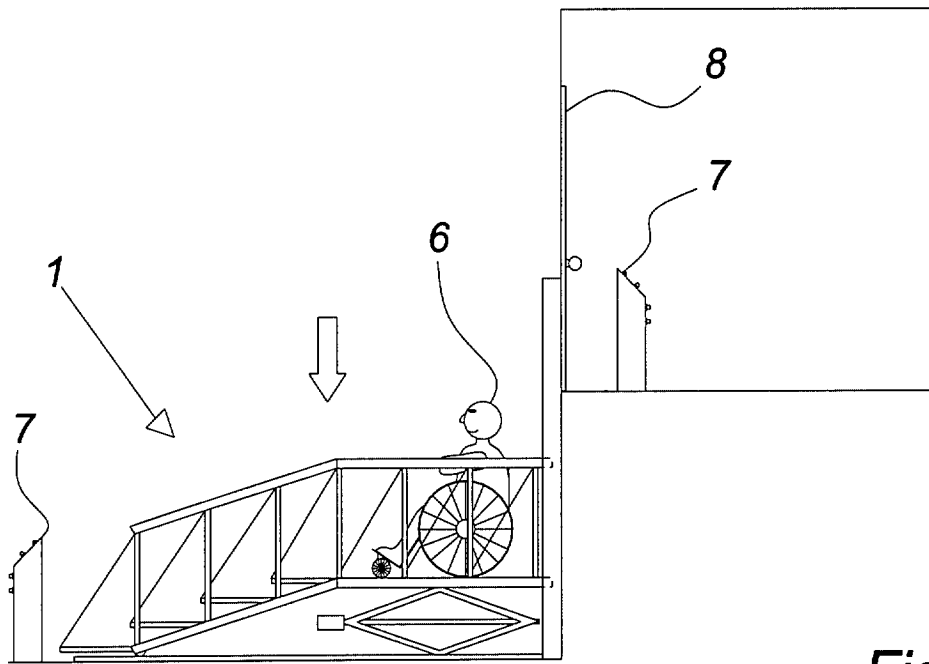


Fig. 4

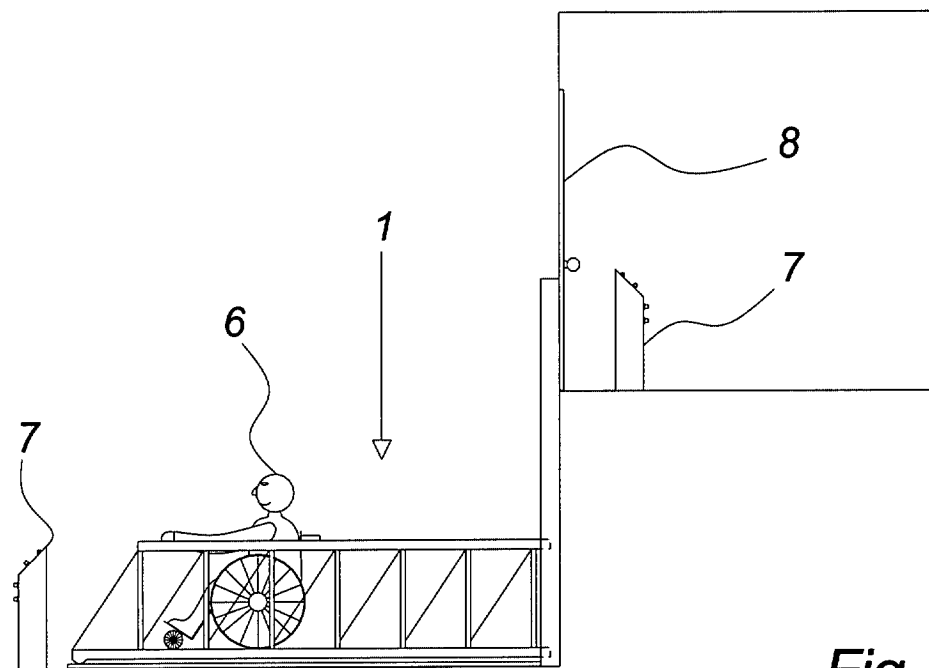
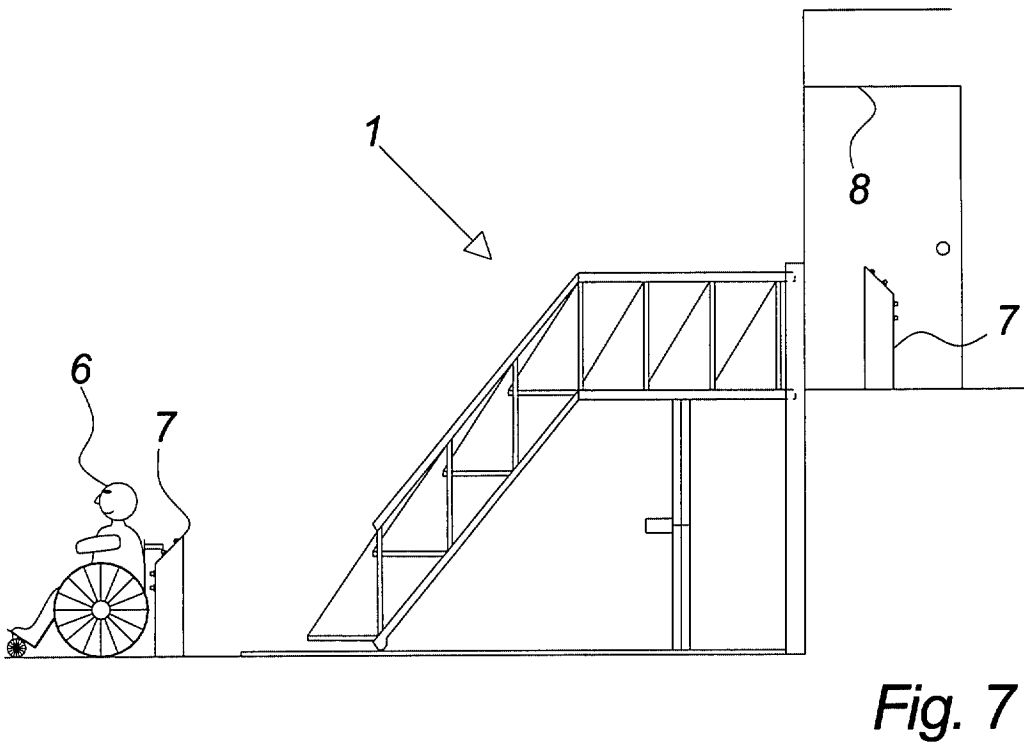
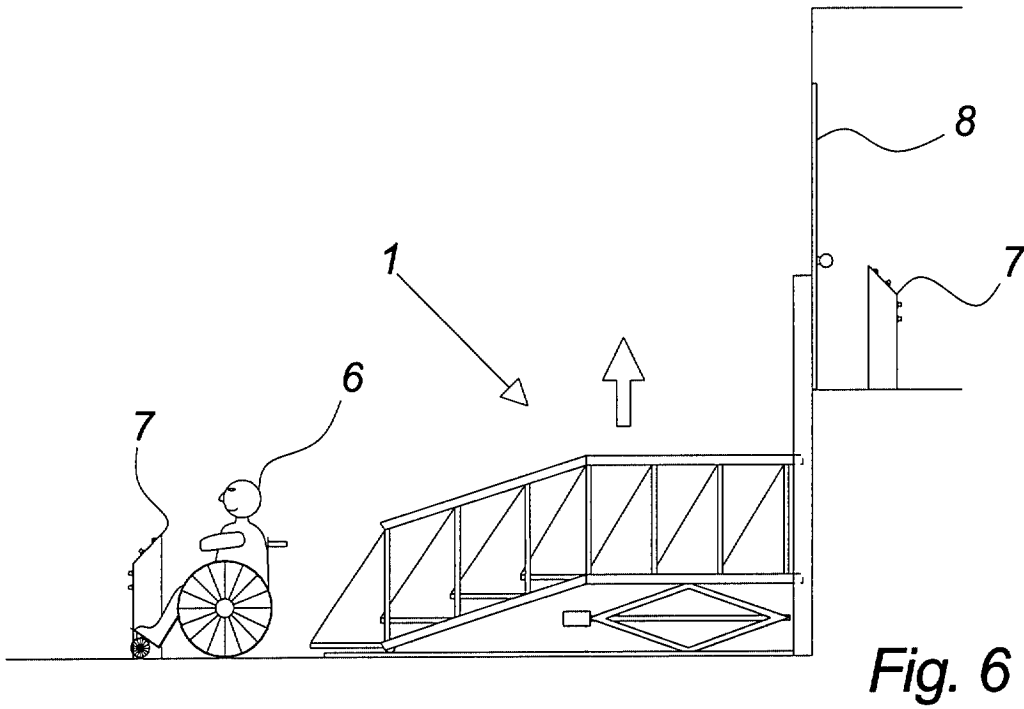
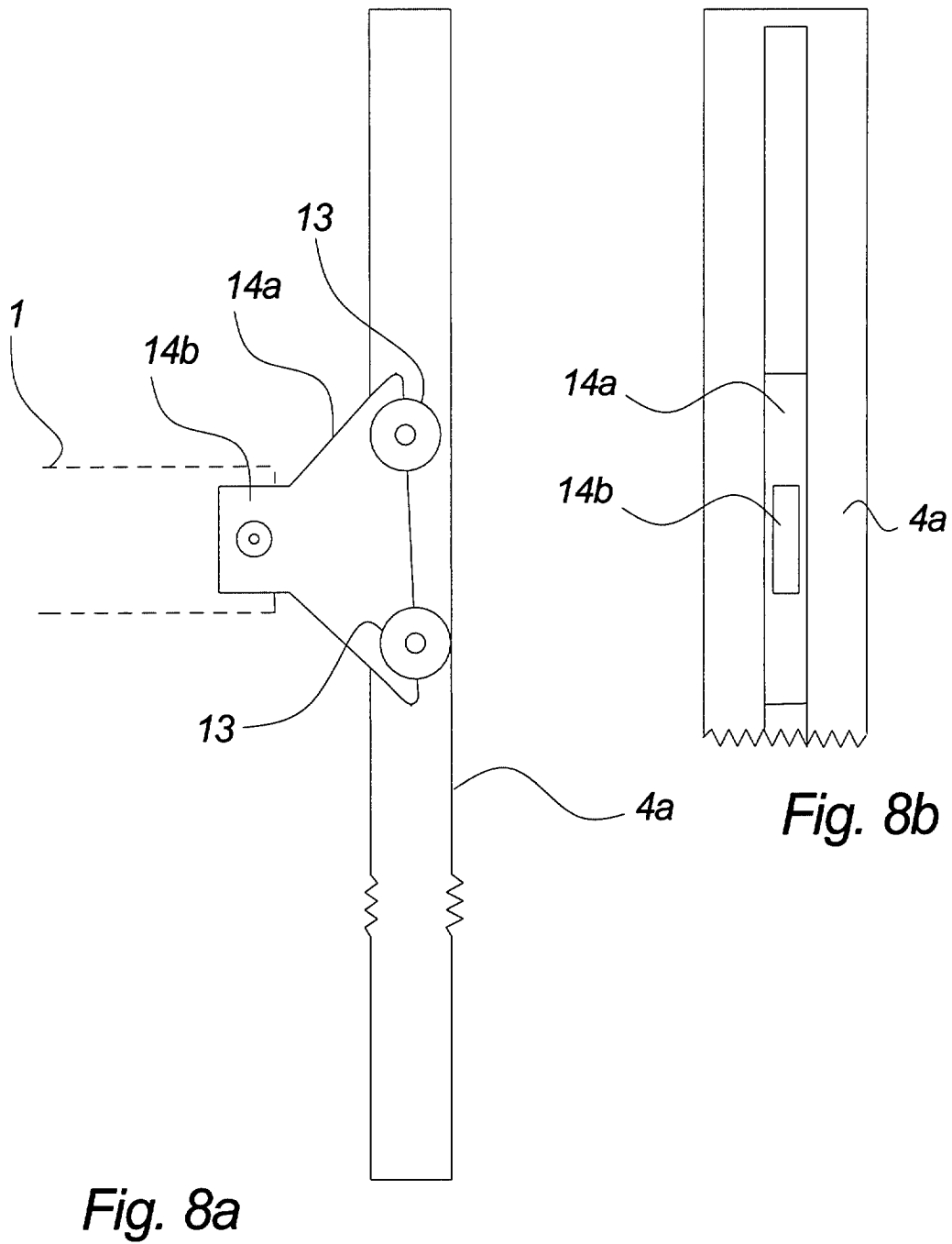


Fig. 5





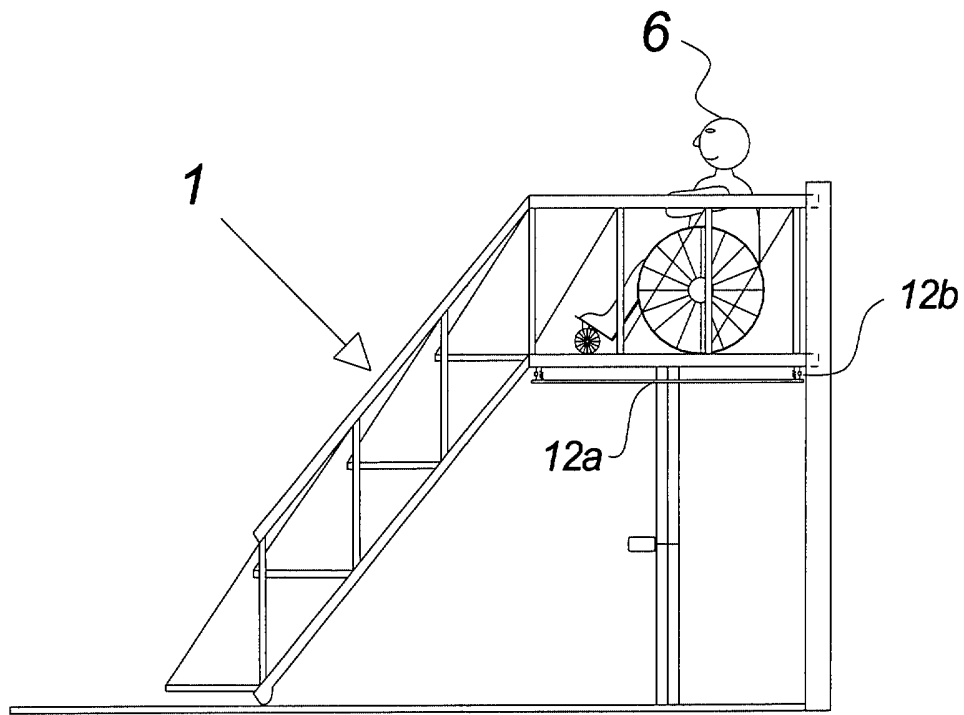


Fig. 9a

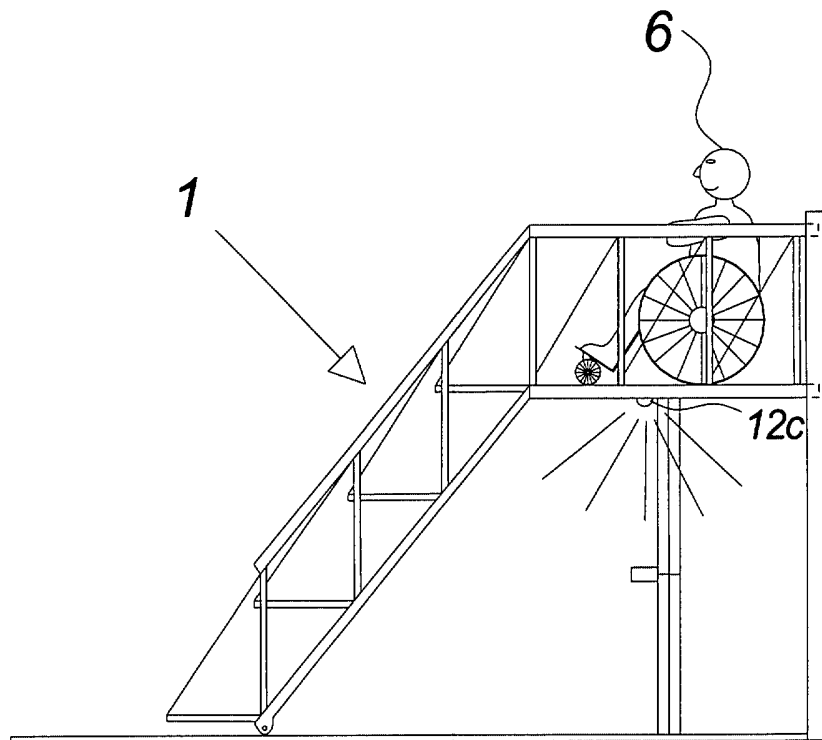


Fig. 9b

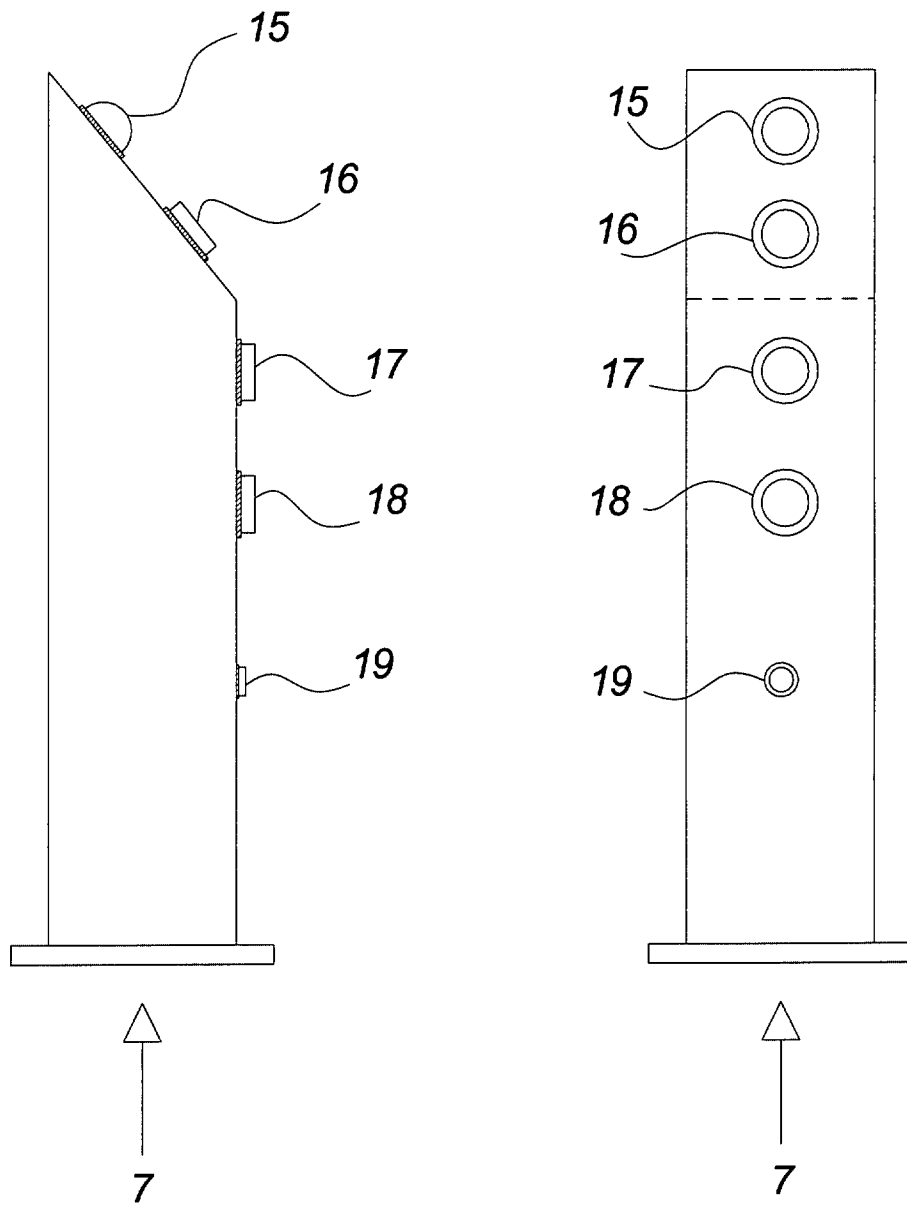


Fig. 10



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 20 1651

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 August 2001	Janssens, G
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 (P04/C01)

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

EP 01 20 1651

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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