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(54) **METHOD AND DEVICE FOR AI-BASED MONITORING OF FUNCTIONALITY OF AT LEAST ONE ELECTROMECHANIC BRAKE OF AN ELEVATOR ARRANGEMENT AS WELL AS COMPUTER PROGRAM AND USE**

(57) The present invention relates to means and methods of monitoring functionality of at least one electromechanic brake of an elevator arrangement, wherein a brake monitoring signal is generated based on brake sensor data, the brake monitoring signal providing for operating condition information to a brake controller of the elevator arrangement, wherein control data is bidirectionally exchanged between the brake controller and an elevator controller of the elevator arrangement, wherein the functioning of the at least one component of the at least one electromechanic brake is analysed by means of an AI module based on the brake monitoring signal, especially based on at least one physical parameter, wherein the AI module provides for at least one operating condition statement determined in computer-implemented manner based on the brake monitoring signal; wherein the respective operating condition statement is provided to the elevator controller, for controlling the elevator arrangement based on the respective operating condition statement.

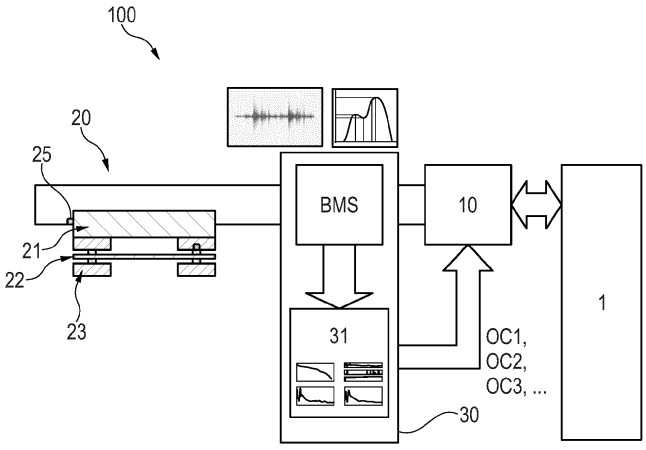

Fig. 1

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Description

TECHNCAL FIELD

[0001] The present invention refers to means and methods of monitoring functionality of at least one electromechanic brake of an elevator arrangement, wherein a brake monitoring signal is generated based on brake sensor data, the brake monitoring signal providing for operating condition information to a brake controller of the elevator arrangement, wherein control data is bidirectionally exchanged between the brake controller and an elevator controller of the elevator arrangement, wherein the functioning of the at least one component of the at least one electromechanic brake is analysed by means of a module based on the brake monitoring signal, wherein the module provides for at least one operating condition statement based on the brake monitoring signal. In particular, the present invention refers to methods and devices according to the respective present independent claim.

BACKGROUND

[0002] Safety rules in context with construction and installation of elevator arrangements require mechanical components of the elevator's brake system to be installed at least in two sets (redundancy); in particular, according to safety rules, some parts/components like e.g. a solenoid plunger are considered being mechanical parts, thus, the redundancy requirement may concern quite a lot of components. More specifically, the safety rules (or the corresponding computer code providing for control of the elevator's components) may require that in case of one of a respective electromechanical device not having/being actuated (e.g. opened), a further movement of any elevator car must be interrupted, especially since fault analysis might be inadequate or even non-existent.

[0003] In order to accomplish such requirements, usually, a double set of devices on each set of mechanical parts is installed, especially of mechanical parts of the brake system, especially in order to facilitate checking whether/why any mechanical part has/was not actuated (opened). This redundancy provides for a high degree of safety and robustness, and also of maintenance flexibility. Nonetheless, such redundant/double set of devices requires quite a lot of sensors, holders, ducts, wiring, as well as additional adjusting and regular maintenance, providing for more complexity and additional costs. Not least, fatigue and the need of replacing redundant components may rise the costs of installation and maintenance even further.

SUMMARY

[0004] It is an object of the present invention to provide for methods and devices for efficiently monitoring resp. supervising functionality of at least one electromechanic brake of an elevator arrangement. In particular, a/the object of the present invention is to provide for means and methods allowing for a high security level with minimum technical equipment and favourable costs.

[0005] 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.

[0006] In particular, the object is therefore solved by a method of monitoring functionality of at least one electromechanic brake of an elevator arrangement, wherein a brake monitoring signal is generated based on brake sensor data, the brake monitoring signal providing for operating condition information to a brake controller of the elevator arrangement, wherein control data is bidirectionally exchanged between the brake controller and an elevator controller of the elevator arrangement, wherein the functioning of the at least one component of the at least one electromechanic brake is analysed by means of an AI module based on the brake monitoring signal, especially based on at least one physical parameter, wherein the AI module provides for at least one operating condition statement determined in computer-implemented manner based on the brake monitoring signal; wherein the respective operating condition statement is provided to the elevator controller, for controlling the elevator arrangement based on the respective operating condition statement. This also allows for an advantageous compromise between a high level of safety and the lowest possible technical equipment and costs.

[0007] In other words: The present invention refers to methods for electromechanic brake monitoring through intelligent devices such as said AI module; the inventive method allows for having significant information about (electro)mechanical brake operation and (electro)mechanical brake components, especially without the need of redundant sets of devices installed on each mechanical part of the brake system.

[0008] The present invention also consists in a device using computerimplemented method steps based on artificial intelligence (AI) for receiving and elaborating information from a module which monitors the brake's behaviour favourably based on physical variables like e.g.: current, voltage applied on a brake coil, vibration or noise data/parameters. In addition, information from sensors indicating the status of the respective brake component (especially "activate" resp. no braking, or "repose" resp. braking) as well as actual wear limit of the respective brake shoes can be monitored for better diagnostic resp. prediction of any risk of failure. Such monitoring can also be realized in conjunction with environmental parameters like e.g. temperature and humidity values. The present invention may involve implementation of consideration of such measurement technology resp. such measurement values.

[0009] According to one advantageous implementation of the present invention, every mechanical state of

the brake system resp. of the respective brake component or brake operation which is captured by the brake monitoring device resp. by the AI module directly reflects on parameters like current consumption (current consumption curve), and/or generated noise frequency. According to the present invention, at least one computer-implemented artificial intelligence algorithm (resp. AI-based method step, resp. said AI module) is configured to be trained to learn what represents a/the curve of normal operation or a/the curve that represents a fault of brake operation. Moreover, such algorithm advantageously is configured to be trained to sort different kinds of brake failures based on machine learning of different curve patterns, e.g. current curve patterns, in particular based on curve patterns exemplarily shown in enclosed figures of the present disclosure.

[0010] The present invention allows for reducing costs of maintenance of brake systems, especially of brake systems exhibiting/using a single coil brake system. The present invention also provides for information about different failures in context with brake operation and failure prediction functionality.

[0011] The present invention also allows for improvements especially by cost reduction and by offering favourable implementation of artificial intelligence functionality in context with operational state monitoring and/or predictive maintenance of electromechanic brake systems.

[0012] According to one embodiment the method comprises computerimplemented functionality monitoring and operating condition statement generation by referring to the trend/progress of at least one physical parameter from the following group: current, voltage, structure-borne vibrational parameter, acoustic parameter; wherein the parameter preferably is a parameter specifically monitored/sensed for at least one brake component from the following group: brake coil, brake disk, brake shoe. This also allows for reliable predictive maintenance and failure prevention. The present invention may involve implementation of such functionality monitoring and operating condition statement generation in conjunction with consideration of measurement technology resp. measurement values referring to environmental parameters like e.g. temperature and humidity values.

[0013] According to one embodiment the method comprises computerimplemented functionality monitoring and operating condition statement generation based on specific curve patterns, especially by referring to at least one reference curve, preferably current curve, and by comparing a monitored curve with said reference curve. This also allows for analysing and diagnosing brake operating conditions in quite exact manner. It should be noted that reference to current curves may also include reference to further or alternative sensor data curves, e.g. voltage curves, distance parameter curves. The present invention may involve implementation of such functionality monitoring and operating condition statement generation in conjunction with consideration of temperature compensation and/or humidity compensation based on measurement technology resp. measurement values referring to environmental parameters like e.g. temperature and humidity values.

[0014] According to one embodiment the at least one operating condition statement is an operating condition statement from the following group: the at least one component momentarily being in normal condition, the at least one component momentarily being in abnormal condition. This also allows for providing, by means of AI-based supervision, a clear basis for decision-making in context with any further elevator control measures. It should be noted that an algorithm according to the present invention (especially involving AI-based supervision) may involve capabilities of detecting several operating condition statements and/or may involve implementation of several algorithm parts each being related to only one condition statement.

[0015] According to one embodiment the at least one operating condition statement refers to at least one brake component from the following group: brake coil, brake disk, brake shoe, spring. This also allows for efficiently checking/supervising functioning of most important safety components. It should be noted that according to the present invention, shoe supervision functionality is considered one of the most important safety monitoring features, especially since wear of the shoe(s) is considered relevant for monitoring momentary braking capabilities.

[0016] According to one embodiment the status of at least one brake component (especially "activate" or "repose") and/or actual wear limit of at least one brake shoe is monitored. This also allows for predicting any risk of failure more easily or more reliably. It should be noted that AI-based supervision functionality (AI means) preferably are configured for generating a score (%) for each output or parameter it is/was trained on. In particular, a trend of each separate score (time-dependent) can be used (referred to) for prediction or failure detection. Thus, said AI means may provide for quite reliable prognosis in context with specific operating parameters.

[0017] According to one embodiment at least one physical parameter is correlated with momentary current consumption and/or momentary noise frequency (structure-borne vibrational parameter resp. acoustic parameter), for computerimplemented functionality monitoring and operating condition statement generation. This also allows for supervising the functioning of quite complex brake assemblies.

[0018] In particular, the above mentioned object is also solved by a computer program (resp. computer module) comprising instructions which, when the program is executed by a computer, cause the computer to execute the steps of the method according to the present disclosure, especially by means of a/the AI module, wherein the AI module preferably generates the at least one operating condition statement based on current and/or voltage and/or vibrational parameters measured by a respective brake sensor. This provides for above mentioned advan-

tages; this also allows for direct correlation of momentary brake functioning and security measures.

[0019] In particular, the above mentioned object is also solved by an elevator arrangement configured for monitoring functionality of at least one electromechanic brake of the elevator arrangement, comprising a brake monitoring device configured for generating a brake monitoring signal based on brake sensor data and providing operating condition information to a brake controller of the elevator arrangement, wherein the elevator arrangement comprises an elevator controller bidirectionally exchanging control data with the brake controller, wherein the brake monitoring device comprises an AI module configured for analysing the functioning of the at least one component of the at least one electromechanic brake based on the brake monitoring signal, especially based on at least one physical parameter, and configured for providing/outputting at least one operating condition statement from the following group: the at least one component momentarily being in normal condition, the at least one component momentarily being in abnormal condition; especially with the elevator arrangement being configured for carrying out a method according to the present disclosure. This provides for above mentioned advantages; this also allows for slim design of at least (electro)mechanic brake components.

[0020] According to one embodiment the brake monitoring device comprises at least one brake sensor sensing at least one of the following physical parameters: current, voltage, structure-borne vibrational parameter, acoustic parameter; wherein the brake monitoring signal is generated based on momentary brake sensor data the of at least one brake sensor, especially providing a parameter curve as a function of time. This also allows for directly correlating elevator control measures with momentary operating conditions, also allowing for very fast implementation of any safety measure.

[0021] According to one embodiment the AI module is configured for outputting the at least one operating condition statement based on specific current curve patterns, especially by referring to at least one reference current curve. This also allows for correlating momentary operating conditions and safety measures in quite direct manner. It should be noted that alternatively or in addition to reference to current curves, reference can be made to voltage curves and/or vibration parameters and/or distance parameters. It has been found that referring to current parameters allows for providing reliable data to distinctly distinguish the operation condition statement. Further source signal(s) for further supervision implementation or further operation condition statement detection measures can also be referred to.

[0022] According to one embodiment the elevator arrangement comprises a single coil brake system. This also allows for implementing means and methods according to the present disclosure in favourable manner.

[0023] According to one embodiment the at least one electromechanic brake is a brake system bare of mechanical redundancy. This also allows for quite slim design and a very cost-effective approach.

[0024] According to one embodiment the brake monitoring device and the brake controller are provided within or by the same device or unit.

[0025] In particular, the above mentioned object is also solved by use of at least one AI-based algorithm for computerimplemented monitoring of functionality of at least one component of at least one electromechanic brake of an elevator arrangement in a method according to the present disclosure for AI-based generation of at least one operating condition statement providing information for generating at least one control command for controlling the elevator arrangement, wherein the at least one operating condition statement is generated based on brake sensor data provided by at least one brake sensor monitoring at least one physical parameter of the electromechanic brake, especially in an elevator arrangement according to the present disclosure. This provides for above mentioned advantages; this also allows for efficient implementation in conjunction with slim design.

SHORT DESCRIPTION OF FIGURES

[0026] These and other aspects of the present invention will also be apparent from and elucidated with reference to the embodiments described hereinafter. Individual features disclosed in the embodiments can constitute alone or in combination an aspect of the present invention.

[0027] Features of the different embodiments can be carried over from one embodiment to another embodiment. In the drawings:

Figure 1 schematically illustrates components and method steps of/for monitoring functionality of at least one electromechanic brake of an elevator arrangement, according to embodiments;

Figure 2 schematically illustrates components and method steps of/for monitoring functionality of at least one electromechanic brake of an elevator arrangement, according to further embodiments;

Figure 3 schematically illustrates method steps for monitoring functionality of at least one electromechanic brake of an elevator arrangement and for controlling the elevator arrangement based on input provided in context with AI-based functionality monitoring, according to further embodiments;

Figures 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17 respectively illustrate three curves showing different brake coil's voltage conditions during power ON and OFF;

DETAILED DESCRIPTION OF FIGURES

[0028] First, the reference signs are described in general terms; individual reference is made in connection with respective figures.

[0029] The present invention provides for an elevator arrangement 100 exhibiting at least one electromechanic brake 20 and a brake monitoring device 30 configured for generating a brake monitoring signal BMS based on brake sensor data and providing operating condition information to a brake controller 10 of the elevator arrangement 100. In particular, the at least one electromechanic brake 20 respectively may comprise a first brake component 21 (especially a brake coil), a second brake component 22 (especially a brake disk), and a third brake component 23 (especially brake shoe). The elevator arrangement 100 comprises at least one brake sensor 25 providing sensor data to the brake monitoring device 30, and comprises an elevator controller 1 bidirectionally exchanging control data with the brake controller 10. The elevator arrangement 100, especially the brake monitoring device 30 comprises an AI module 31 configured for analysing the functioning of the at least one component 21, 22, 23 of the at least one electromechanic brake 20 based on the brake monitoring signal BMS and configured for providing/outputting at least one operating condition statement OC1, OC2, OC3... from the following group: the at least one component momentarily being in normal condition, the at least one component momentarily being in abnormal condition.

[0030] The present invention also provides for a method of monitoring functionality of at least one electromechanic brake 20 of such elevator arrangement 100, wherein a/the brake monitoring signal BMS is generated based on brake sensor data measured by at least on brake sensor 25 based on transmitted sensor data D, wherein the brake monitoring signal BMS provides operating condition information to the brake controller 10, wherein control data resp. at least one control command C is bidirectionally exchanged between the brake controller and the elevator controller 1, wherein the functioning of the at least one component 21, 22, 23 of the at least one electromechanic brake 20 is analysed by means of an AI module 31 based on the respective brake monitoring signal BMS, especially based on at least one physical parameter measured/monitored by the at least one brake sensor 25, wherein the AI module 31 provides for at least one operating condition statement OC 1, OC2, OC3 ... determined in computerimplemented manner based on the brake monitoring signal BMS; wherein the respective operating condition statement OC1, OC2, OC3... is provided to the elevator controller 1, for controlling the elevator arrangement 100 based on the respective operating condition statement.

[0031] The present invention also provides for interaction resp. correlation of the following steps or of a partial selection of the following steps, wherein the sequence of the steps can also be varied or implemented in an adapted manner within the scope of the present invention:

first step **S1** provision of brake sensor data D resp. brake parameter(s);

second step **S2** generation of a brake monitoring signal BMS;

third step **S3** providing operating condition information to the brake controller 10;

fourth step **S4** AI-based analysis of functioning of at least one brake component 21, 22, 23;

fifth step **S5** generation of at least one operating condition statement OC1, OC2, OC3...;

sixth step **S6** provision of the operating condition statement to the elevator controller 1;

seventh step(s) **S7** controlling the elevator arrangement 100 based on respective operating condition statement(s);

[0032] **Fig. 1** illustrates interaction and signal/information transmittance in methods and devices according to the present disclosure.

[0033] **Fig. 2** generally describes communication between system components in methods and devices according to the present disclosure.

[0034] **Fig. 3** illustrates steps of methods according to the present disclosure.

[0035] In the following figures 4 to 17, reference is made to three different current derivative curves, respectively, each designating dependency of current parameter of at least one brake component at a specific voltage value, e.g. 43,2V (continuous line), 48V (dotted line), and 52,8V (dashed line). Minima of each curve are illustrated by a point, respectively, and maxima are illustrated by a cross, respectively. These curves may also provide for training data for AI-based algorithms configured to sort different kinds of brake failures based on machine learning of different curve patterns. It can be found that based on boundary conditions such as number of brakes, left or right brake, power on/off, the respective current derivative curve can be characterized specifically by curve analysis also involving e.g. minima and/or maxima coordinates.

[0036] **Fig. 4** illustrates a brake coil current's derivative during the brake power ON, wherein the brake's status is NORMAL ("OK").

[0037] **Fig. 5** illustrates a brake coil current's derivative during the brake power OFF, wherein the brake's status is NORMAL ("OFF").

[0038] **Fig. 6** illustrates a brake coil current's derivative during the brake power ON, wherein the right disk brake's status is ENGAGE.

[0039] **Fig. 7** illustrates a brake coil current's derivative during the brake power OFF, wherein the right disk brake's status is ENGAGE.

[0040] **Fig. 8** illustrates a brake coil current's derivative during the brake power ON, wherein the left disk brake's status is ENGAGE.

[0041] **Fig. 9** illustrates a brake coil current's derivative during the brake power OFF, wherein the left disk brake's status is ENGAGE.

[0042] **Fig. 10** illustrates a brake coil current's derivative during the brake power ON, wherein the status of

both disk brakes is ENGAGE.

[0043] **Fig. 11** illustrates a brake coil current's derivative during the brake power OFF, wherein the status of both disk brakes status is ENGAGE.

[0044] **Fig. 12** illustrates a brake coil current's derivative during the brake power ON, wherein the right disk brake's status is DISENGAGE.

[0045] **Fig. 13** illustrates a brake coil current's derivative during the brake power OFF, wherein the right disk brake's status is DISENGAGE.

[0046] **Fig. 14** illustrates a brake coil current's derivative during the brake power ON, wherein the left disk brake's status is DISENGAGE.

[0047] **Fig. 15** illustrates a brake coil current's derivative during the brake power OFF, wherein the left disk brake's status is DISENGAGE.

[0048] **Fig. 16** illustrates a brake coil current's derivative during the brake power ON, wherein the status of both disk brakes is DISENGAGE.

[0049] **Fig. 17** illustrates a brake coil current's derivative during the brake power OFF. Illustrates both disk brake's status is DISENGAGE.

List of reference signs

[0050]

1	elevator controller
10	brake controller
20	brake
21	first brake component, especially brake coil
22	second brake component, especially brake disk
23	third brake component, especially brake shoe
25	brake sensor (at least one)
30	brake monitoring device
31	AI module
100	elevator arrangement
BMS	brake monitoring signal
C	control command
D	(sensor) data transmission
OC1, OC2, OC3	operating condition statement
S1	first step, especially provision of brake sensor data or parameter(s)
S2	second step, especially generation of a brake monitoring signal
S3	third step, especially providing operating condition information to a brake controller
S4	fourth step, especially AI-based analysis of functioning of the at least one brake component
S5	fifth step, especially generation of at least one operating condition statement
S6	sixth step, especially provision of the operating condition statement to the elevator controller
S7	seventh step(s), especially controlling the elevator arrangement based on respective operating condition statement(s)

Claims

1. Method of monitoring functionality of at least one electromechanic brake (20) of an elevator arrangement (100), wherein a brake monitoring signal (BMS) is generated based on brake sensor data, the brake monitoring signal providing for operating condition information to a brake controller (10) of the elevator arrangement, wherein control data is bidirectionally exchanged between the brake controller and an elevator controller (1) of the elevator arrangement, wherein the functioning of at least one component (21, 22, 23) of the at least one electromechanic brake (20) is analysed by means of an AI module (31) based on the brake monitoring signal, especially based on at least one physical parameter, wherein the AI module (31) provides for at least one operating condition statement (OC1, OC2, OC3) determined in computerimplemented manner based on the brake monitoring signal (BMS); wherein the respective operating condition statement is provided to the elevator controller (1), for controlling the elevator arrangement based on the respective operating condition statement.

2. Method according to the preceding method claim, wherein the method comprises computerimplemented functionality monitoring and operating condition statement generation by referring to the trend/progress of at least one physical parameter from the following group: current, voltage, structure-borne vibrational parameter, acoustic parameter; wherein the parameter preferably is a parameter specifically monitored/sensed for at least one brake component from the following group: brake coil, brake disk, brake shoe.

3. Method according to any of the preceding method claims, wherein the method comprises computerimplemented functionality monitoring and operating condition statement generation based on specific curve patterns, especially by referring to at least one reference curve, preferably current curve, and by comparing a monitored curve with said reference curve.

4. Method according to any of the preceding method claims, wherein the at least one operating condition statement is an operating condition statement from the following group: the at least one component momentarily being in normal condition, the at least

one component momentarily being in abnormal condition.

5. Method according to any of the preceding method claims, wherein the at least one operating condition statement refers to at least one brake component from the following group: brake coil, brake disk, brake shoe, spring.

6. Method according to any of the preceding method claims, wherein the status of at least one brake component (especially "activate" or "repose") and/or actual wear limit of at least one brake shoe is monitored.

7. Method according to any of the preceding method claims, wherein at least one physical parameter is correlated with momentary current consumption and/or momentary noise frequency (structure-borne vibrational parameter resp. acoustic parameter), for computerimplemented functionality monitoring and operating condition statement generation.

8. Computer program comprising instructions which, when the program is executed by a computer, cause the computer to execute the steps of the method according to at least one of the preceding claims, especially by means of a/the AI module.

9. Elevator arrangement (100) configured for monitoring functionality of at least one electromechanic brake (20) of the elevator arrangement, comprising a brake monitoring device (30) configured for generating a brake monitoring signal (BMS) based on brake sensor data and providing operating condition information to a brake controller (10) of the elevator arrangement, wherein the elevator arrangement (100) comprises an elevator controller (1) bidirectionally exchanging control data with the brake controller, wherein the brake monitoring device comprises an AI module (31) configured for analysing the functioning of the at least one component (21, 22, 23) of the at least one electromechanic brake based on the brake monitoring signal (BMS), especially based on at least one physical parameter, and configured for providing/outputting at least one operating condition statement from the following group: the at least one component momentarily being in normal condition, the at least one component momentarily being in abnormal condition; especially with the elevator arrangement being configured for carrying out a method according to any of the claims 1 to 7.

10. Elevator arrangement according to the preceding claim, wherein the brake monitoring device comprises at least one brake sensor sensing at least one of the following physical parameters: current, voltage, structure-borne vibrational parameter, acoustic parameter; wherein the brake monitoring signal is generated based on momentary brake sensor data the of at least one brake sensor, especially providing a parameter curve as a function of time.

11. Elevator arrangement according to any of the preceding device claims, wherein the AI module is configured for outputting the at least one operating condition statement based on specific current curve patterns, especially by referring to at least one reference current curve.

12. Elevator arrangement according to any of the preceding device claims, wherein the elevator arrangement comprises a single coil brake system.

13. Elevator arrangement according to any of the preceding device claims, wherein the at least one electromechanic brake is a brake system bare of mechanical redundancy.

14. Elevator arrangement according to any of the preceding device claims, wherein the brake monitoring device and the brake controller are provided within or by the same device or unit.

15. Use of at least one AI-based algorithm for computer-implemented monitoring of functionality of at least one component (21, 22, 23) of at least one electromechanic brake (20) of an elevator arrangement (100) in a method according to any of the preceding method claims 1 to 7 for AI-based generation of at least one operating condition statement (OC1, OC2, OC3) providing information for generating at least one control command (C) for controlling the elevator arrangement (100), wherein the at least one operating condition statement is generated based on brake sensor data provided by at least one brake sensor (25) monitoring at least one physical parameter of the electromechanic brake (20), especially in an elevator arrangement according to any of the preceding device claims 9 to 14.

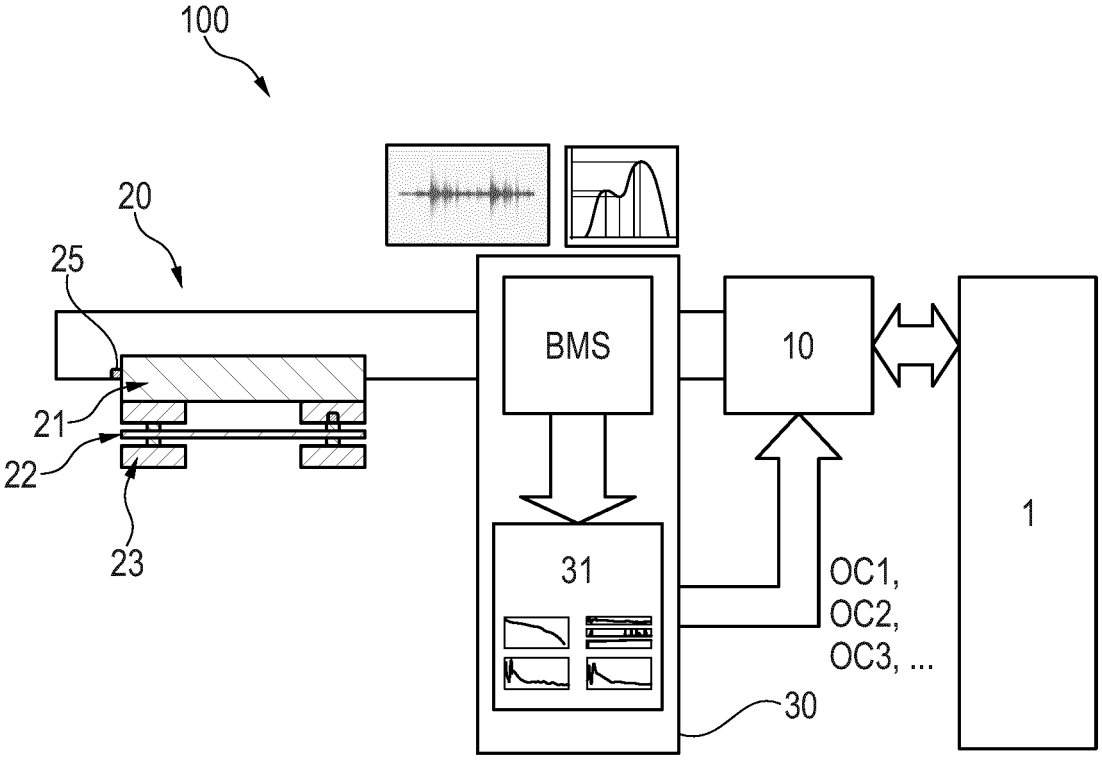
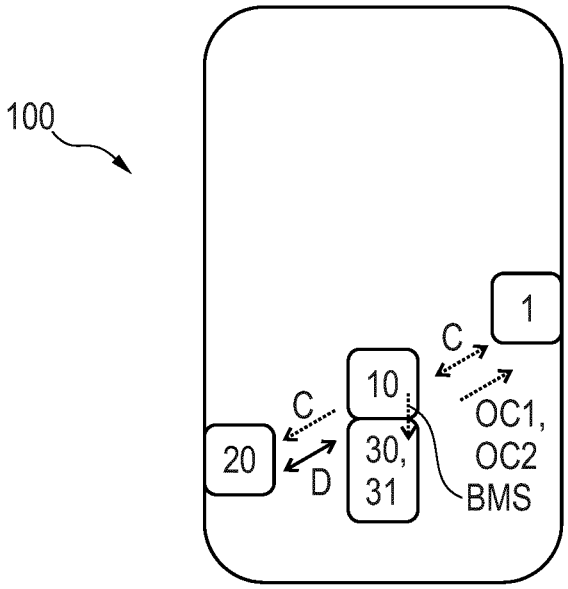

100
20
25
21
22
23
BMS
10
1
31
OC1,
OC2,
OC3, ...
30

Fig. 1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OC1,
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BMS

Fig. 2

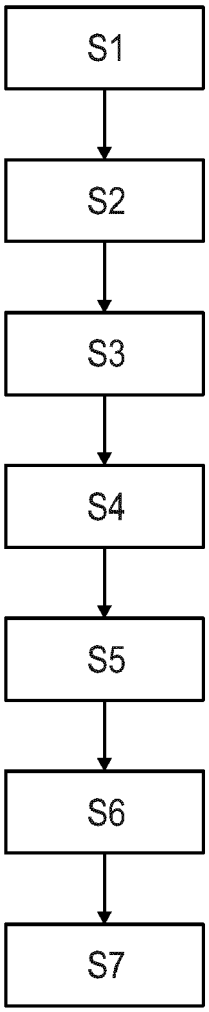

Fig. 3

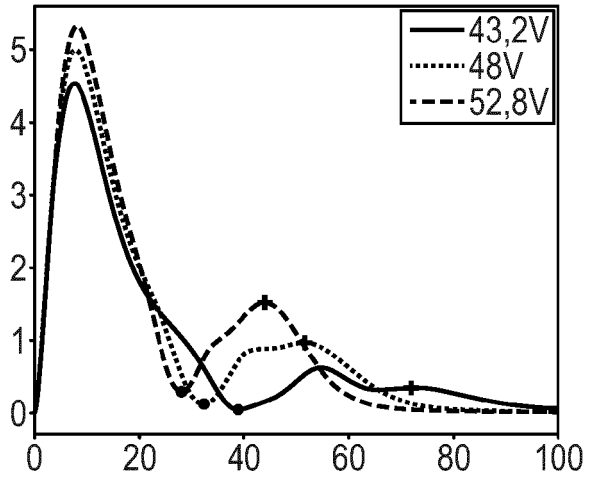

Fig. 4

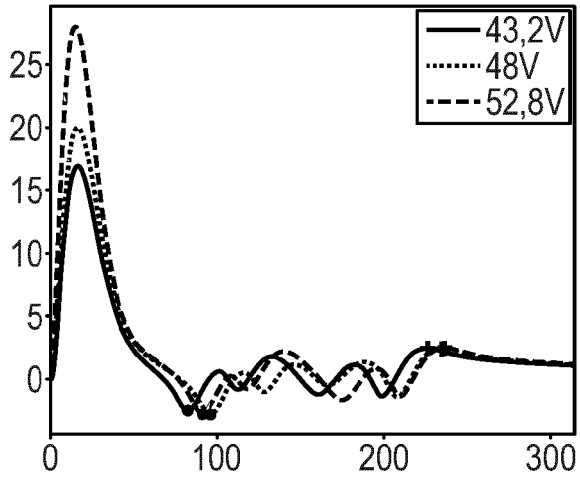

Fig. 5

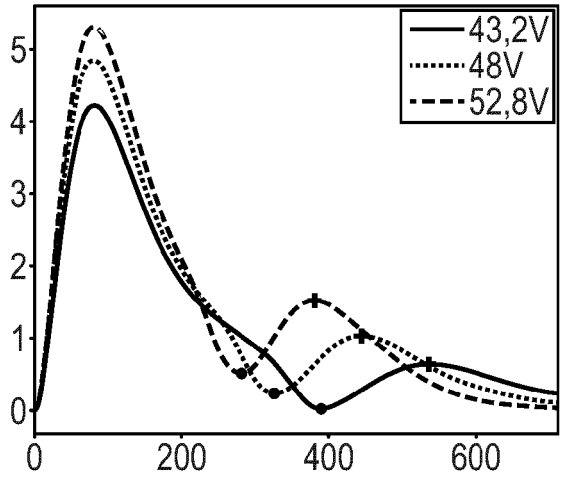

Fig. 6

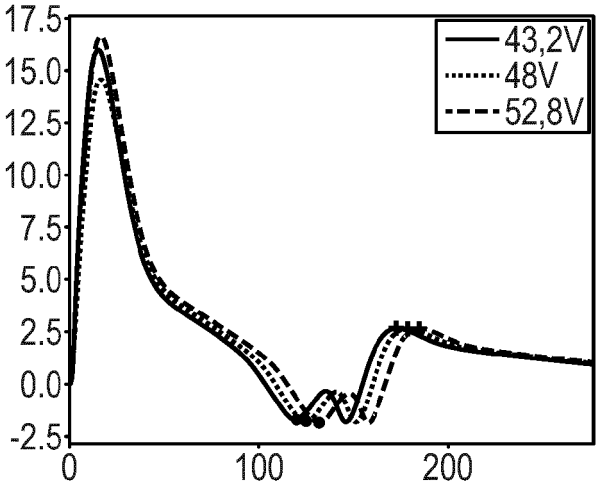

Fig. 7

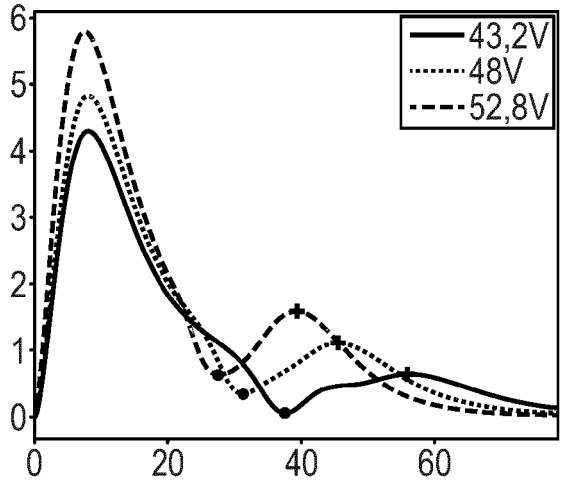

Fig. 8

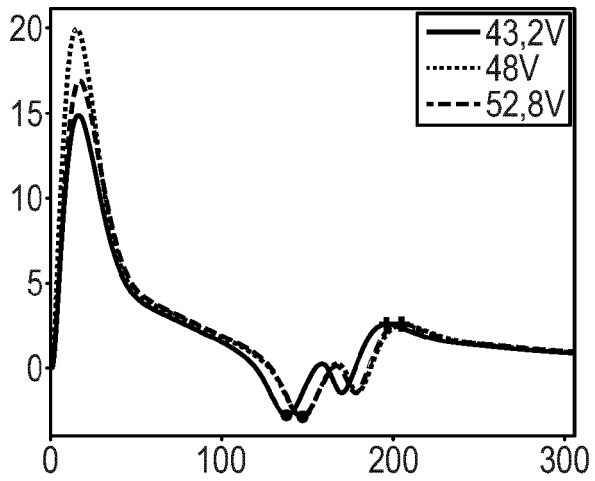

Fig. 9

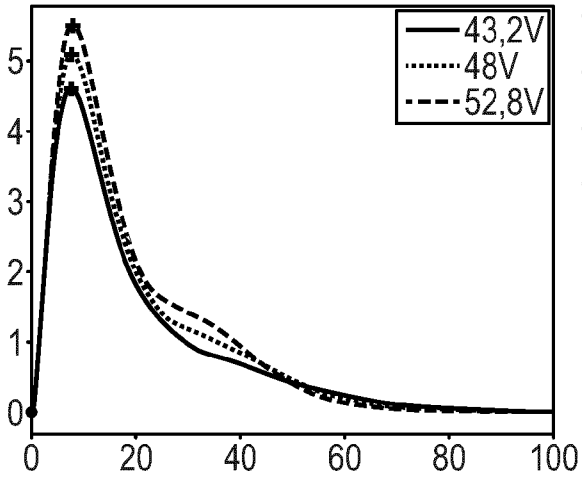

Fig. 10

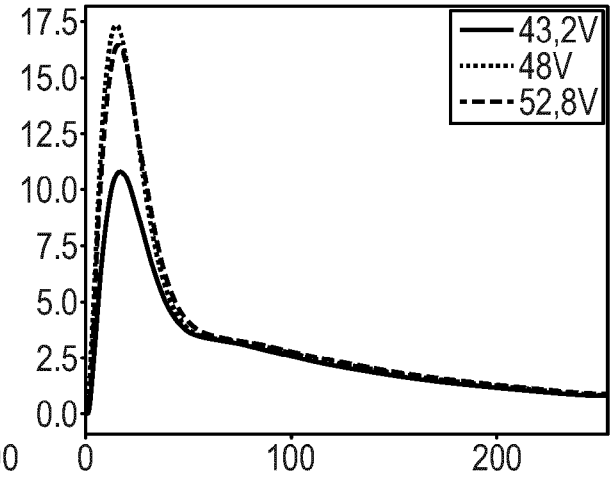

Fig. 11

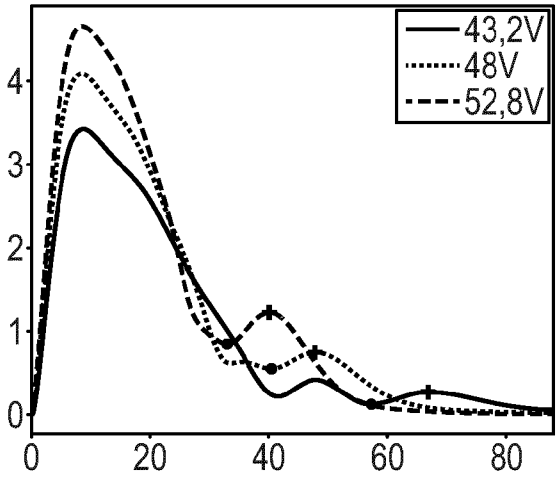

Fig. 12

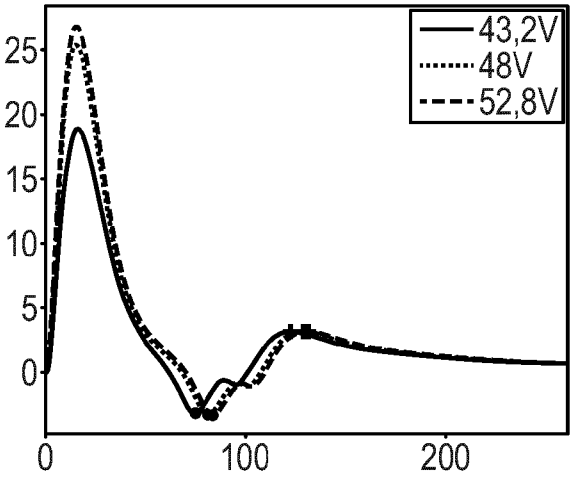

Fig. 13

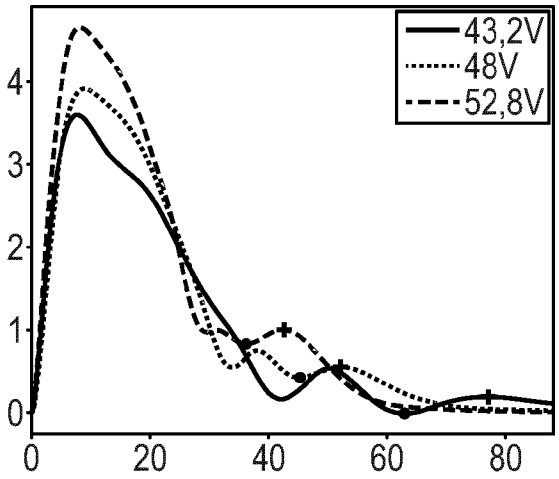

Fig. 14

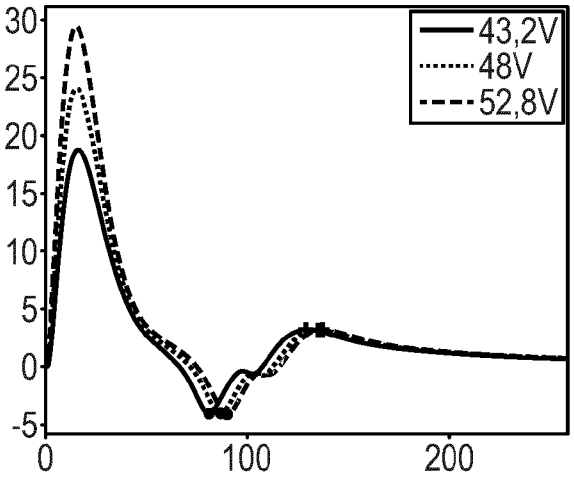

Fig. 15

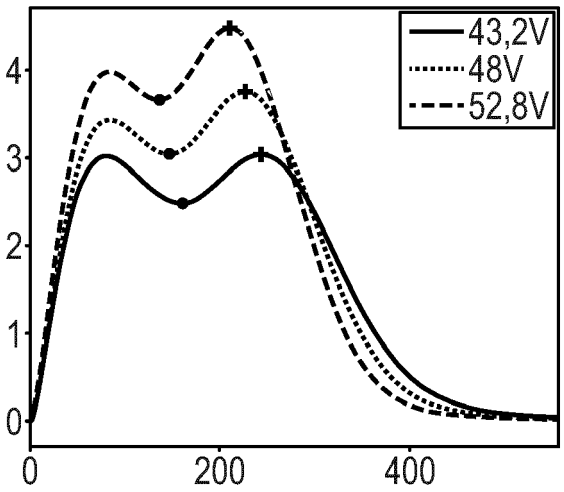

Fig. 16

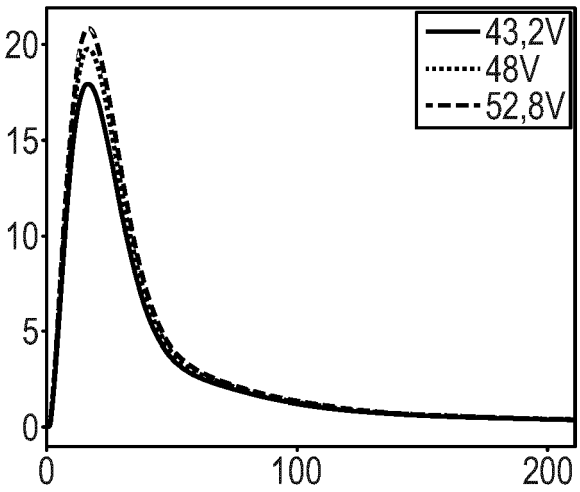

Fig. 17

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EUROPEAN SEARCH REPORT

Application Number
EP 23 38 2702

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	CN 108 203 033 A (HITACHI ELEVATOR CHINA CO LTD) 26 June 2018 (2018-06-26) * paragraph [0010] - paragraph [0015] * * paragraph [0024] - paragraph [0029] * * figure 1 *	1-15	INV. B66B5/00
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TECHNICAL FIELDS SEARCHED (IPC)

B66B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 November 2023	Szován, Levente

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