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(57) The present invention provides for pit service mode control unit for an elevator arrangement which exhibits at least one cabin arranged in a lift shaft and at least one drive unit, wherein the at least one cabin is coupled with the drive unit by means of at least one traction means interacting with the drive unit, wherein the control unit is coupled with or is configured to be coupled with a plurality of buttons or command input means providing for at least one control command commanding/controlling the drive unit to move/position the cabin to reach at least one predefined position depending on a predefined combination or sequence of the buttons or command input means. Thereby, the present invention relates to devices and methods for providing an elevator arrangement allowing for easy and safe activation of at least one constellation of a pit service mode. This configuration also allows for efficient and safe execution of any maintenance actions during pit service mode.

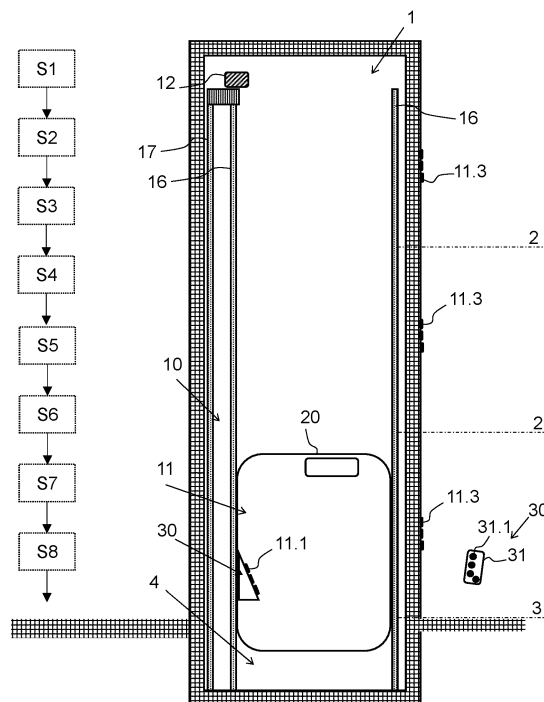


Fig. 1

Description

TECHNICAL FIELD

[0001] The present invention refers to a pit service mode control unit for an elevator arrangement which exhibits at least one cabin arranged in a lift shaft and at least one drive unit, wherein the at least one cabin is coupled with the drive unit by means of at least one traction means interacting with the drive unit, wherein the control unit is coupled with or is configured to be coupled with a plurality of buttons or command input means providing for at least one control command commanding/controlling the drive unit to move/position the cabin. The present invention also refers to elevator arrangements exhibiting such control units. Furthermore, the present invention refers to methods for switching to and controlling a pit service mode in an elevator arrangement. Furthermore, the present invention refers to use of at least one predefined sequence or combination of a specific type of buttons of an elevator arrangement for provision of at least one control command commanding/controlling a drive unit of the elevator arrangement. In particular, the present invention refers to control units and methods according to the respective present independent claim.

BACKGROUND

[0002] Elevator arrangements exhibiting at least one cabin arranged in a lift shaft may require, from time to time, maintenance or any other such measure for ensuring safe and proper operation. In particular, some of such measures have to be carried out while the cabin is positioned in at least one specific position in height. There is a need for easily and safely activating and accessing such constellation.

SUMMARY

[0003] It is an object of the present invention to provide for easy and safe activation of the at least one cabin of an elevator arrangement occupying an advantageous position within a lift shaft, for realizing a pit service mode. In particular, a/the object of the present invention is to provide for devices and methods allowing for predefining and controlling the cabin's position within the lift shaft such that at least one pit service mode constellation is realized.

[0004] The object of the invention is solved by the features of the independent main claims. Advantageous features are indicated in the subclaims. The features of the subclaims can be combined with the features of the main claims and further subclaims.

[0005] In particular, the object is therefore solved by a pit service mode control unit for an elevator arrangement which exhibits at least one cabin arranged in a lift shaft and at least one drive unit, wherein the at least one cabin is coupled with the drive unit by means of at least one traction means interacting with the drive unit, wherein the pit service mode control unit is coupled with or is configured to be coupled with a plurality of buttons and/or command input means providing for at least one control command commanding/controlling the drive unit to move/position the cabin to reach at least one predefined pit service mode position depending on a predefined combination or sequence of the buttons or command input means (i.e., when a predefined combination or sequence of the buttons or command input means is pressed/activated by a user). This also provides for easy and efficient handling for initiating a/the pit service mode.

[0006] The control functions according to the present disclosure also facilitate a maintenance technician to move the cabin during an inspection. In particular, the technician is enabled to easily control the elevator arrangement to move the cabin a defined distance from a/the momentary position when/by pressing a special sequence or combination of in-cabin call buttons. In particular, the technician is not required to actively drive the cabin. Preferably, the cabin or the elevator system in general comprises a plurality of sensing means configured for acquiring sensor data providing information about momentary conditions especially within the lift shaft, e.g. referring to the path of motion of the cabin. This allows for high security level also in context with automatic/autonomous driving of the cabin. For example, a first sequence or combination of in-cabin call buttons exerts a first control command commanding/controlling the drive unit to move/position the cabin from any floor to access the cabin roof. For example, a second sequence or combination of in-cabin call buttons exerts a second control command commanding/controlling the drive unit to move/position the cabin to perform a visual inspection of the cabin's bottom from the pit access floor. For example, a third sequence or combination of in-cabin call buttons exerts a third control command commanding/controlling the drive unit to move/position the cabin to reach components on the cabin's bottom from the pit access floor.

[0007] The at least one cabin is preferably guided by means of at least one cabin guide rail, wherein the elevator arrangement preferably exhibits at least one guide rail for at least one counterweight.

[0008] In the following, the pit service mode control unit is also referred to by simply mentioning a/the "control unit", especially since the pit service mode control unit can (optionally) be provided in the form of a separate control unit specifically provided for (especially exclusively) controlling the pit service mode or in conjunction with (resp. unified with/into) a/the (main) control unit controlling the whole elevator system. The skilled person may decide which manner

of implementation be most favourable for specific applications.

[0009] It has been found to allow for advantageous implementation when strictly deciding the input to be based on either the in-cabin call buttons (or further buttons) or based on command input means (other than in-cabin call buttons or further buttons directly associated with the lift shaft) such as input means provided by any handheld device e.g. in conjunction with an application program (app). Nonetheless, this logical or-combination does not prevent the control unit to be suitable for both types of implementation. Preferably, the user/technician may decide which type of input means be activated, before initiating the pit service mode.

[0010] According to one embodiment the control unit is configured such that activation of the pit service mode is dependent on at least one sequence or combination of in-cabin call buttons or other command input means exerting at least one control command commanding/controlling the drive unit to move/position the cabin to reach at least one predefined position. This also facilitates standardization e.g. in view of predefined inspection and maintenance measures.

[0011] According to one embodiment the control unit is configured such that activation of the pit service mode is dependent on at least one of the following sequences or combinations of actuation of buttons or other command input means: a first sequence or combination of in-cabin call buttons or other command input means exerting a first control command commanding/controlling the drive unit to move/position the cabin from any floor to access the cabin roof, a second sequence or combination of in-cabin call buttons or other command input means exerting a second control command commanding/controlling the drive unit to move/position the cabin to perform a visual inspection of the cabin's bottom from the pit access floor, a third sequence or combination of in-cabin call buttons or other command input means exerting a third control command commanding/controlling the drive unit to move/position the cabin to reach components on the cabin's bottom from the pit access floor. This configuration allows for provision of most relevant pit service mode functions by means of (only) implementation of specific sequences or combinations of command inputs, i.e. without the need of any further control means or buttons, and also for efficient handling and standardization especially in view of specific and most exact positions in height of the respective cabin.

[0012] According to one embodiment the control unit is configured such that activation of the pit service mode is dependent on a (first) sequence or combination of in-cabin call buttons or other command input means exerting a (first) control command commanding/controlling the drive unit to move/position the cabin from any floor to access the cabin roof, wherein the control command provides for actuation of the drive unit such that the cabin is lowered by a predefined distance starting from any floor other than the lowest floor, preferably starting from the floor directly above the lowest floor. This also facilitates initiating pit service mode in a quite specific manner, for one of several specific maintenance or inspection measures.

[0013] According to one embodiment the control unit is configured such that activation of the pit service mode is dependent on a (second) sequence or combination of in-cabin call buttons or other command input means exerting a (second) control command commanding/controlling the drive unit to move/position the cabin to perform a visual inspection of the cabin's bottom from the pit access floor, wherein the control command preferably provides for actuation of the drive unit such that the cabin is lifted by a predefined (first) distance starting from the lowest floor (especially ground floor). This also facilitates initiating pit service mode in a quite specific manner, for one of several specific maintenance or inspection measures.

[0014] According to one embodiment the control unit is configured such that activation of the pit service mode is dependent on a (third) sequence or combination of in-cabin call buttons or other command input means exerting a (third) control command commanding/controlling the drive unit to move/position the cabin to reach components on the cabin's bottom from the pit access floor, wherein the control command preferably provides for actuation of the drive unit such that the cabin is lifted by a predefined (second) distance starting from the lowest floor (especially ground floor). This also facilitates initiating pit service mode in a quite specific manner, for one of several specific maintenance or inspection measures.

[0015] According to one embodiment the control unit is configured such that activation of the pit service mode is dependent on at least one sequence or combination of in-cabin call buttons or other command input means, wherein the sequence or combination involves at least three buttons or command input means and/or wherein the sequence or combination comprises at least three inputs/actuations to be carried out within a predetermined time frame. This also provides for high security level, especially without the need to provide additional or separate buttons or input means. This aspect also reveals favourable/easy implementation of the present invention in context with already existing (built-in) elevator systems.

[0016] According to one embodiment the control unit is configured such that at least three different sequences or combinations of in-cabin call buttons or other command input means provide for a corresponding number (at least three) of control commands commanding/controlling at least the drive unit each in one specific predefined manner for moving/positioning at least the cabin to one specific of several predefined positions according to a/the pit service mode. This also provides for broad functionality based on different sequences or combinations, i.e., based on a plurality of specific implementations of the button's functionality.

[0017] According to one embodiment the control unit is configured for controlling the elevator arrangement according

to several activation steps determined by the control unit and allowing for specific workflows for initiating different types of pit service modes, especially according to the following activation steps or depending on determination of the following activation steps: determining a duration of activation of a door open button (first step); determining the number of activations of at least one specific button (second step); determining release of the door open button (third step); initiating/determining door closing (fourth step); intermittent beep sound emission or determination thereof (fifth step); constant beep sound emission or determination thereof (sixth step); determination/emission of a landing call at the current floor (seventh step); deactivating the beeping, if still active (eighth step). Such workflow may also effectively prevent any maloperation.

[0018] According to one embodiment the control unit is configured such that quitting/aborting of the pit service mode requires activation/actuation of a specific sequence or combination of (only) in-cabin call buttons when activation of the pit service mode previously has been initiated by in-cabin call buttons. This further improves security level, and this may also prevent any interference in context with any sequence or combination of other command input means. Nonetheless, in case activation of the pit service mode previously has been initiated by other command input means (other than in-cabin call buttons or any further buttons directly associated with the lift shaft), preferably, also the function of quitting/aborting of the pit service mode remains accessible via these other command input means. This also facilitates remote control, e.g. without the need of accessing the cabin.

[0019] In particular, the above mentioned object is also solved by an elevator arrangement comprising a pit service mode control unit according to the present disclosure, wherein a/the respective cabin of the elevator arrangement comprises a plurality of in-cabin call buttons which are in communication with the pit service mode control unit, wherein the in-cabin call buttons are configured such that activation of the pit service mode is dependent on at least one sequence or combination of actuation of the in-cabin call buttons. This also provides for above mentioned advantages. In particular, the technician is not required to walk any stairs in any lift shaft or staircase to reach a control unit arrangement positioned in the area of the lead of the lift shaft. Also, there is no need for involving at least two technicians/persons; rather, the configuration according to the present disclosure allows for carrying out inspection and/or maintenance work or the like by one single person.

[0020] In particular, the above mentioned object is also solved by a method for switching to and controlling a pit service mode in an elevator arrangement, especially in an elevator arrangement according to the present disclosure, especially by means of a pit service mode control unit according to the present disclosure, wherein the control unit is coupled with a plurality of buttons and/or command input means providing for at least one control command commanding/controlling a drive unit of the elevator arrangement to move/position a cabin of the elevator arrangement to reach at least one predefined position, wherein the method comprises predefining the at least one predefined position suitable for a/the pit service mode depending on a predefined combination or sequence of said buttons or command input means. This also provides for above mentioned advantages.

[0021] It should be noted that in practice, activation of a specific pit service mode may also be designated as "landing leveling request". In the following, different kinds/types of pit service mode commands resp. different kinds of landing leveling requests are described in more detail.

[0022] It has been found that that a distinction into three types of commands/modes allows for advantageous variability in practice. In particular, the control unit can be configured to activate an operation mode according to a first "landing leveling request" (LLR) based on the following first workflow, if all of the following conditions are met: the cabin service mode is in normal service, and the cabin's position is known, and the cabin is parked at a floor, and the control unit is configured to determine the cabin's position (including intermediate positions between floors), and the control unit has detected a/the manual activation of the pit service mode by a technician. Then, the control unit is configured to detect the following steps in sequence:

- Step **S1** a/the cabin door open button is pressed and held for at least 4s;
- Step **S2** during activation of said door open button, any cabin call button at the current floor and side is pressed three times (especially each time less than 4s and at least 0.5s);
- Step **S3** the door open button is released;
- Step **S4** the door closes especially in nudging speed;
- Step **S5** during door closing, an intermittent beep sounds especially with 2Hz, 50% duty cycle;
- Step **S6** after the door has been fully closed, the beeping is constant, especially not more than 5s or after step S8 is completed, whichever occurs first;
- Step **S7** after the door has been fully closed, a landing call at the current floor and side is made;
- Step **S8** after landing call has been detected, the beeping is deactivated (if still active).

[0023] Thereby, activation according to a first mode has been completed. Preferably, if this first LLR workflow is initiated

from the 1st floor, the control unit controls the cabin (resp. the drive unit) to move upwards by an adjustable distance; if this first LLR workflow is initiated from any floor other than 1st floor, the control unit controls the cabin (resp. the drive unit) to move downwards to by an adjustable distance (e.g. by 2000mm, for cabin roof inspection).

[0024] In particular, the control unit can be configured to activate an operation mode according to a second "landing leveling request" (LLR) based on the following second workflow, if all of the following conditions are met: the cabin service mode is in normal service, and the cabin's position is known, and the cabin is parked at the 1st floor, and the control unit is configured to determine the cabin's position (including intermediate positions between floors), and the control unit has detected a/the manual activation of the pit service mode by a technician. Then, the control unit is configured to detect the following steps in sequence: Step **S1** as described above, Step **S2** as described above but with the cabin call button being pressed four times (especially each time less than 4s and at least 0.5s), and Steps **S3** to **S8** as described above.

[0025] Thereby, activation according to a second mode has been completed. Preferably, if this second LLR workflow is initiated, the control unit controls the cabin (resp. the drive unit) to move upwards by an adjustable distance (especially 2700mm); thereby, the cabin's displacement provides for a safe access for pit inspection, especially in order to perform a visual review of guide shoes, safety gear mechanism diverting pulleys and/or other safety elements under the cabin.

[0026] In particular, the control unit can be configured to activate an operation mode according to a third "landing leveling request" (LLR) based on the following third workflow, if all of the following conditions are met:

the cabin service mode is in normal service, and the cabin's position is known, and the cabin is parked at the 1st floor, and the control unit is configured to determine the cabin's position (including intermediate positions between floors), and the control unit has detected a/the manual activation of the pit service mode by a technician. Then, the control unit is configured to detect the following steps in sequence: Step **S1** as described above, Step **S2** as described above but with the cabin call button being pressed five times (especially each time less than 4s and at least 0.5s), and Steps **S3** to **S8** as described above.

[0027] Thereby, activation according to a third mode has been completed. Preferably, if this third LLR workflow is initiated, the control unit controls the cabin (resp. the drive unit) to move upwards by an adjustable distance (especially 1150mm); thereby, the cabin's displacement provides for a safe access for pit inspection, especially in order to manipulate guide shoes, safety gear mechanism diverting pulleys and/or other safety elements under the cabin. It should be noted that during pit service mode, the control unit preferably is configured to control the cabin according to the following conditions:

- once the cabin is stopped, the control unit disables any motion at this point;
- during cabin movement, an intermittent beep is emitted within the cabin;
- the control unit cancels existing calls;
- the control unit prevents registration of new calls;

[0028] It should be noted that the pit service mode can be quit based on predefined conditions, especially in order to initiate end of inspection mode(s). In particular, the pit service mode is quit/deactivated if all of the following conditions are met:

- pit access landing door is closed and locked;
- all stopping devices in pit are inactive;
- while a pit inspection wait out adjustment is activated, inspection is deactivated if the following conditions are met:
 - o a recall switch is activated and de-activated, or
 - o a secondary contact associated with the pit entrance is activated and deactivated four times, especially between 1 and 5 seconds.

[0029] It should be noted that deactivation of the landing leveling request (as described above) can be initiated resp. carried out based on several conditions, especially based on the following conditions.

[0030] First deactivation mode, based on time out: With the door not being opened manually within the next 20 seconds after the cabin has been stopped for safe access, the control unit disables the LLR operation.

[0031] Second deactivation mode, based on inspection activation: If inspection operation already is active (preferably, inspection operation includes cabin top inspection and pit inspection), the control unit disables the LLR operation.

[0032] Third deactivation mode, based on opening of a/the safety chain: After the cabin starts to run, the control unit disables the LLR operation if the safety chain opens before the cabin is positioned for a safe access.

[0033] According to one embodiment the method comprises generating at least one of three different control commands for predefining at least one of three different motions resp. positions respectively depending on activation of the pit service mode based on at least three different sequences or combinations of actuation of buttons or other command

input means, especially such that one of the following positions is reached by the cabin: a first control command commanding/controlling the drive unit to move/position the cabin from any floor to access the cabin roof, a second control command commanding/controlling the drive unit to move/position the cabin to perform a visual inspection of the cabin's bottom from the pit access floor, a third control command commanding/controlling the drive unit to move/position the cabin to reach components on the cabin's bottom from the pit access floor. This provides for a configuration allowing for easily (directly) activating the pit service mode respectively for one of three (or even more) most relevant/important target positions. Thus, a technician may easily and specifically initiate an appropriate one of several optional pit service mode constellations.

[0034] According to one embodiment at least one type of pit service mode is activated based on the following workflow: determining activation of a door open button (first step); determining the number of activations of at least one specific button (second step), especially at least three activations; determining release of the door open button (third step); initiating/determining door closing (fourth step); intermittent beep sound emission or determination thereof (fifth step); constant beep sound emission or determination thereof (sixth step); determination/emission of a landing call at the current floor (seventh step); deactivating the beeping, if still active (eighth step); wherein preferably, the second step provides for several types of pit service modes depending on the number of activations of at least one specific button.

[0035] According to one embodiment the pit service mode is/remains on hold as long as the pit service mode is not quit out by providing one specific predetermined sequence or combination of actuation of the in-cabin call buttons. This also provides for high security in context with any maintenance actions during pit service mode especially within the pit or below or above the respective cabin.

[0036] According to one embodiment quitting/aborting initiation of the pit service mode is carried out based on at least one of the following deactivation modes: first deactivation mode based on time out; second deactivation mode based on priority of inspection activation; third deactivation mode based on opening of a/the safety chain.

[0037] According to one embodiment quitting/aborting the pit service mode is carried out by providing one specific predetermined sequence or combination of actuation of the in-cabin call buttons, thereby generating a control command commanding/controlling the drive unit to move/position the cabin to reach the intended position corresponding to one of the floors, especially at the next floor (i.e., the floor which is closest to the current position of the cabin). This also improves efficient handling also in context with termination of the (respective) pit service mode.

[0038] According to one embodiment an inspection mode of the pit service mode is deactivated depending on at least one of the following conditions: a pit access landing door is closed and locked; all stopping devices in the pit are inactive; a recall switch is activated and deactivated, or a secondary contact associated with the pit entrance is activated and deactivated by a predefined number of activations.

[0039] According to one embodiment the pit service mode is controlled (especially de-/activated) by means of command input means provided by a handheld device especially in conjunction with an application program, wherein the command input means are provided in the form of a digital twin of in-cabin call buttons of the at least one cabin. Such additional input means allow for even more flexibility and variability and also for remote control (without the need of adapting or changing any manner of inputting the command), thereby further alleviating technician's work load.

[0040] In particular, the above mentioned object is also solved by use of at least one predefined sequence or combination of in-cabin call buttons of an elevator arrangement for provision of at least one control command commanding/controlling a drive unit of the elevator arrangement to move/position at least one cabin of the elevator arrangement to reach at least one of several optional pit service mode positions, wherein the sequence or combination of in-cabin call buttons is/are implemented such that activation of the (respective) pit service mode can be realized by means of a/the control unit of the elevator arrangement and is dependent on at least one of the following sequences or combinations of actuation of buttons: a first sequence or combination of in-cabin call buttons exerting a first control command commanding/controlling the drive unit to move/position the cabin from any floor to access the cabin roof, a second sequence or combination of in-cabin call buttons exerting a second control command commanding/controlling the drive unit to move/position the cabin to perform a visual inspection of the cabin's bottom from the pit access floor, a third sequence or combination of in-cabin call buttons exerting a third control command commanding/controlling the drive unit to move/position the cabin to reach components on the cabin's bottom from the pit access floor, especially use of a pit service mode control unit according to the present disclosure in an elevator arrangement according to the present disclosure, especially for implementing a method according to the present disclosure. This also provides for above mentioned advantages.

SHORT DESCRIPTION OF FIGURE

[0041] These and other aspects of the present invention will also be apparent from and elucidated with reference to the embodiment described hereinafter. Individual features disclosed in the embodiments can constitute alone or in combination an aspect of the present invention.

[0042] Features of the different embodiments can be carried over from one embodiment to another embodiment. In the drawings, Figure 1 schematically shows a configuration according to one embodiment.

DETAILED DESCRIPTION OF FIGURES

[0043] Fig. 1 illustrates an elevator arrangement 10 exhibiting a cabin (car) 11 being driven within a lift shaft 1 to reach specific positions especially corresponding to the ground floor 3 and to any of several floors 2 (other than ground floor). The lift shaft 1 exhibits a pit 4. The cabin is driven by means of a drive unit 12, and the cabin is guided by means of cabin guide rails 16, and a counterweight is guided by means of a counterweight guide rails 17. The elevator arrangement 10 exhibits at least one control unit 20; according to the embodiment shown in Fig. 1, the control unit 20 also provides for a/the pit service mode control unit resp. for pit service mode control functionality. The elevator arrangement 10 exhibits in-cabin call buttons 11.1 provided within a/the respective cabin, and the elevator arrangement 10 may further exhibit further buttons 11.3 (other than in-cabin call buttons). The elevator arrangement 10 exhibits at least one user interface 30 configured for user input for activating a pit service mode, comprising a/the user interface provided by the in-cabin call buttons 11.1, and optionally, at least one further user interface 30 is provided by said further buttons 11.3 (especially at each floor 2, 3) and/or provided by/on a handheld device 31. Thus, in addition to said in-cabin call buttons 11.1, further command input means 31.1 (other than button or in-cabin call buttons) can be provided by mobile devices (e.g. command input means provided by a computer program implemented on a mobile device).

[0044] The pit service mode control unit 10 is coupled with or is configured to be coupled with a plurality of the buttons 11.1, 11.3 or command input means 31.1 providing for at least one control command commanding/controlling the drive unit 12 to move/position the cabin 11 to reach at least one predefined position depending on a predefined combination or sequence of the buttons or command input means.

[0045] The control unit 20 is configured to control/command the elevator arrangement 10 according to several activation steps allowing for specific workflows for initiating different types of pit service modes. Preferably, pit service mode activation is carried out according to at least one mode/process comprising the following steps:

S1 first activation step: a door open button is pressed and held for a predefinable duration;

S2 second activation step: a specific button is pressed three or more times;

S3 third activation step: the door open button is released;

S4 fourth activation step: the door closes;

S5 fifth activation step: an intermittent beep sound is emitted;

S6 sixth activation step: a constant beep sound is emitted;

S7 seventh activation step: a landing call at the current floor is made;

S8 eighth activation step: the beeping is deactivated (if still active);

[0046] It should be noted that the drive unit is arranged above the cabin guide rail, i.e., the (eccentric) position of the cabin guide rail does directly not affect/influence the relative position of the drive unit resp. of the belt drive (since the cabin guide rail ends below the drive).

List of reference signs

[0047]

- 1 lift shaft
- 2 floor
- 3 ground floor
- 4 pit
- 10 elevator arrangement
- 11 cabin (car)
- 11.1 button, especially in-cabin call button
- 11.3 further button
- 12 drive unit
- 16 cabin guide rail
- 17 counterweight guide rail(s)
- 20 control unit
- 30 user interface
- 31 handheld device
- 31.1 command input means, especially mobile
- S1 first activation step: a door open button is pressed and held for a predefinable duration
- S2 second activation step: a specific button is pressed three or more times
- S3 third activation step: the door open button is released

- S4 fourth activation step: the door closes
- S5 fifth activation step: an intermittent beep sound is emitted
- S6 sixth activation step: a constant beep sound is emitted
- S7 seventh activation step: a landing call at the current floor is made
- 5 S8 eighth activation step: the beeping is deactivated (if still active)

Claims

- 10 1. Pit service mode control unit (20) for an elevator arrangement (10) exhibiting at least one cabin (11) arranged in a lift shaft (1) and at least one drive unit (12), wherein the at least one cabin (11) is coupled with the drive unit (12) by means of traction means interacting with the drive unit (12), wherein the control unit (20) is coupled with or is configured to be coupled with a plurality of buttons (11.1, 11.3) and/or further command input means (31.1) providing for at least one control command commanding/controlling the drive unit (20) to move/position the cabin (11) to reach at least one predefined pit service mode position depending on a predefined combination or sequence of the buttons or command input means.
- 15 2. Pit service mode control unit (20) according to claim 1, wherein the control unit (20) is configured such that activation of the pit service mode is dependent on at least one sequence or combination of in-cabin call buttons (11.1) or command input means (31.1) exerting at least one control command commanding/controlling the drive unit (12) to move/position the cabin (11) to reach at least one predefined position; and/or wherein the control unit (10) is configured such that activation of the pit service mode is dependent on at least one of the following sequences or combinations of actuation of in-cabin call buttons (11.1) or command input means (31.1): a first sequence or combination of in-cabin call buttons or command input means exerting a first control command commanding/controlling the drive unit to move/position the cabin from any floor (2, 3) to access the cabin roof, a second sequence or combination of in-cabin call buttons or command input means exerting a second control command commanding/controlling the drive unit to move/position the cabin to perform a visual inspection of the cabin's bottom from a pit access floor, a third sequence or combination of in-cabin call buttons or command input means exerting a third control command commanding/controlling the drive unit to move/position the cabin to reach components on the cabin's bottom from a pit access floor.
- 20 3. Pit service mode control unit (20) according to any of the preceding claims, wherein the control unit (20) is configured such that activation of the pit service mode is dependent on a sequence or combination of in-cabin call buttons (11.1) or command input means (31.1) exerting a control command commanding/controlling the drive unit to move/position the cabin from any floor (2, 3) to access the cabin roof, wherein the control command provides for actuation of the drive unit (12) such that the cabin (11) is lowered by a predefined distance starting from any floor (2) other than the lowest floor, preferably starting from the floor directly above the lowest floor; and/or wherein the control unit (20) is configured such that activation of the pit service mode is dependent on a sequence or combination of in-cabin call buttons (11.1) or command input means (31.1) exerting a control command commanding/controlling the drive unit (12) to move/position the cabin (11) to perform a visual inspection of the cabin's bottom from the pit access floor, wherein the control command preferably provides for actuation of the drive unit such that the cabin is lifted by a predefined distance starting from the lowest floor (3); and/or wherein the control unit (20) is configured such that activation of the pit service mode is dependent on a sequence or combination of in-cabin call buttons (11.1) or command input means (31.1) exerting a control command commanding/controlling the drive unit (12) to move/position the cabin (11) to reach components on the cabin's bottom from a pit access floor, wherein the control command preferably provides for actuation of the drive unit (12) such that the cabin (11) is lifted by a predefined distance starting from the lowest floor (3).
- 30 4. Pit service mode control unit (20) according to any of the preceding claims, wherein the control unit (20) is configured such that activation of the pit service mode is dependent on at least one sequence or combination of in-cabin call buttons (11.1) or command input means (31.1), wherein the sequence or combination involves at least three buttons or command input means and/or wherein the sequence or combination comprises at least three inputs/actuations to be carried out within a predetermined time frame; and/or wherein the control unit (20) is configured such that at least three different sequences or combinations of in-cabin call buttons (11.1) or command input means (31.1) provide for a corresponding number of control commands commanding/controlling at least the drive unit (12) each in one specific predefined manner for moving/positioning at least the cabin (11) to one specific of several predefined positions according to a/the pit service mode.
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- 5 **5.** Pit service mode control unit (20) according to any of the preceding claims, wherein the control unit (20) is configured for controlling the elevator arrangement (10) according to several activation steps determined by the control unit and allowing for specific workflows for initiating different types of pit service modes, especially according to the following activation steps or depending on determination of the following activation steps: determining a duration of activation of a door open button (S1); determining the number of activations of at least one specific button (S2); determining release of the door open button (S3); initiating/determining door closing (S4); intermittent beep sound emission or determination thereof (S5); constant beep sound emission or determination thereof (S6); determination/emission of a landing call at the current floor (S7); deactivating the beeping, if still active (S8).
- 10 **6.** Pit service mode control unit (20) according to any of the preceding claims, wherein the control unit (20) is configured such that quitting/aborting of the pit service mode requires activation/actuation of a specific sequence or combination of in-cabin call buttons (11.1) when activation of the pit service mode previously has been initiated by in-cabin call buttons (11.1).
- 15 **7.** Elevator arrangement (10) comprising a pit service mode control unit (20) according to any of the preceding claims, wherein a/the respective cabin (11) of the elevator arrangement comprises a plurality of in-cabin call buttons (11.1) which are in communication with the control unit (20), wherein the in-cabin call buttons (11.1) are configured such that activation of the pit service mode is dependent on at least one sequence or combination of actuation of the in-cabin call buttons (11.1).
- 20 **8.** Method for switching to and controlling a pit service mode in an elevator arrangement (10), especially in an elevator arrangement according to claim 7, especially by means of a pit service mode control unit (20) according to any of claims 1 to 6, wherein the control unit (20) is coupled with a plurality of buttons (11.1, 11.3) and/or command input means (31.1) providing for at least one control command commanding/controlling a drive unit (12) of the elevator arrangement to move/position at least one cabin (11) of the elevator arrangement to reach at least one predefined position, wherein the method comprises predefining the at least one predefined position suitable for a/the pit service mode depending on a predefined combination or sequence of said buttons (11.1, 11.3) or command input means (31.1).
- 25 **9.** Method according to the preceding method claim, wherein the method comprises generating at least one of three different control commands for predefining at least one of three different motions resp. positions respectively depending on activation of the pit service mode based on at least three different sequences or combinations of actuation of buttons (11.1, 11.3) or command input means (31.1), especially such that one of the following positions is reached by the cabin (11): a first control command commanding/controlling the drive unit (12) to move/position the cabin from any floor (2, 3) to access the cabin roof, a second control command commanding/controlling the drive unit to move/position the cabin to perform a visual inspection of the cabin's bottom from the pit access floor, a third control command commanding/controlling the drive unit to move/position the cabin to reach components on the cabin's bottom from the pit access floor.
- 30 **10.** Method according to any of the preceding method claims, wherein at least one type of pit service mode is activated based on the following workflow: determining activation of a door open button (S1); determining the number of activations of at least one specific button (S2), especially at least three activations; determining release of the door open button (S3); initiating/determining door closing (S4); intermittent beep sound emission or determination thereof (S5); constant beep sound emission or determination thereof (S6); determination/emission of a landing call at the current floor (S7); deactivating the beeping, if still active (S8); wherein preferably, the second step (S2) provides for several types of pit service modes depending on the number of activations of at least one specific button; and/or wherein the pit service mode is/remains on hold as long as the pit service mode is not quit out by providing one specific predetermined sequence or combination of actuation of the in-cabin call buttons (11.1).
- 35 **11.** Method according to any of the preceding method claims, wherein quitting/aborting initiation of the pit service mode is carried out based on at least one of the following deactivation modes: first deactivation mode based on time out; second deactivation mode based on priority of inspection activation; third deactivation mode based on opening of a/the safety chain.
- 40 **12.** Method according to any of the preceding method claims, wherein quitting/aborting the pit service mode is carried out by providing one specific predetermined sequence or combination of actuation of the in-cabin call buttons (11.1), thereby generating a control command commanding/controlling the drive unit (12) to move/position the cabin to reach the intended position corresponding to one of the floors (2, 3).
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13. Method according to any of the preceding method claims, wherein an inspection mode of the pit service mode is deactivated depending on at least one of the following conditions: a pit access landing door is closed and locked; all stopping devices in the pit are inactive; a recall switch is activated and de-activated, or a secondary contact associated with the pit entrance is activated and de-activated by a predefined number of activations.

14. Method according to any of the preceding method claims, wherein the pit service mode is controlled by means of command input means provided by a handheld device especially in conjunction with an application program, wherein the command input means are provided in the form of a digital twin of in-cabin call buttons of the at least one cabin.

15. Use of at least one predefined sequence or combination of in-cabin call buttons (11.1) of an elevator arrangement (10) for provision of at least one control command commanding/controlling a drive unit (12) of the elevator arrangement to move/position at least one cabin (11) of the elevator arrangement to reach at least one of several optional pit service mode positions, wherein the sequence or combination of in-cabin call buttons (11.1) is/are implemented such that activation of the pit service mode can be realized by means of a/the control unit (20) of the elevator arrangement and is dependent on at least one of the following sequences or combinations of actuation of buttons (11.1): a first sequence or combination of in-cabin call buttons exerting a first control command commanding/controlling the drive unit (12) to move/position the cabin (11) from any floor to access the cabin roof, a second sequence or combination of in-cabin call buttons exerting a second control command commanding/controlling the drive unit to move/position the cabin to perform a visual inspection of the cabin's bottom from the pit access floor, a third sequence or combination of in-cabin call buttons exerting a third control command commanding/controlling the drive unit to move/position the cabin to reach components on the cabin's bottom from the pit access floor, especially use of a pit service mode control unit (20) according to any of the claims 1 to 6 in an elevator arrangement according to claim 7, especially for implementing a method according to any of claims 8 to 14.

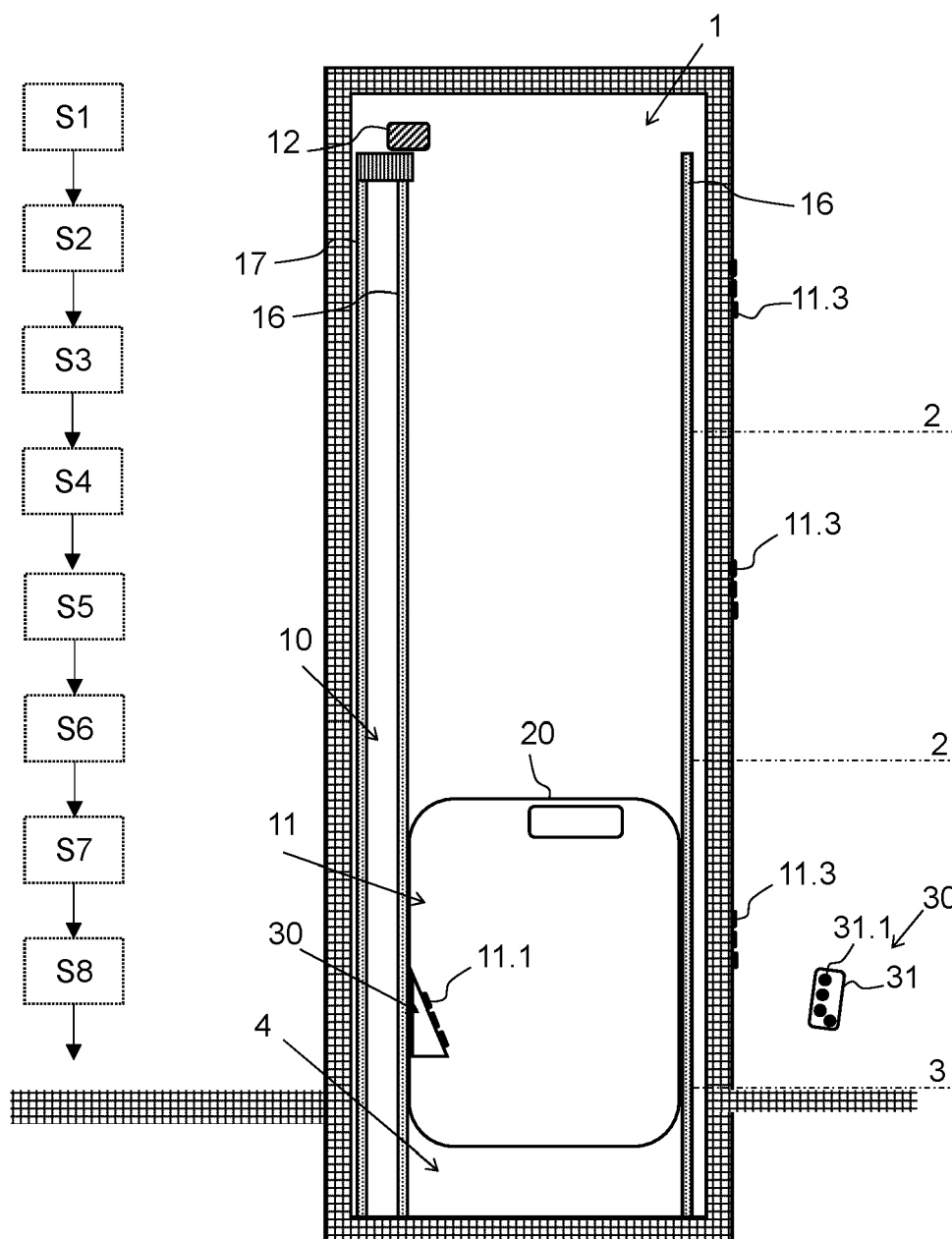


Fig. 1



EUROPEAN SEARCH REPORT

Application Number

EP 22 38 2937

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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	

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