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(54) **A METHOD AND A SYSTEM FOR ELEVATOR DOOR OPERATION MONITORING AND ADJUSTMENT**

(57) The current disclosure relates to a method for adjusting elevator door operation. The method is characterized in that it comprises monitoring at least one door-related parameter during door panel (6,7) movement; and if a monitored door-related parameter reaches a pre-determined threshold value, and/or when a change in the door-related parameter value reaches a pre-determined threshold value, reducing door panel (6,7) movement speed. The current disclosure further relates to an elevator and to components thereof.

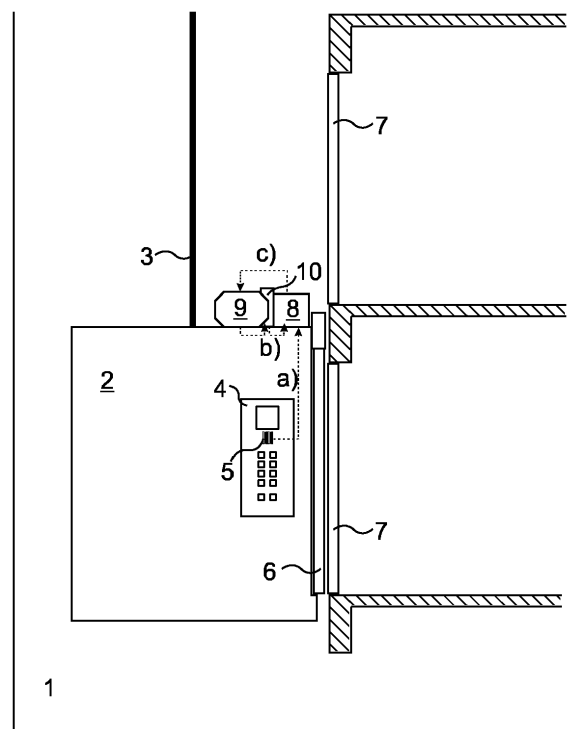


Fig. 2

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a method and to a system for monitoring and adjusting elevator door operation. The present disclosure further relates to an elevator door controller, to an elevator door operator and to an elevator.

BACKGROUND ART

[0002] Elevator sliding automatic doors are a regular target of maintenance visits. They contain a number of wearing components, and the door structures, especially the door sill, tend to gather dirt and pieces of rubbish hindering the movement of the door panels. Although a pre-scheduled maintenance regime can be used to optimize for the regular wearing of components, malfunctions and deterioration of components because of dirt, rubbish and other unforeseen events are more difficult to predict.

[0003] The current approaches to rationalize elevator door maintenance include the scheduling of preventive maintenance visit based on a set of characteristics descriptive of the operation of the door, which is compared to the set of characteristics for a normal operating condition of a door stored in memory, and the need for servicing and the servicing time are established based on the comparison of the two sets of characteristics, as was done in WO 02/36476.

SUMMARY

[0004] Drawbacks of the current solutions include that the door condition might necessitate an earlier-than-scheduled maintenance visit, thus not reducing the maintenance costs.

[0005] An object of the present disclosure is to alleviate at least some of the problems related to prior-art solutions. It is especially the object of the present disclosure to provide a new type of a method and a system for elevator door operation monitoring and adjusting.

[0006] The present method and system are in particular, but not only, intended for elevators, especially for passenger or cargo elevators of buildings.

[0007] The method according to the present disclosure is characterized by what is presented in claim 1.

[0008] The elevator door controller according to the present disclosure is characterized by what is presented in claim 10.

[0009] The elevator door operator according to the present disclosure is characterized by what is presented in claim 13.

[0010] The elevator door operation monitoring and adjusting system according to the present disclosure is characterized by what is presented in claims 14 and 15.

[0011] The elevator according to the present disclosure

is characterized by what is presented in claims 16 and 17.

[0012] The method and system according to the present disclosure may offer at least one of the following advantages over prior art.

[0013] The reduction in door operating speed might increase the operational life of the door components, even if not functioning optimally. This might allow the door to function until the next scheduled maintenance visit. This, in turn, may save the costs of an additional visit, and allow the coordinated maintenance and/or replacement of all relevant elevator components.

[0014] The current method and system are simple, but may detect the most common signals of elevator door malfunctions. Thus, minimal investment is necessary to improve the reliability and service level of the elevator.

BRIEF DESCRIPTION OF DRAWINGS

[0015] The accompanying drawings, which are included to provide a further understanding of the disclosure and constitute a part of this specification, illustrate embodiments and together with the description help to explain the principles of the disclosure but the disclosure is not limited to the specific embodiments illustrated in the drawings. In the drawings:

Fig. 1 presents an embodiment of the method according to the present disclosure.

Fig. 2 presents a schematic overview of an elevator according to the present disclosure.

DETAILED DESCRIPTION

[0016] In one aspect, a method for monitoring and adjusting elevator door operation is disclosed. The method is characterized in that it comprises monitoring at least one door-related parameter during door panel movement; and if a monitored door-related parameter reaches a pre-determined threshold value, and/or if a change in the door-related parameter value reaches a pre-determined threshold value, reducing door panel movement speed.

[0017] In the method according to the present disclosure, a door-related parameter is monitored during door panel movement in order to detect deterioration of door condition before the door malfunctions. The system is automatic, and is based on a pre-determined set of instructions that can be executed without a maintenance visit by personnel.

[0018] Each monitored door-related parameter is given a pre-determined threshold value, and if this value is reached, the door panel movement speed is reduced. Alternatively or in addition, a pre-determined threshold value may be set for the change in the door-related parameter. In other words, if there is a change of given magnitude in the door-related parameter, the door panel movement speed may be reduced.

[0019] Embodiments may be envisaged in which the change in the door-related parameter value is monitored as a function of time. In other words, the change has to take place within a pre-determined time, in order to trigger the reduction in door panel movement speed. Such an arrangement would allow taking the normal wearing of the devices into account, in case the value of the monitored door-related parameter has a tendency to shift during use.

[0020] In one embodiment, the monitored door-related parameter is door motor current and/or door panel movement speed and/or change rate of the door motor current and/or change rate of the door panel movement speed and/or noise level during door panel movement. Thus, the monitored door-related parameter may be door motor current. The monitored door-related parameter may be change rate of the door motor current. The monitored door-related parameter may be door panel movement speed. The monitored door-related parameter may be change rate of the door panel movement speed. The monitored door-related parameter may be noise level during door panel movement.

[0021] The elevator door is moved by a door motor and a mechanism associated with it. The current used by the motor is an indication on how hard it is working to bring about the opening and closing movement of the door panels. In many elevator systems, the door panels are configured to open and close according to a pre-determined speed curve. Typically, each door panel starts the movement slowly, accelerating to a constant speed, and at a pre-determined distance before the end of the movement, gradually slows down. The movement may be in the opening direction or in the closing direction. The speed curves in opening direction and inclosing direction may be the same or different.

[0022] In situations where the speed curve of door panel movement is pre-determined, the door motor current increases, if the door panels face added resistance to movement, since the set movement speed is maintained, if possible. Such resistance may be created by, for example, dirt in the door sill grooves, along which the door panels move.

[0023] Alternatively, it is possible that the motor current used remains constant or has an upper limit. In such a case, the movement speed of the door panels slows down when the motor faces increased resistance to the door panel movement, or if the resistance exceeds the set upper limit for the motor current, respectively. Yet another possibility is that both door panel movement speed and the door motor current are monitored, and the reduction of door panel movement speed is effected if the proportion of these two quantities reaches a pre-determined threshold value.

[0024] It is further possible that the change rate of the door motor current is monitored or the change rate of the door panel movement speed, or both are monitored. Thus, the first derivate of the door motor current or the door panel movement speed, or their combination may

be used as the monitored door-related parameter.

[0025] A further alternative for the door-related parameter is noise level during door panel movement. The noise level may be measured inside the elevator car. Therein, it may be measured through, for example, a microphone present in many elevator car operating panels. Alternatively, the noise level may be measured outside the elevator car, for example in the vicinity of the door motor, or on the landing side of the door.

[0026] Typically the noise level during door panel movement increases in case a door panel movement-related component is not functioning optimally. The change in the noise level may be abrupt, if it is caused by an external factor, such as an item between moving parts. Alternatively, the noise level may increase gradually, in case it is due to continuing wearing of a component.

[0027] As many different factors influence the noises present in or around the elevator, different screening system may be applied in order to discern different types of noises that may be indicative of the various possible noise sources. For example, passenger noises may be differentiated from noises caused by worn-out or damaged door components.

[0028] If noise level in the elevator car is monitored, the noise level may be monitored also when the door panels are not moving, in order to provide a reference for the background noise level.

[0029] It is also possible that any combination of the above parameters is used as the monitored door-related parameter. The selection of the most suitable monitoring strategy depends on the application in question and can be determined by a skilled person.

[0030] In one embodiment, the door-related parameter is monitored continuously, or the door-related parameter is monitored at pre-determined time intervals.

[0031] The door related parameter may be measured continuously. For example, if the parameter value tends to fluctuate at a large range, continuous measurement might offer advantages, as a pattern change in the parameter value may be detected faster, or more accurately. If a door-related parameter is monitored continuously, the availability of resources, such as electricity or computing capacity, is ascertained. The monitoring interferes minimally with the normal operation of the elevator doors. In other words, the continuous monitoring of the door-related parameter is poses only a low burden on the elevator.

[0032] If the door-related parameter is measured at pre-determined time intervals, even resource-intensive measurement regime may be applied. The measurement may be effected during low-use time of the elevator, for example on weekends or night hours. For example, the elevator may make a test run, during which the door-related parameter is measured.

[0033] Further, it is possible, that the pre-determined time interval changes with time. For example, the monitoring may be performed more frequently during heavy

weather season, like autumn or winter. Alternatively or in addition, the monitoring interval may be shortened with increased time after the previous maintenance visit.

[0034] As a further alternative, a door-related parameter is monitored after a change in another door-related parameter is detected. In such a case, there is one or more first door-related parameter, which is monitored first, and one or more second door-related parameter, which is monitored if a change in the first door-related parameter is detected. In one embodiment, if a monitored door-related parameter reaches a pre-determined threshold value, and/or if a change in the door-related parameter value reaches a pre-determined threshold value, at least one further door-related parameter is monitored. Thus, if one or more indications of a problem is detected, further measurements and/or test drives can be initiated in order to better locate the problem and maintain safety.

[0035] The second or further door-related parameter may be monitored immediately after a change in the first door-related parameter has been detected. Alternatively the monitoring of the at least one second door-related parameter may be performed after a pre-determined time has elapsed, or when a pre-determined condition is fulfilled. Such a pre-determined condition may be, for example, the beginning of a low-use time. Monitoring of a second door-related parameter may be implemented through a test run.

[0036] Such delayed monitoring may be performed during night hours or weekends, or outside opening hours in commercial buildings. Such an embodiment of the method allows the continued use of the elevator even if a potential malfunction is detected. When reduction in the door panel movement speed is effected upon detecting a change in the first door-related parameter, but the possibly time-consuming further diagnostic is performed only when it disturbs the users of the elevator less, an improved user experience may be achieved without compromising safety of the elevator.

[0037] For example, a change in door motor current, or door panel movement speed may prompt the monitoring of the noise level. Alternatively, if a change in noise level is detected, the door motor current and/or door movement speed may be tested. The testing of an additional door-related parameter may also involve a more carefully monitoring the same door-related parameter in which the change was originally detected.

[0038] Such an arrangement may be seen as comprising initial screening to detect a possible cause of malfunction, and subsequent diagnostic to gather more information on the nature of the possible problem.

[0039] In one embodiment, reducing door panel movement speed comprises reducing door panel movement maximum speed and/or reducing the speed of door panel acceleration and/or reducing the speed of door panel deceleration.

[0040] The reduction in door panel movement speed may be effected in different ways. For example, the maximum speed of door panel movement may be reduced.

Alternatively or in addition, the door panel accelerated slower in the beginning of the door panel movement. Further, the door panel may decelerate slower at the end of the door panel movement.

[0041] The changes in speed and/or acceleration and/or deceleration may be percentage changes, or they may be brought about by a pre-determined number of measurement units. The change may be of different magnitude for different phases of the door panel movement.

[0042] In one embodiment, the method further comprises collecting elevator car position information. It is possible to monitor the door-related parameter at each landing separately. If the door-related parameter information is combined with the positioning of the elevator car, it may be possible to discern where the change in the door-related parameter takes place. By elevator car position information is herein meant information on in which landing the elevator car is.

[0043] For example, if a change in the door-related parameter value is detected in all landing positions, the elevator car door is likely to be affected by the change. On the other hand, if the change occurs only in one or some of the landings, the landing doors of the landings in question are likely to be affected. It is also possible that different door-related parameters change in different landings, in which case the possible problems might have different causes in different floors, affecting the landing doors.

[0044] If the elevator car position information is available, it is possible to adjust the door panel movement speed in a targeted manner, so that the overall functioning of the elevator is affected as little as possible. In one embodiment, the door panel movement speed is reduced only at those landings in which the door-related parameter reaches a pre-determined threshold value, or in which a change in the door-related parameter value reaches a pre-determined threshold value. At those landings, in which the door-related parameters, or changes thereof, remain within pre-determined range, the door panels keep moving at the original speed. This reduces the slowing-down effect caused by slowed door panel movement.

[0045] In addition to reduction of door panel movement speed, it might be possible to adjust the movement of the elevator cars in elevator installations comprising multiple elevators so that the affected landing doors and/or elevator car doors are used less frequently. This might contribute to the reduction of further wear of the affected components, and help keeping the user experience at a high level.

[0046] In one embodiment, the method further comprises receiving and/or storing and/or processing door-related parameter values. The door-related parameter values may be received and/or stored and/or processed by any of the local control or monitoring units, such as a door controller, an elevator controller, a group controller or a building automation computer. Alternatively, the

door-related parameter values may be received and/or stored and/or processed by a remote control or monitoring unit, such as a service center computer. Further, any control or monitoring unit may provide commands relating to the monitoring of a door-related parameter, as well as receive such commands. The door-related parameter values may be received, stored and/or processed by any control or monitoring unit present in the elevator installation, or remotely. If the door-related parameter values are received, stored and/or processed by a unit remote to the elevator installation, any of the control or monitoring units at the elevator installation may send the door-related parameter values to the remote location.

[0047] By a door controller is herein meant a device comprising the means for speed and position control of the elevator door panels, as well as the door safety features. The door controller may comprise, for example, different types of hardware and software for performing its tasks.

[0048] If the door-related parameter values are stored, it might be possible to gather information on the development of the monitored door-related parameter before the threshold value has been reached, supporting the determination of the cause of the problem. The data, combined with the knowledge gained during maintenance visits, may further be used in optimizing the method for adjusting door operation. For example, the pre-determined threshold values for the door-related parameters may be adjusted. The memory for storing the data may be, for example, in the door controller, or elsewhere in the elevator system, such as in the central control unit of the elevator. It may as well be at a remote location.

[0049] The monitored door-related parameter values may be sent to an elevator service center, in which they may be processed. By an elevator service center is herein meant a center, which in itself may be in one location or in several locations, for handling and coordinating elevator maintenance-related matters. The elevator service center may be specific for a given elevator installation, to a given building, or for a number of elevator installations and/or buildings. It may thus be externally located and connected to the elevator through a communication link or network. Said processing may be automatic or manual. The door-related parameter values may be sent in batch, continuously or at pre-determined time or measurement intervals. They may be sent also only after a door-related parameter has reached a pre-determined threshold value.

[0050] In one embodiment, the method further comprises a step of sending a signal to an elevator service center for providing information of elevator door operational status after reducing the door panel movement speed. It might offer advantages to provide information to an elevator service center when the door panel movement speed in a given elevator has been reduced.

[0051] The change in the monitored door-related parameter value might indicate a possible door-related problem. Thus, the maintenance work may be rational-

ized, for example, if the information is at hand, in case an earlier-than-anticipated maintenance visit is scheduled for other reasons. It might further be possible to deduce the likelihood of imminent door malfunction based on the information.

[0052] By elevator operational status is herein meant, for example, the monitored door-related parameter values, if available, the elevator doors, whose door panel movement speed has been reduced, and if there are alternatives according to which the door panel movement speed has been reduced, information concerning the performed speed reduction. It is further possible to keep monitoring the door-related parameter values, and to send them.

[0053] In one aspect, an elevator door controller arranged to control the movement of an elevator door panel with adjustable speed is disclosed. The elevator door controller is characterized in that the adjustment of speed is regulated by a change in at least one door-related parameter. The door controller comprises means for receiving door-related parameter values from other devices, and to process the values in order to reduce the door panel movement speed if the monitored door-related parameter reaches a pre-determined threshold value. For example, the elevator door controller may comprise means for receiving door panel movement speed information, door motor current information and/or noise level information during door panel movement.

[0054] The door controller may be connected to further control units or to an elevator service center, with which it may exchange information. For example, the door controller may be configured to store door-related parameter values. The door controller may send the stored door-related parameter values to an elevator service center. It is further possible that the door controller is configured to send a signal to an elevator service center for providing information of elevator door operational status after reducing the door panel movement speed.

[0055] In one embodiment of the elevator door controller, the door-related parameter is door motor current and/or door panel movement speed and/or change rate of the door motor current and/or change rate of the door panel movement speed and/or noise level during door panel movement. The door controller may be adapted to monitor one or more of the above variables.

[0056] The information may be conveyed through an elevator door motor and the associated power electronics, if door panel movement speed, door motor current or their combination is monitored. In case noise is used as the door-related parameter to be monitored, the door controller is configured to receive information from a sound-sensing device, such as a microphone. The sound-sensing device may be located in the elevator car or outside it. The sound-sensing device may be dedicated for monitoring the door-related parameter or it may have other functions.

[0057] In one embodiment, the door controller is arranged to control the movement of an elevator door panel

with to two or more different speed settings. If the door panel movement speed is reduced in response to detecting a change in a door-related parameter, the corresponding speed settings need to be available to the door controller. The speed settings may be selected from alternatives stored within the door controller, or they may be retrieved from another location.

[0058] For example, there may be a first speed setting, according to which the door panel movement is controlled before a monitored door-related parameter reaches a threshold value, and a second speed setting, according to which the door panel movement is controlled after a monitored door-related parameter has reached a threshold value. There may be also a third and further speed settings for different kinds of changes in the door-related parameter.

[0059] The selected speed settings may depend on the detected change in the monitored door-related parameter. Depending on the monitored door-related parameter, and how carefully its changes are recorded, it might be advantageous to effect different kinds of changes in the door panel movement speed. Therefore, the door controller may be configured to control the door panel movement with different kinds of speed settings.

[0060] Further, if the elevator car position information is combined with monitoring a door-related parameter, and this information is used in adjusting the door panel movement, it is possible to control the door panel movement according to different speed settings in different landings.

[0061] In one aspect, an elevator door operator is disclosed. The elevator door operator is characterized in that the door operator is arranged to transmit current usage and/or door panel movement speed information during door panel movement to a control or monitoring unit for monitoring a door-related parameter. An elevator door controller drives the movement of the elevator door panels.

[0062] The elevator door operator according to the present disclosure may be configured to transmit current usage information during door panel movement to the door controller. Alternatively or in addition, the door operator may be configured to transmit door panel movement speed information to a door controller. This information is used to monitor if a pre-determined threshold value of a door-related parameter has been reached, and thus, if door panel movement speed is to be reduced.

[0063] A microphone system for an elevator may be used to implement the current method. Such microphone system is characterized in that the system is arranged to record and to transmit noise level information during elevator door panel movement to a door control or monitoring unit for monitoring a door-related parameter. The microphone system comprises a microphone and the necessary connections to transmit noise level information to the door controller. This information is used to monitor if a pre-determined threshold value of a door-related parameter has been reached, and thus, if door

panel movement speed is to be reduced. The microphone may be positioned inside the elevator car or outside it.

[0064] In one aspect, an elevator door operation monitoring and adjusting system comprising the elevator door controller according to the current disclosure and/or the elevator door operator according to the current disclosure is disclosed.

[0065] The elevator door operation monitoring and adjusting system according to the present disclosure may be constructed as one unit, or it may comprise more than one separated units operationally connected to each other in order to form a functional system. The system may be retrofitted to existing elevators, or new elevators may be equipped with the system according to the present disclosure. Thus, the system may comprise pre-existing components, which are modified to fit the system according to the present disclosure.

[0066] In one aspect, an elevator door operation and adjusting system is disclosed. The system is characterized in that it is configured to monitor at least one door-related parameter during door panel movement; and if a monitored door-related parameter reaches a pre-determined threshold value, and/or if a change in the door-related parameter value reaches a pre-determined threshold value, to reduce door panel movement speed. Optionally, the system may be configured to collect elevator car position information.

[0067] In one aspect, an elevator is disclosed. The elevator comprises the elevator door controller according to the current disclosure and/or the elevator comprises the elevator door operator according to the current disclosure and/or the elevator comprises the elevator door operation monitoring and adjustment system according to the present disclosure. In other words, the elevator may comprise the elevator door controller according to the current disclosure and the elevator comprises the elevator door operator according to the current disclosure and the elevator comprises the elevator door operation monitoring and adjustment system according to the present disclosure. It is alternatively possible that the elevator comprises the elevator door controller according to the current disclosure, or the elevator door operator according to the current disclosure or the elevator door operation monitoring and adjustment system according to the present disclosure.

[0068] An elevator according to the present disclosure comprises an elevator car comprising an elevator car door, and at least two landing levels on which passenger and/or cargo may be loaded or unloaded. The elevator according to the present disclosure further comprises a door controller responsible for the door operation and safety mechanisms. The elevator doors are opened and closed through the movement of one or more door panels on the elevator car side and on each landing, driven by a door motor and an associated mechanism. The door panels on the elevator car are termed car door panels and the door panels on each landing are termed landing

door panels.

[0069] In an aspect, an elevator is disclosed. The elevator is characterized in that said elevator is configured to monitor at least one door-related parameter during door panel movement; and if a monitored door-related parameter reaches a pre-determined threshold value, and/or if a change in the door-related parameter value reaches a pre-determined threshold value, to reduce door panel movement speed.

[0070] In the elevator according to the present disclosure, the movement speed of the elevator door panels may be reduced when a change in a door-related parameter reaches a pre-determined threshold value. The change in parameter value may be indicative of deterioration in the door performance, which might be possible to be counteracted through reduction of the door panel movement speed.

DESCRIPTION OF DRAWINGS

[0071] The following figures are to be understood as exemplary embodiments of the method, elevator components, system and an elevator according to the present disclosure. Further embodiments of the invention are envisaged. It is to be understood that any feature described in relation to any one embodiment may be used alone, or in combination with other features described, and may also be used in combination with one or more features of any other of the embodiments, or any combination of any other of the embodiments. Furthermore, equivalents and modifications not described below may also be employed without departing from the scope of the invention, which is defined in the accompanying claims.

[0072] There are various controlling and safety devices for the elevator and its components, but all of them have been omitted from the figures for clarity and any conventional methods can be used for their design. All parts of the elevator and its components are depicted only schematically and their sizes are not drawn proportionally. Further, all additional elevator components are omitted from the figures.

[0073] Fig. 1 presents an embodiment of the method according to the present disclosure. Optional operations are depicted with dashed outline. In the method, at least one door-related parameter is monitored during door panel movement. If a parameter reaches a threshold value, or if a change in parameter reaches a threshold value, door panel movement speed is reduced.

[0074] The monitored door-related parameter may be door motor current and/or door panel movement speed and/or change rate of the door motor current and/or change rate of the door panel movement speed and/or noise level during door panel movement. Reducing door panel movement speed may comprise reducing door panel movement maximum speed and/or reducing the speed of door panel acceleration and/or reducing the speed of door panel deceleration.

[0075] Optionally, the method may comprise sending

a signal to an elevator service center for providing information of elevator door operational status after reducing the door panel movement speed.

[0076] Further, it is possible that elevator car position information is collected, and this is used when selecting how to reduce the door panel movement speed. For example, the door panel movement speed may be reduced in only certain landings.

[0077] Fig. 2 presents a schematic overview of an elevator according to the present disclosure. Dashed arrows in fig. 2 depict information transfer between different components. The embodiment of an elevator in fig. 2 comprises an elevator shaft 1 and an elevator car 2 within the elevator shaft 1, as well as a hoisting cable 3 connected to hoisting machinery (not shown).

[0078] Further, the elevator comprises elevator doors, which include the car door panels 6 and landing door panels 7. The elevator doors are opened and closed by a door motor 9, the motion of which is controlled by a door controller 8. The door controller 8 is an embodiment of a door control or monitoring unit. The elevator further comprises a door operator 10, which transmits current usage and/or door panel 6, 7 movement speed information during door panel 6, 7 movement to the door controller 8. The door motor 9 powers the movement of door panels 6, 7 and is connected to the door panels 6, 7 through a mechanism (not shown). The mechanism comprises a clutch, which opens the locking mechanism of the landing doors, and pulls the landing door panels 7 open together with the elevator car door panels 6.

[0079] The elevator car 2 comprises a car operating panel 4 through which a passenger may choose a destination floor. The car operating panel 4 further comprises a microphone 5 which is able to receive sound signals from the elevator car 2. The microphone 5 is typically connectable to a service center for reporting serious elevator malfunctions.

[0080] In the embodiment of fig. 2, the microphone 5 is a part of the elevator door operation monitoring and adjustment system according to the present disclosure. In other words, the sound signals within the elevator car 2 may be transmitted to the door controller 8 for monitoring a door-related parameter (arrow a) in fig. 2).

[0081] The door operator 10 transmits current usage and/or door panel 6, 7 movement speed information during door panel 6, 7 movement from the door motor 9 to the door controller 8 for monitoring a door-related parameter (arrows b)). If the door-related parameter reaches a pre-determined threshold value, the door controller 8 reduces the movement speed of the door panels 6, 7 (arrow c)).

Claims

1. A method for monitoring and adjusting elevator door operation, **characterized in that** the method comprises

- monitoring at least one door-related parameter during door panel (6,7) movement; and
 - if a monitored door-related parameter reaches a pre-determined threshold value, and/or if a change in the door-related parameter value reaches a pre-determined threshold value, reducing door panel (6,7) movement speed.
2. The method according to claim 1, wherein the monitored door-related parameter is door motor (9) current and/or door panel (6,7) movement speed and/or change rate of the door motor (9) current and/or change rate of the door panel (6,7) movement speed and/or noise level during door panel (6,7) movement.
 3. The method according to claim 1 or 2, wherein reducing door panel (6,7) movement speed comprises reducing door panel (6,7) movement maximum speed and/or reducing the speed of door panel (6,7) acceleration and/or reducing the speed of door panel (6,7) deceleration.
 4. The method according to any of the preceding claims, wherein the door-related parameter is monitored continuously, or wherein the door-related parameter is monitored at pre-determined time intervals.
 5. The method according to any of the preceding claims, wherein if a monitored door-related parameter reaches a pre-determined threshold value, and/or if a change in the door-related parameter value reaches a pre-determined threshold value, at least one further door-related parameter is monitored.
 6. The method according to any of the preceding claims, wherein the method further comprises collecting elevator car (2) position information.
 7. The method according to claim 6, wherein the door panel (6,7) movement speed is reduced only at those landings in which the door-related parameter reaches a pre-determined threshold value, or in which a change in the door-related parameter value reaches a pre-determined threshold value.
 8. The method according to any of the preceding claims, wherein the method further comprises receiving and/or storing and/or processing door-related parameter values.
 9. The method according to any of the preceding claims, wherein the method further comprises a step of sending a signal to an elevator service center for providing information of elevator door operational status after reducing the door panel (6,7) movement speed.
 10. An elevator door controller arranged to control the movement of an elevator door panel (6,7) with adjustable speed, **characterized in that** the adjustment of speed is regulated by a change in at least one door-related parameter.
 11. The elevator door controller (8) according to claim 10, wherein the door-related parameter is door motor (9) current and/or door panel (6,7) movement speed and/or change rate of the door motor (9) current and/or change rate of the door panel (6,7) movement speed and/or noise level during door panel (6,7) movement.
 12. The elevator door controller (8) according to claim 10 or 11, wherein the door controller (8) is arranged to control the movement of an elevator door panel (6,7) with two or more different speed settings.
 13. An elevator door operator, **characterized in that** the door operator is arranged to transmit current usage and/or door panel (6,7) movement speed information during door panel (6,7) movement to a control or monitoring unit for monitoring a door-related parameter.
 14. An elevator door operation monitoring and adjusting system, **characterized in that** said system comprises the elevator door controller (8) according to any of claims 10-12 and/or the elevator door operator according to claim 13.
 15. An elevator door operation monitoring and adjusting system, **characterized in that** said system is configured to monitor at least one door-related parameter during door panel (6,7) movement; and if a monitored door-related parameter reaches a pre-determined threshold value, and/or if a change in the door-related parameter value reaches a pre-determined threshold value, to reduce door panel (6,7) movement speed.
 16. An elevator, **characterized in that** said elevator comprises the elevator door controller (8) according to any of claims 10-12 and/or the elevator door operator according to claim 13 and/or the elevator door operation monitoring and adjustment system according to claim 14 or 15.
 17. An elevator, **characterized in that** said elevator is configured to monitor at least one door-related parameter during door panel (6,7) movement; and if a monitored door-related parameter reaches a pre-determined threshold value, and/or if a change in the door-related parameter value reaches a pre-determined threshold value, to reduce door panel (6,7) movement speed.

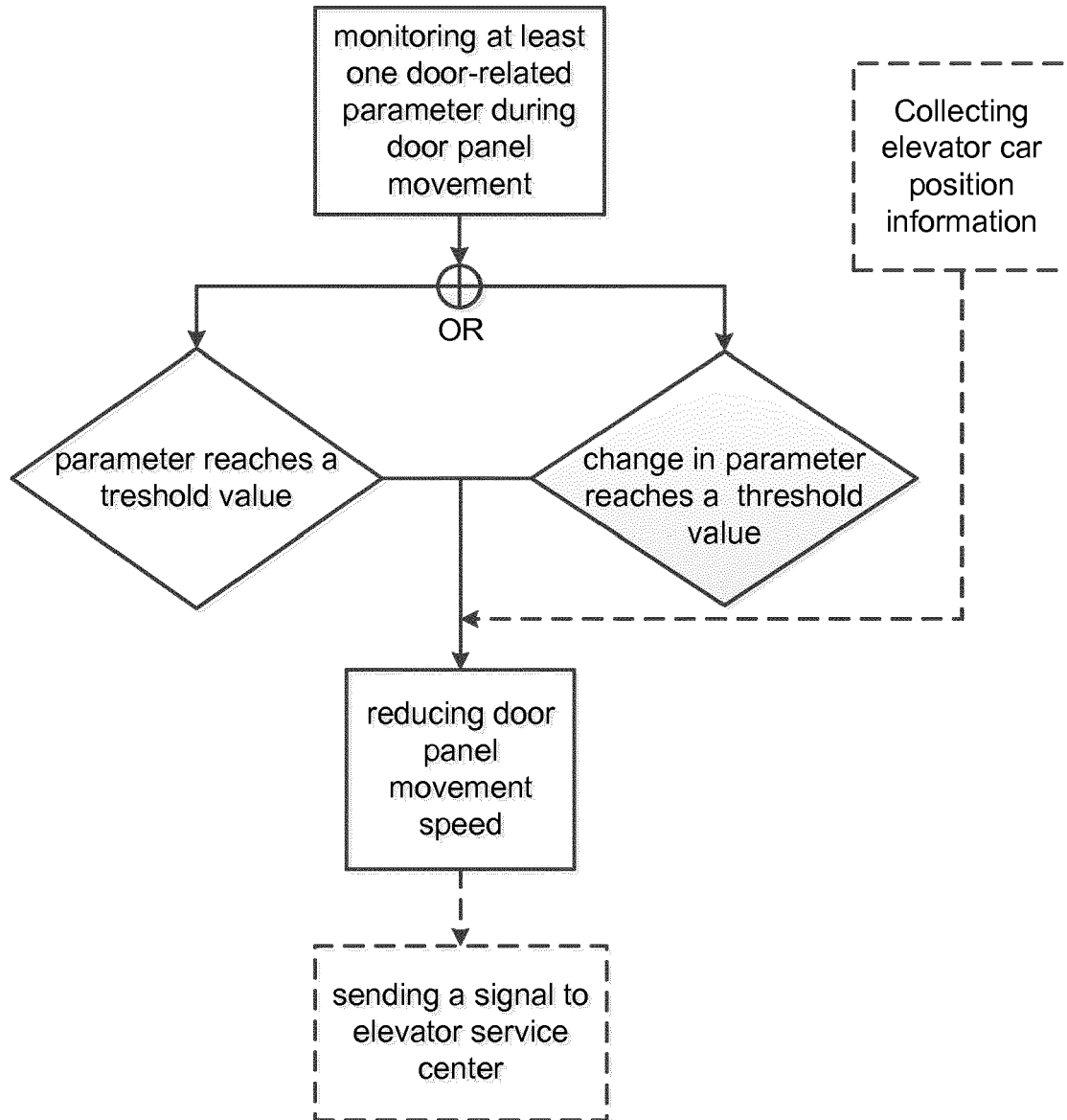


Fig. 1

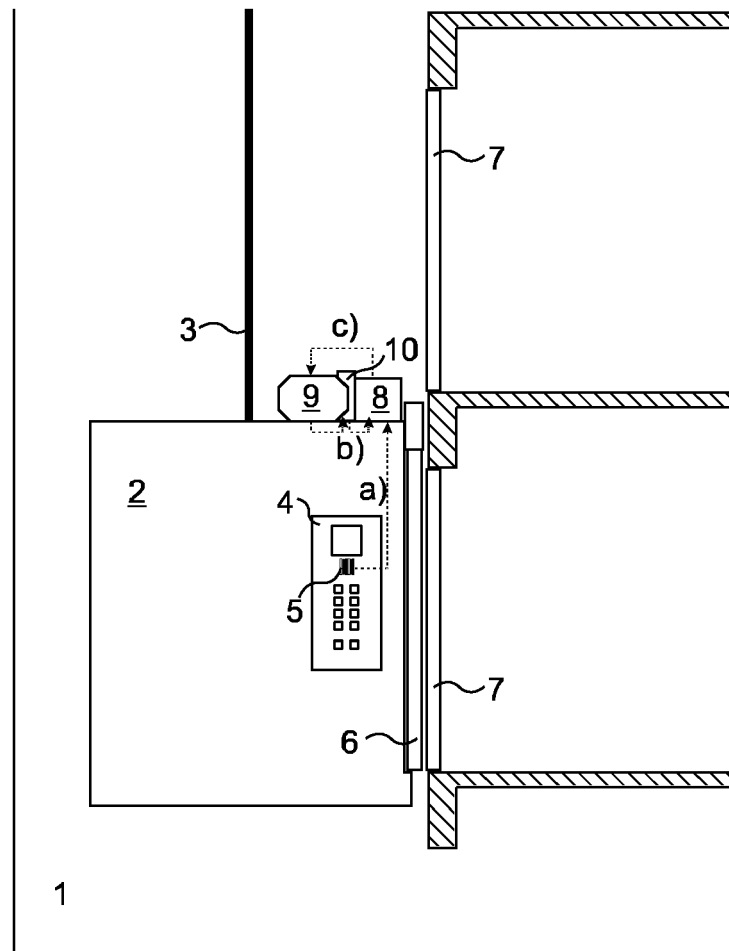


Fig. 2

**PARTIAL EUROPEAN SEARCH REPORT**

Application Number

under Rule 62a and/or 63 of the European Patent Convention.
This report shall be considered, for the purposes of
subsequent proceedings, as the European search report

EP 16 18 8058

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2012 240781 A (HITACHI BUILDING SYST CO LTD) 10 December 2012 (2012-12-10) * paragraph [0026] - paragraph [0029] * * paragraph [0010] - paragraph [0011] *	1-12,14	INV. B66B13/14 B66B5/00
A	WO 2004/037700 A1 (WITTUR SPA [IT]; GIORGIONI PAOLO [IT]) 6 May 2004 (2004-05-06) * page 6, line 12 - line 14 *	9	
A	US 2009/166133 A1 (TYNI TAPIO [FI] ET AL) 2 July 2009 (2009-07-02) * paragraphs [0012], [0025] *	1-12,14	
			TECHNICAL FIELDS SEARCHED (IPC)
			B66B

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

1

EPO FORM 1503 03.82 (P04E07)

Place of search	Date of completion of the search	Examiner
The Hague	6 April 2017	Fiorani, Giuseppe
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		



INCOMPLETE SEARCH SHEET C

Application Number

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Claim(s) completely searchable:
1-12, 14

Claim(s) not searched:
13, 15-17

Reason for the limitation of the search:

The applicant's arguments relating to the device claims relate either to the substance of the claimed subject-matter ("separate parts that can be used...") or to search strategy ("no undue burden"). These arguments could have been appropriate in case lack of unity had been argued. This is not the case of an invitation under Rule 61a(1) EPC, for which fulfilment of the requirements under Rule 43(2) EPC should have been proven in stead.

The applicant has in fact not convincingly argued that claims 10, 13 and 17 are in line with any one of the alternatives (a), (b) or (c) of Rule 43(2) EPC.

In the present case, claims 10, 13 and 17 have not been convincingly argued to fulfil the requirements of Rule 43(2) EPC, for the following reasons.

Rule 43(2)(a) EPC refers to "interrelated products", i.e. products of the plug-and-socket or transmitter-and-receiver type: the applicant has merely argued that the claims are either referred to "separate parts that can be used in a system..." or to claims "in line with [another claim]". This is not a sufficient argumentation to consider the claims as "interrelated" in the sense of Rule 43(2)(a) EPC.

Rule 43(2)(b) EPC refers to different uses of a product or apparatus. None of claims 10-17 refers to a use, nor has the applicant argued so.

Rule 43(2)(c) EPC refers to alternative solutions to a particular problem, when it is inappropriate to cover them with a single claim. The applicant has neither provided any problem linking together the subject-matter of the independent claims 10, 12, 13 and 17, nor has it given any reason with respect to the inappropriateness of one single claim.

The arguments of the applicant not being convincing, the search has been performed on claims 1 and 10 and their dependent claims.

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

EP 16 18 8058

5 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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-04-2017

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 0236476 A [0003]