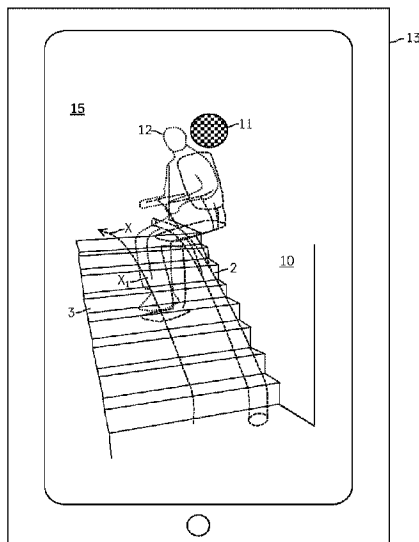




(86) Date de dépôt PCT/PCT Filing Date: 2018/04/19
(87) Date publication PCT/PCT Publication Date: 2018/10/25
(45) Date de délivrance/Issue Date: 2023/04/25
(85) Entrée phase nationale/National Entry: 2019/10/16
(86) N° demande PCT/PCT Application No.: EP 2018/060044
(87) N° publication PCT/PCT Publication No.: 2018/193034
(30) Priorité/Priority: 2017/04/20 (US62/487,624)

(51) Cl.Int./Int.Cl. *B66B 9/08* (2006.01)
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(54) Titre : PROCEDE DE PLANIFICATION DE PLATE-FORME ELEVATRICE
(54) Title: METHOD OF PLANNING A PLATFORM LIFT



(57) Abrégé/Abstract:

Method of planning a platform lift (1), in particular a stairlift (1), at a stair (3), the platform lift (1) comprising a rail (2), a platform (8), in particular a chair (8), a drive unit (6) for driving the platform (8) along the rail (2), the platform (4) is attached to the drive unit (6), the method comprising the steps - utilizing an augmented reality device (13); - acquiring 3D-data of a stair (2) on which the platform lift (1) is to be installed; - calculating based on the acquiring 3D-data and predetermined clearance information (C) a path of travel (D) of the rail (2); - visualizing at least parts (2, 6), in particular the rail (2) or the platform (6), of the platform lift (1) in accordance with the calculated path of travel (D) by means of the augmented reality device (13), wherein acquiring 3D-data of the stair (2) comprising the follow steps: - observing an area of the stair (2) with the help of the augmented reality device (13); - marking a location of the stair, in particular with the help of a marker (14), thereby in particular confirming the location of the marking via a user input; - continue with subsequently marking several locations at the stairs (2); - extracting surface information via a computer based analysis on the markings and optical information taken by the augmented reality device (13); and based on the optical information and predetermined clearance information calculating the path of travel (D).

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
25 October 2018 (25.10.2018)



(10) International Publication Number
WO 2018/193034 A1

(51) International Patent Classification:
B66B 9/08 (2006.01)

(21) International Application Number:
PCT/EP2018/060044

(22) International Filing Date:
19 April 2018 (19.04.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/487,624 20 April 2017 (20.04.2017) US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,

(54) Title: METHOD OF PLANNING A PLATFORM LIFT

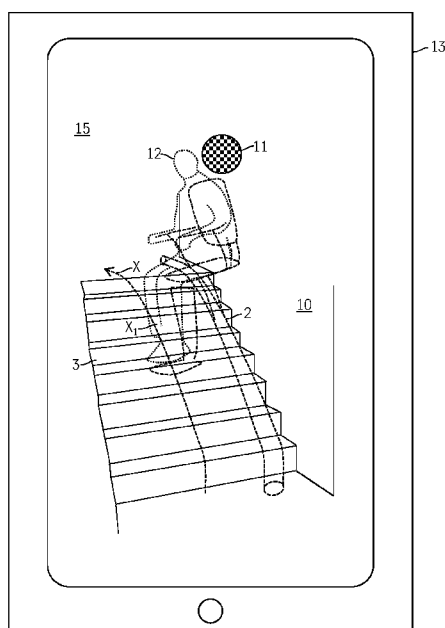


Fig. 9

(57) Abstract: Method of planning a platform lift (1), in particular a stairlift (1), at a stair (3), the platform lift (1) comprising a rail (2), a platform (8), in particular a chair (8), a drive unit (6) for driving the platform (8) along the rail (2), the platform (4) is attached to the drive unit (6), the method comprising the steps - utilizing an augmented reality device (13); - acquiring 3D-data of a stair (2) on which the platform lift (1) is to be installed; - calculating based on the acquiring 3D-data and predetermined clearance information (C) a path of travel (D) of the rail (2); - visualizing at least parts (2, 6), in particular the rail (2) or the platform (6), of the platform lift (1) in accordance with the calculated path of travel (D) by means of the augmented reality device (13), wherein acquiring 3D-data of the stair (2) comprising the follow steps: - observing an area of the stair (2) with the help of the augmented reality device (13); - marking a location of the stair, in particular with the help of a marker (14), thereby in particular confirming the location of the marking via a user input; - continue with subsequently marking several locations at the stairs (2); - extracting surface information via a computer based analysis on the markings and optical information taken by the augmented reality device (13); and based on the optical information and predetermined clearance information calculating the path of travel (D).

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WO 2018/193034 A1

WO 2018/193034 A1

TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

Method of planning a platform lift

The invention refers to a method of planning a platform lift, in particular a stairlift.

EP 1 554 210 A1 discloses a platform lift for the use of a disabled person in a wheelchair. WO 2013/129923 A1 discloses a platform lift in the form of a stairlift. In both cases the platform is part of a drive unit which travels along at least one guide rail. A leveling mechanism is provided to hold the platform always in a horizontal orientation, even if the inclination angle of the guide rail is changing along the path of travel. In particular the rail of such platform lifts has curved shape, like shown in figure 3 of WO 2015/052489 A1.

WO 2013/129923 A1 discloses a stairlift. The stairlift comprises a chair mounted on a drive assembly. The drive assembly travels along at least one guide rail. A leveling mechanism is provided to hold the chair always in a horizontal orientation, even if the inclination angle of the guide rail is changing.

In particular in small houses, where the stairs are narrow and/curved, the purchaser, which is later the user of the stairlift, cannot imagine, how the stairlift could fit into the stairs. It is often difficult to provide a real impression on the dimensions of the stairlift compared to the surrounding area of the stairlift merely from drawings or prospects. An additional problem is to deal with bottleneck areas or obstacles at the staircase.

It is an object of the present invention to improve the described situation. The object is solved by a method of planning a platform lift, in particular a stairlift, at a stair, the platform lift comprising

a rail,

a platform, in particular a chair,

a drive unit for driving the platform along the rail,

the platform is attached to the drive unit.

In particular the method comprising the steps:

- **utilizing** an augmented reality device;
- **acquiring** 3D-data of a stair on which the platform lift is to be installed;
- **calculating** based on the acquiring 3D-data and predetermined clearance information a path

of travel of the rail;

- **visualizing** at least parts, in particular the rail or the platform, of the platform lift in accordance with the calculated path of travel by means of the augmented reality device.

Here the appearance of the parts of the platform lift can be simulated by means of the augmented reality device. The user can get a realistic visual impression of the appearance of the stairlift, without the need to install a prototype or similar. Also, the overall effort of planning is reduced.

In particular the step acquiring 3D-data of the stair comprising the follow steps:

- **observing** an area of the stair with the help of the augmented reality device;
- **marking** a location of the stair, in particular with the help of a marker, thereby in particular confirming the location of the marking via a user input;
- **continue** with subsequently marking several locations at the stairs;
- **extracting** surface information via a computer based analysis on the markings and optical information taken by the augmented reality device;

and

based on the optical information and predetermined clearance information **calculating** the path of travel.

Here the path of travel, which constitutes the basis for all further visualizations, is calculated with the help of the extracted surface information. By marking several important or structures of the stairs are highlighted, which are relevant for extracting the relevant surface information.

In particular the platform, in particular a seat, is visualized along the calculated path by means of the augmented reality device. The user can now get an impression of the spatial condition, when a real platform is traveling along the real rail. Also for the planning important information can be obtained by the respective visualization.

In particular a passenger is visualized along the calculated path by means of the augmented reality device, in particular located on the visualized platform. Here a person sitting on the platform can be simulated; in particular large person can be visualized, which may have

problems with obstacles during the course of travel. Therefore, in particular the stature, in particular the magnitude, of the visualized person is adapted based on a user input.

In particular the platform and/or the person is/are visualized in various locations in accordance with the path of travel. Thereby Specific situations can be simulated. In particular the platform and or the person is/are visualized in various orientations at the same location of the path of travel, in particular swiveled around a vertical axis and/or tilted around a horizontal axis upon a user input. In particular a collision situation with a real obstacle and the visualization of parts of the platform lift or the visualization of the person is determined by bringing the visualization of parts of the platform lift or the visualization of the person in the zone of influence of the obstacle, wherein the visualization of parts of the platform lift or the visualization of the person is in accordance with the path of travel. Here a collision situation can be simulated. If the visualization shows a collision between the user or platform lift and a obstacle, a real collision of the real platform lift is likely. In this case a redesign of the rail can be briefly planned, avoiding extensive costs.

In particular for avoiding a collision between an obstacle and the visualization of parts of the platform lift or the visualization of the person, the visualization of the platform or of the user can be swiveled around a vertical axis and/or tilted around a horizontal axis upon a user input. By means of swiveling or tilting a collision can already be avoided. A redesign of the rail may become obsolete.

In particular a tilting angle or a swivel angle, which supports an avoidance of collision, is stored in a database in combination with a corresponding position along the path of travel. Later the real platform lift may be controlled with the help of the stored angle.

The object is further solved by a method for installing a platform lift, in particular a stairlift, at a stair, the platform lift comprising a method for planning as described above, wherein geometrical data of path of travel are used for manufacturing the rail.

In particular the method for installing a platform lift, in particular a stairlift, at a stair, the platform lift comprising a method for plaining as described above, wherein the stored tilting

angle or stored swivel angle is used during programming a control unit of the platform lift for controlling the tilting swiveling the platform during use.

In this context the term “visualization” of elements of the platform lift or the “visualization” of the person in accordance with the path of travel” means: when viewed with the help of the augmented reality device a picture appears at a position, which is realistic when the platform travels along the path of travel. So, the picture, which the user sees through the augmented reality device confirms widely with a real picture a user would see without the augmented reality device, if the lift would be installed base on the determined path of travel. So, if the display shows a collision with an obstacle, then this collision would happen in the real world as well, when the chair would drive along the real rail.

The invention is described in more detail by means of the figures, herein shows.

- figure 1 two conventional platform lifts in side view, on which the invention can be applied to;
- figure 2 augmented reality device in form of a tablet PC, a)in front view, b) in rear view;
- figure 3 a stair, at which a stair lift has to be installed;
- figures 4 and 5 the stair being watched with the help of the augmented reality device during marking with a marker;
- figure 6 a visualization of a stairlift comprising a rail along the stairs;
- figure 7 the visualization of figure 6 comprising a carrier and a chair;
- figure 8 an isolated visualization of the chair in different orientations;
- figure 9 the visualization of figure 7 comprising a person sitting on the chair in the near to an obstacle;

Figure 1 shows two exemplary embodiments of a generic platform lift 1, to which the invention can be applied. In figure 1a a platform lift 1 for the use with a wheelchair is shown. The platform 8 therefore comprises a kind of lifting ramp, which can travel along a direction of travel D from a first landing area 4 to a second landing area 5. The direction of travel D is defined by a rail 2, and is limited in main by the course of an existing stairway 3 in a house. An alternative embodiment is shown in figure 1b wherein the platform 8 comprises a seat.

The rail 2 has a curved shape, which deviates from a straight line; thus the direction of travel will change at least once during the course of the rail 2.

The platform 8 is part of a drive unit 6, which further comprises a carrier 7. The carrier 7 has non-shown rollers, which roll along the rail 2. For driving the carrier 7 positive engagements means 12 (only shown in detail in figure 1b) are provided on the rail 2, which cooperates with driving means, in particular a driven pinion (not shown), of the drive unit 6. A leveling mechanism 9 is provided on the drive unit 6, to keep the platform 8 always in a horizontal orientation, even if the inclination of the rail 2 varies during its course.

Figure 2 shows augmented reality device 13, here a tablet PC, which is used during the further course of the planning. However, there are lot of other augmented reality devices possible for use within this application. The augmented reality device 13 comprise a display 15, on which a virtual reality visualization can be displayed. One or more cameras 16, and optionally an IR sensor, are provided for acquiring optical 3D-information of the field of view. The augmented reality device 13 comprises an integrated computer or is connected to an external computer.

Figure 3 shows a stair 3 attached to a wall 10, on which the platform lift 1 is to be installed. In a first step the user takes a marker and marks a characteristic area of the stair, here a corner of the stair. Thereby the user confirms the position to be marked by a user input, e.g. by a spoken word, a confirmation gesture or a keyboard input, as it relates to the area of the stair

The marker related to the stair may be any hardware device, the location and orientation of which may be captured electronically. Said marker may comprise any machine readable elements, e.g., a specific optical appearance and/or RF tags and/or orientation sensors, which may give a signal about its location and/or orientation to a sensor, in particular a camera or RF sensor.

Subsequently the computer analyses the information obtained in particular by sensors of the augmented reality device in the area of the marking and extracts spatial surface information of the observed area, here the stairs and the adjacent wall. The surface of the stairs and the wall is extracted and virtually provided with geometric triangles 17, so that the user can see, which surface is already observed and analyzed (figure 4). In figure 5 more surfaces are analyzed; thus

more surfaces are virtually provided with triangles. In this manner the stair is to be completely analyzed.

The user has now the opportunity to decide, on which side of the stair 3 the rail 2 is to be arranged. In this example the user selects the right side. The computer now retrieves clearance parameters C from a database. This clearance parameters C contain e.g. minimum distances between the rail and an adjacent surface such as the wall 10 or the stair 3. Based on this parameters C the computer calculates the path of travel D. Subsequently a matching visualization of a rail 2 is added around to the path of travel D and is put out via the display 15.

Now the user sees on the display if the augmented reality device a picture of the real stairs 3 and a virtual rail 2 (figure 6). The user can now select, that a virtual platform 8 is added to the visualization (figure 7). Upon user input the virtual platform 8 can travel along the virtual rail 3. The purchaser can now get a virtual model of the stairlift which may provide a real impression.

Upon user input the orientation of the platform virtual can be changed. So the virtual platform 8 may be swiveled around a vertical axis V (figure 8a) and/or may be tilted around a horizontal axis H (figure 8a), as a real chair of a chairlift can do, e.g. as described in European patent application 16 156 184.0 (not yet published).

Figure 11 shows also a visualization of a virtual passenger 12 sitting on the seat 8, visualized by the display 15 of the virtual reality device 13. The stature of the passenger 12 can be changed by a user input and can be adapted to the real purchaser of the lift. With the help of the visualization of the passenger sitting on the seat it is possible to detect a virtual collision of the passenger 12 with a real obstacle 11. To avoid the collision virtually and also the real world, the orientation of the platform 8 or the course of the path of travel D can be changed, as shown in 12. In this example, the virtual chair is a little bit tilted in forward direction, so that the virtual head of the passenger 12 is not touching the real obstacle 11. This orientation is stored in a database and linked to the respective position X_1 along the rail.

During installation of the real platform lift, the geometric data of the path of travel, which was obtained in the previous method for planning, can be retrieved from a database and can be used to manufacture the rail. In another step the real stairlift can be programmed in a manner,

that the real chair will perform the same orientation at the position X_1 as determined during the planning, so that a collision with the obstacle 11 is prevented during the usage of the real stairlift.

List or reference signs

- | | |
|----|--------------------------------------|
| 1 | platform lift |
| 2 | rail |
| 3 | stairs |
| 4 | first landing area |
| 5 | second landing area |
| 6 | drive unit |
| 7 | carrier |
| 8 | platform / seat |
| 9 | leveling mechanism |
| 10 | wall |
| 11 | obstacle |
| 12 | passenger (not the user) |
| 13 | augmented reality device / tablet PC |
| 14 | marker |
| 15 | display |
| 16 | camera |
| 17 | geometric triangle |
| | |
| D | path of travel D |
| X | position along path of travel |
| V | vertical axis |
| H | horizontal axis |
| C | clearance parameter |

Claims

1. A method of planning a platform lift at a stair, the platform lift comprising
a rail,
a platform,
a drive unit for driving the platform along the rail (2),
wherein the platform is attached to the drive unit,

the method comprising the steps

- **utilizing** an augmented reality device;
- **acquiring** 3D-data of a stair on which the platform lift is to be installed;
- **calculating** based on the acquired 3D-data and predetermined clearance information a
path of travel of the rail;
- **visualizing** at least parts of the platform lift in accordance with the path of travel by
means of the augmented reality device, and **visualizing** the platform and/or a passenger
by means of the augmented reality device in various locations in accordance with the
path of travel; and
- **manufacturing** the rail of the platform lift using geometrical data of the path of travel.
2. The method according to claim 1, wherein the platform lift is a stairlift.
3. The method according to claim 1 or 2, wherein the platform is a chair or a seat.
4. The method according to any one of claims 1 to 3, wherein the step of **visualizing** at
least parts of the platform comprises visualizing the rail or the platform.
5. The according to any one of claims 1 to 4,
wherein the step of **visualizing** at least parts of the platform comprises
visualizing the platform along the path of travel by means of the augmented reality
device.
6. The method according to any one of claims 1 to 5,
comprising

- visualizing** the person along the path of travel by means of the augmented reality device.
7. The method according to claim 6, wherein the visualized person is located on the visualized platform.
 8. The method according to claim 7,
wherein
the stature of the visualized person is adapted based on a user input.
 9. The method according to claim 8,
wherein
the stature of the visualized person is the magnitude of the visualized person.
 10. The method according to any one of claims 1 to 9,
wherein the step of **acquiring** 3D-data of the stair comprises the follow steps:
 - **observing** an area of the stair with the help of the augmented reality device;
 - **marking** a location of the stair thereby confirming the location of the marking via a user input;
 - **continuing** with subsequently marking several locations at the stair; and
 - **extracting** surface information via a computer based analysis on the markings and optical information taken by the augmented reality device;and wherein the step of **calculating** the path of travel uses the optical information and predetermined clearance information.
 11. The method according to claim 10, wherein the step of **marking** a location is performed with a marker.
 12. The method according to any one of claims 1 to 11,
wherein
the platform and/or the person is visualized in various orientations at the same location of the path of travel.

13. The method according to claim 12, wherein the platform and/or the person is visualized in various orientations at the same location of the path of travel swiveled around a vertical axis and/or tilted around a horizontal axis upon a user input.
14. The method according to any one of claims 1 to 13, wherein
a collision situation with a real obstacle and the visualization of at least parts of the platform lift or the visualization of the person is determined by bringing the visualization of at least parts of the platform lift or the visualization of the person in the zone of influence of the obstacle, wherein the visualization of at least parts of the platform lift or the visualization of the person is in accordance with the path of travel.
15. The method according to any one of claims 1 to 14, wherein
for avoiding a collision between an obstacle and the visualization of at least parts of the platform lift or the visualization of the person, the visualization of the platform or of the user is swiveled around a vertical axis and/or tilted around a horizontal axis upon a user input.
16. The method according to any one of claims 1 to 15, wherein
a tilting angle or a swivel angle, which supports an avoidance of collision, is stored in a data base in combination with a corresponding position (X_1) along the path of travel.
17. A method for installing a platform lift at a stair, wherein the platform lift is planned using the method for planning according to any one of claims 1 to 16.
18. The method according to claim 17, wherein the platform lift is a stairlift.
19. A method for installing a platform lift at a stair, wherein the platform lift is planned using the method for planning according to claim 16, wherein the stored tilting angle or stored swivel angle is used during programming a control unit of the platform lift for controlling the tilting swiveling the platform during use.

20. The method according to claim 19, wherein the platform lift is a stairlift.

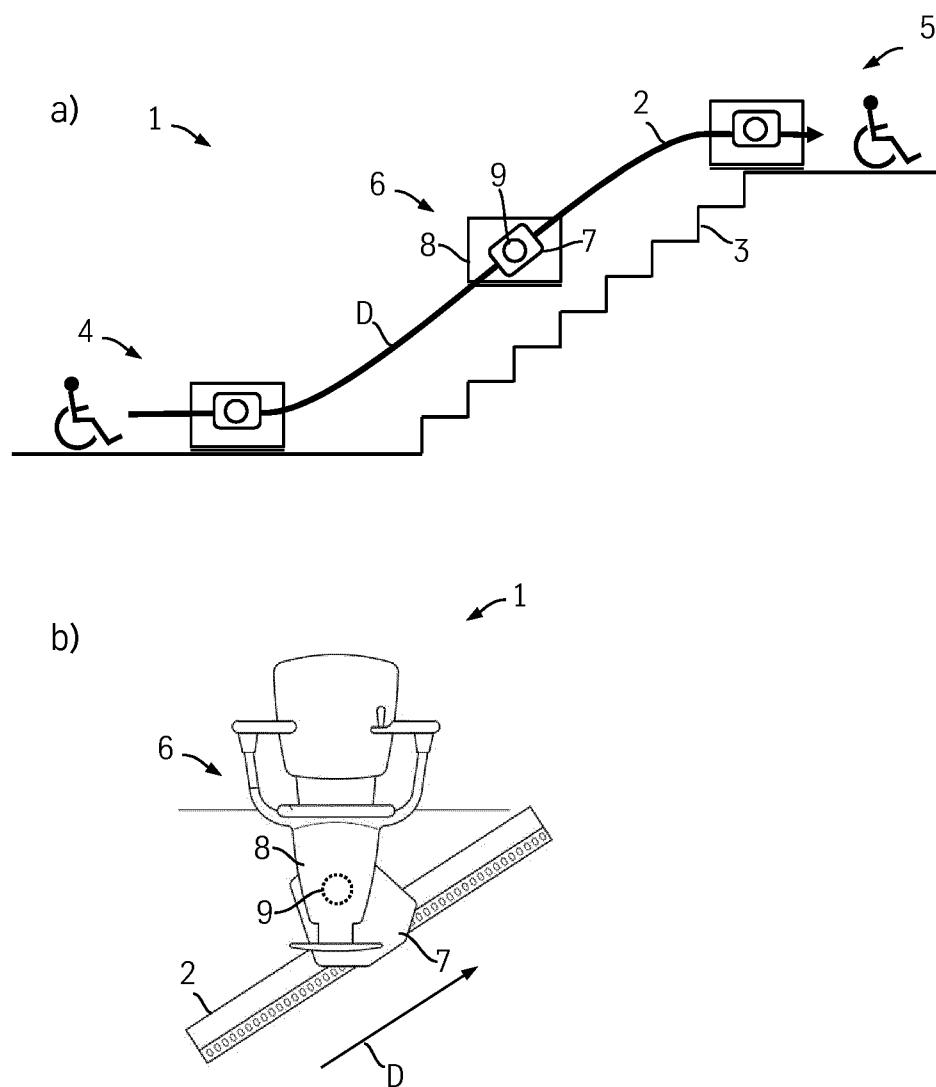


Fig. 1

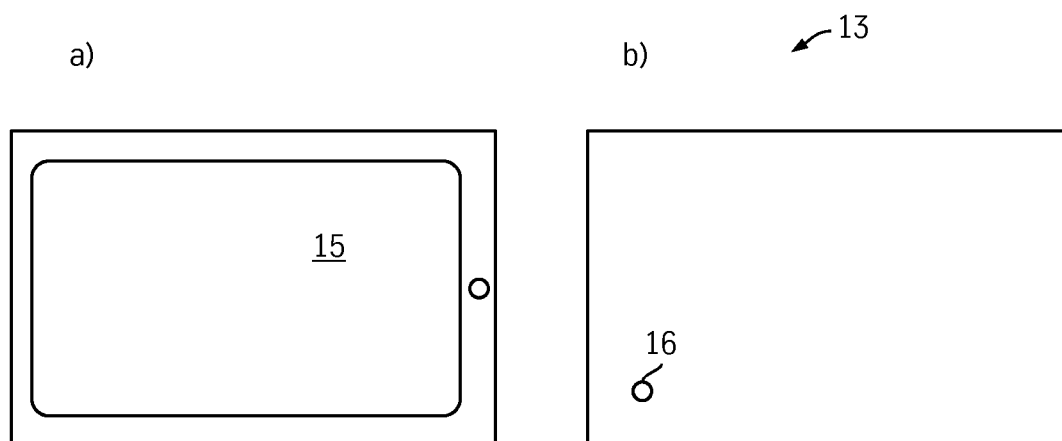


Fig. 2

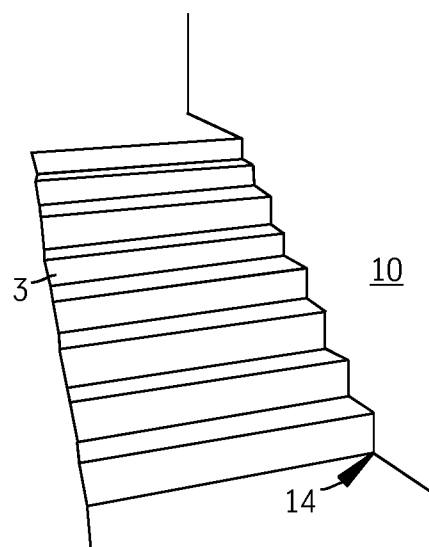


Fig. 3

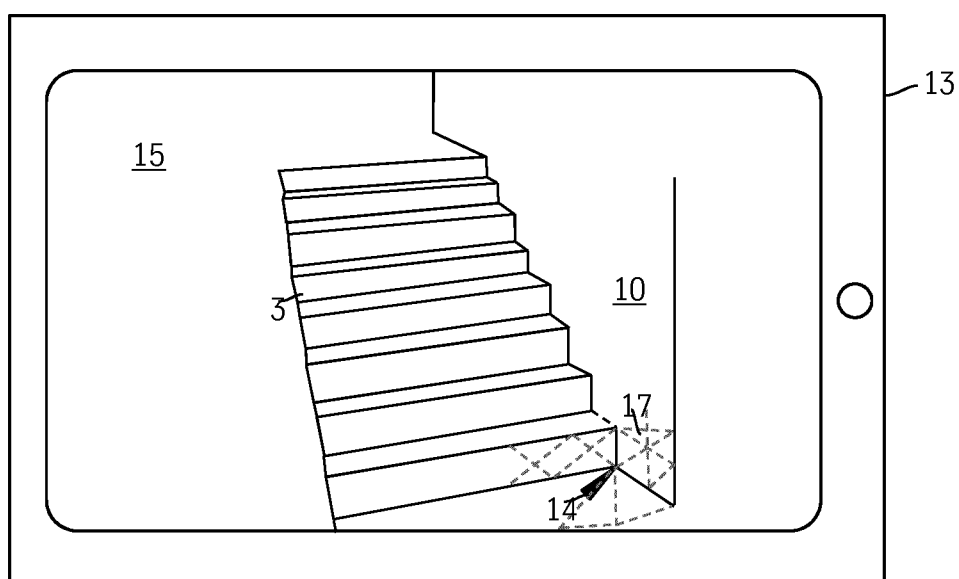


Fig. 4

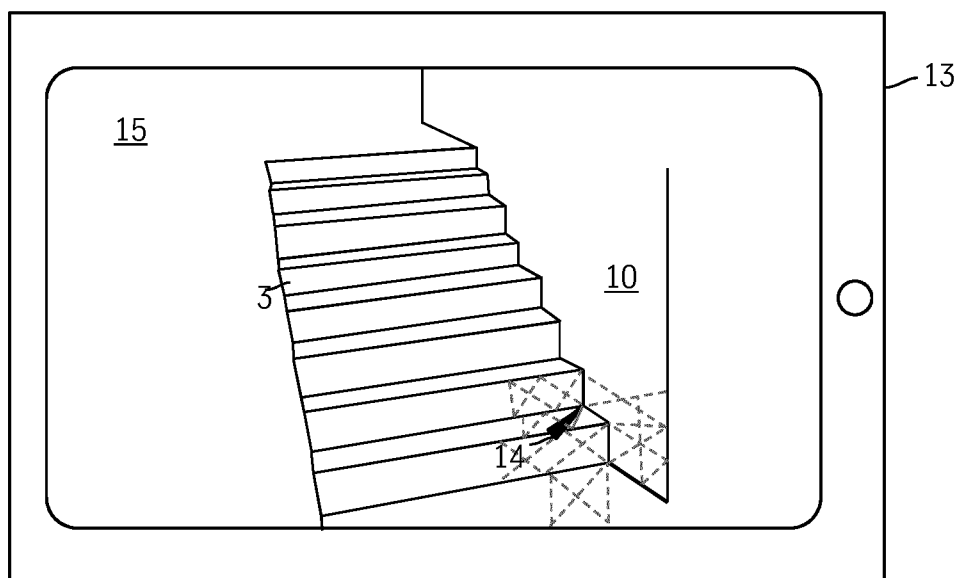


Fig. 5

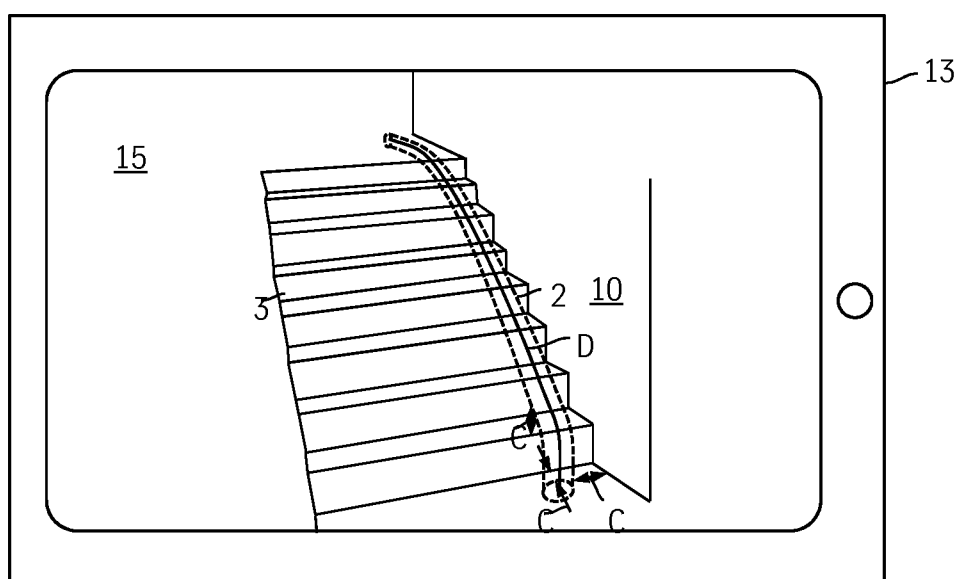


Fig. 6

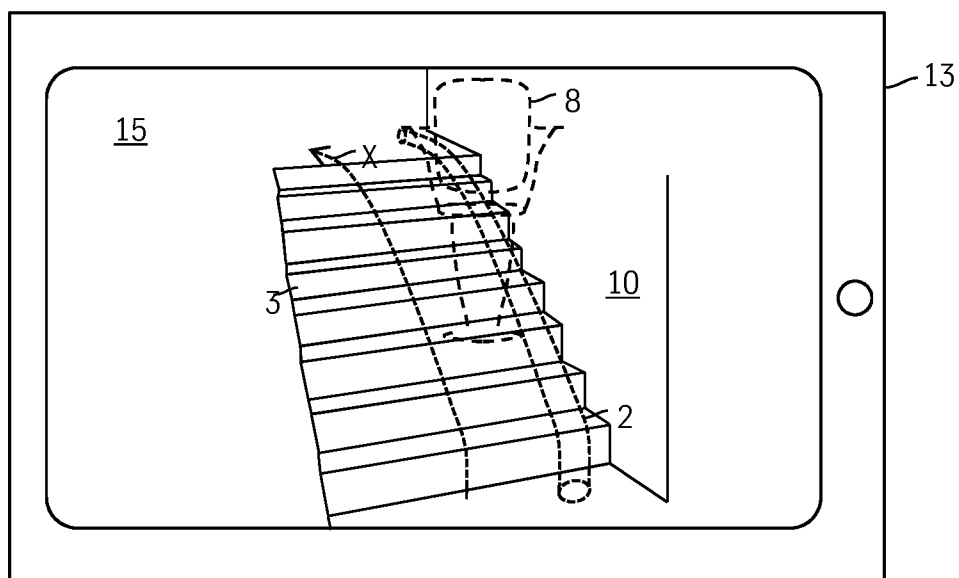


Fig. 7

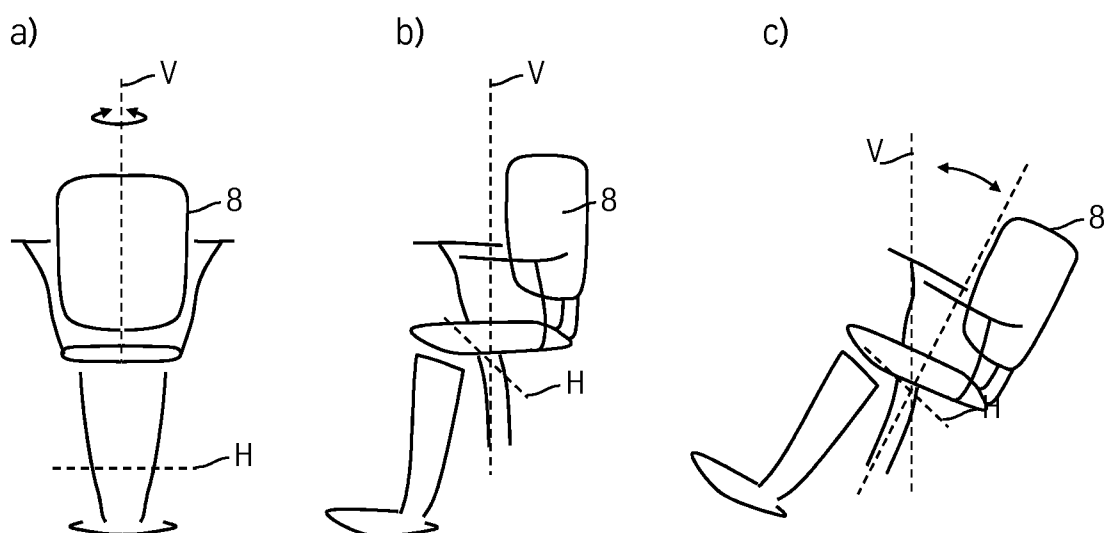


Fig. 8

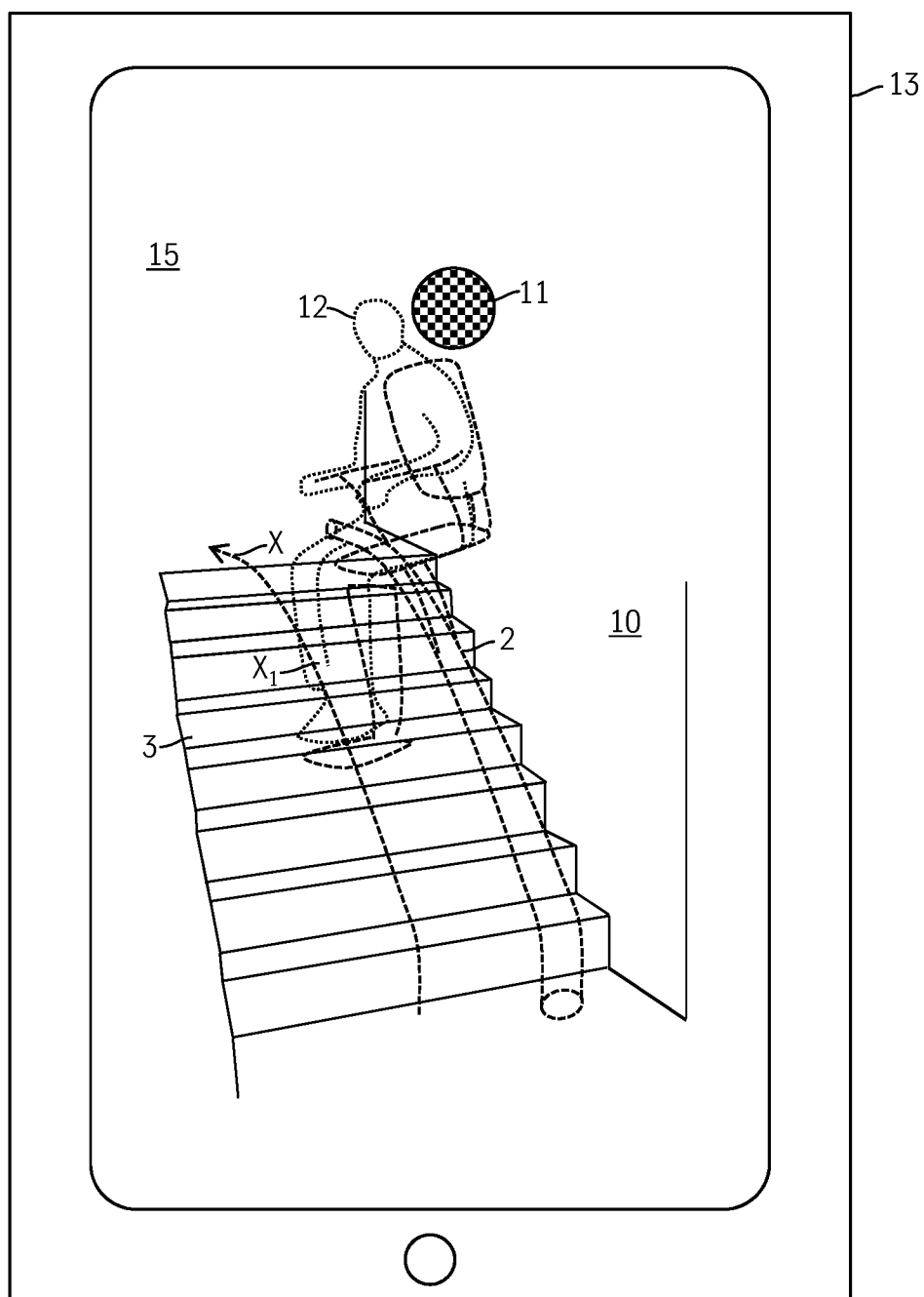


Fig. 9

