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(54) **A RESCUE APPARATUS AND AN ELEVATOR**

(57) The invention concerns an elevator, comprising: an elevator car (1) vertically movable in an elevator shaft (4); an elevator hoisting machinery (9) disposed in the elevator shaft (4); an emergency rescue device (2) disposed in the elevator shaft (4); and an elevator controller (3) disposed at an elevator landing (5). A communication channel (6) is arranged between the elevator controller (3) and the emergency rescue device (2).

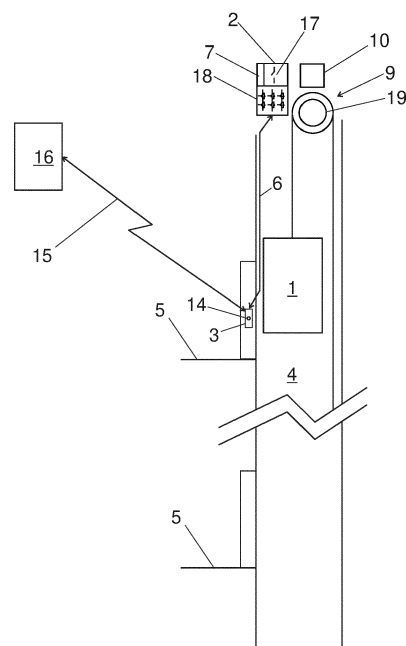


Fig. 1

Description

Field of the invention

[0001] The subject matter described herein relates to elevators and in particular to elevator rescue devices.

Background

[0002] Sometimes an operational anomaly, such as a power failure interrupts elevator travel, causing stopping of elevator car between landings. In that case elevator car needs to be relocated to a landing to release passengers from the car. This operation is referred to as rescue operation.

[0003] In rescue operation, hoisting motor and / or hoisting machinery brakes may be energized by a battery-operated emergency rescue device to move the car. In machine-room less elevators emergency rescue device is usually disposed inside an elevator shaft, for example in upper part of the shaft, close to the elevator hoisting machinery. In that case the rescue device is not easily accessible. In case of a failure, service person must enter elevator shaft and try to debug the rescue device for example from elevator car roof.

Summary of the invention

[0004] The objective of the present invention is to solve at least partially the above-identified problems. Therefore the invention discloses an elevator according to claim 1. Some preferred embodiments of the invention are described in the dependent claims. Some inventive embodiments, as well as inventive combinations of various embodiments, are presented in the description and in the drawings.

[0005] According to the invention, an elevator is provided. The elevator comprises an elevator car vertically movable in an elevator shaft, an elevator hoisting machinery disposed in the elevator shaft, an emergency rescue device disposed in the elevator shaft, an elevator controller disposed at an elevator landing and a communication channel between the elevator controller and the emergency rescue device. The emergency rescue device comprises a battery acting as a voltage supply of the emergency rescue device during an operational anomaly of the elevator and a power unit connected to the battery and configured for energizing at least one of elevator hoisting motor and hoisting machinery brakes to relocate the elevator car during an operational anomaly of the elevator. The emergency rescue device further comprises a sensor array comprising at least one sensor configured for measuring one or more operational parameters of the emergency rescue device and a processing unit connected to the sensor array and configured to generate a rescue device performance indicator based on the information received from sensor array and to send the performance indicator to the elevator controller. This

means that debugging of the emergency rescue device may be performed from a landing, outside of the elevator shaft.

[0006] Preferably, the elevator controller is disposed next to a landing door or inside a landing door frame.

[0007] According to an embodiment, the emergency rescue device comprises a contactor for separating the emergency rescue device from the mains. The operational parameter of the emergency rescue device is one of contactor status, status of a power transistor of the power unit, temperature of the power unit, battery current, battery voltage, battery power, output voltage of the power unit, output current of the power unit, phase failure of the power unit.

[0008] According to an embodiment, the elevator controller is configured to display a fault code based on the performance indicator. Thus the elevator controller may comprise a display, or it may be connectable with an external display device, such as a mobile device to display the information.

[0009] According to an embodiment, the elevator controller comprises a manual input for receiving a debug command. The elevator controller is configured to send an energizing command to the power unit responsive to receiving a debug command. This can mean that debug commands for emergency rescue device can be provided from a landing, outside of elevator shaft.

[0010] According to an embodiment the elevator controller comprises a remote connection to a cloud or to a remote server.

[0011] According to a refinement, the elevator controller is configured to send the performance indicator to a cloud or a remote server via a remote connection. The cloud or remote server may perform computing operations based on a performance indicator or a sequence of performance indicators to diagnose degraded condition and schedule a service request before failure of the emergency rescue device. Thus degraded condition of the emergency rescue device may be diagnosed early and adequate service may be provided to minimize elevator downtime.

[0012] According to another refinement, the elevator controller is configured to receive a fault code or maintenance instruction as a response from the cloud or remote server, and to display said fault code or maintenance instruction received. Therefore elevator may be diagnosed remotely in the remote server or in the cloud on the basis of the performance indicators, and the diagnostics result may be utilized by service personnel on elevator site.

Brief description of the drawings

[0013] In the following, the invention will be described in more detail by the aid of some examples of its embodiments, which in themselves do not limit the scope of application of the invention, with reference to the attached drawings, wherein

Fig. 1 shows a schematic view of an elevator.

Fig. 2 shows a block diagram of an emergency rescue device.

More detailed description of preferred embodiments of the invention

[0014] For the sake of intelligibility, in figs 1 and 2 only those features are represented which are deemed necessary for understanding the invention. Therefore, for instance, certain components / functions which are widely known to be present in the art may not be represented.

[0015] Fig. 1 shows an elevator according to an exemplary embodiment. Elevator comprises an elevator car 1 and a counterweight (not shown) suspended on hoisting ropes. Hoisting ropes run via a traction sheave of an elevator hoisting machinery 9. Hoisting machinery 9 has electrical motor 19, preferably a permanent magnet motor, which provides driving torque to move the elevator car 1. Power signals for operating the electrical motor 19 are generated by the inverter 18. Hoisting machinery 9 comprises brakes 10, which are controlled by an actuator, such as an electromagnetic actuator. Brakes 10 are engaged to hold elevator car 1 standstill in elevator shaft and opened to enable elevator car 1 movement. Opening of the brakes 10 takes place by supplying electrical power to the actuators. Brakes 10 are engaged by interrupting the power supply. In normal operation, electrical power for the motor 19 and the brakes 10 is supplied from mains. Control commands for operating the elevator are generated by an elevator controller 3.

[0016] In some abnormal situations, such as during power failure, there is a need to relocate elevator car 1 to a landing 5. Therefore, the elevator of Fig. 1 comprises an emergency rescue device 2.

[0017] The emergency rescue device 2, as well as the elevator hoisting machinery 9 and the inverter 18 are disposed in upper portion of elevator shaft 4. Elevator controller 3 is disposed at an elevator landing 5. A communication channel 6 is arranged between the elevator controller 3 and the emergency rescue device 2. Communication channel 6 may be in the form of any suitable wired or wireless communication bus, such as serial data bus or parallel data bus. Exemplary embodiments of the communication bus are CAN bus, LON bus and ethernet bus. Via the communication channel 6, control commands and / or debug commands may be provided from the elevator controller 3 to the emergency rescue device 2. Further, performance information of the rescue device 2 may be provided from the emergency rescue device 2 to the elevator controller 3 via the communication channel 6 such that debugging and / or condition monitoring of the emergency rescue device 2 may be performed from outside of the elevator shaft 4.

[0018] The emergency rescue device 2 comprises a battery 7, which provides voltage supply for the electronics of the emergency rescue device 2 as well as power supply to the hoisting motor 19 and / or the hoisting ma-

chinery brakes 10 during specific operational anomalies of the elevator.

[0019] Turning to Fig. 2, the emergency rescue device 2 of Fig. 1 comprises a power unit 8 connected to the battery 7. Power unit 8 comprises power components, such as contactor and power transistors. The emergency rescue device 2 further comprises a sensor array 11 and a processing unit 12 connected to the sensor array 11. The sensor array 11 comprises at least one sensor configured for measuring one or more operational parameters of the emergency rescue device 2. Sensor may be an auxiliary contact of the contactor 17, indicating contactor 17 status, i.e. actual open or closed state. Sensor may be voltage or current meter indicating status of power transistor of the power unit 8 (e.g. to determine transistor failure or short circuit) Sensor may be a temperature sensor indicating temperature of the power unit 8 and / or the battery 7 (e.g. to determine possible over-temperature of the power unit and / or the battery). Sensor may be a voltage or current meter indicating voltage or current of the battery 7 (e.g. to determine possible over- or undervoltage of the battery 7 under load condition or in an overcurrent situation), or a power meter indicating output power of the battery 7 (e.g. power supply capability of the battery 7). Additionally or alternatively, the sensor may be a voltage or current meter indicating output voltage or current of the power unit 8 or- if the power unit has a multi-phase AC output - a phase failure of the power unit 8.

[0020] The processing unit 12 is configured to generate a rescue device performance indicator based on the information received from sensor array 11 and addressing at least some of the above-identified defects. Further, processing unit 12 is configured to send the performance indicator to the elevator controller 3. The elevator controller 3 may be configured to display a fault code based on the performance indicator. The elevator controller 3 may comprise a display, or it may be connectable with an external display device, such as a mobile device to display the information.

[0021] According to an embodiment, the drive unit of elevator hoisting machinery (e.g. motor inverter 18 and brake control unit) is part of the emergency rescue device 2. In particular, the drive unit is configured for providing electrical power to hoisting machinery brakes 10 and motor 19 from the battery 7 when an operational anomaly is determined. Thus the emergency rescue device 2 may comprise a contactor 17 or a relay for separating the drive unit from mains and connecting with the battery 7 in case of an operational anomaly.

[0022] According to an alternative embodiment, the emergency rescue device 2 is a separate unit from the drive unit.

[0023] According to a refinement, the elevator controller 3 comprises a remote connection 15 to a cloud or to a remote server 16. Such remote connection may be an internet connection via a router, or a wireless cellular network. The elevator controller 3 is configured to send

a performance indicator or a sequence of performance indicators to a cloud or to a remote server 16 via a remote connection 15, to diagnose degraded operating condition and to schedule a service request before failure of the emergency rescue device 2. This way availability of the elevator service may be improved.

[0024] According to an embodiment, the elevator controller 3 is configured to receive a related fault code or maintenance instruction as a response from the cloud or remote server 16, and to display said fault code or maintenance instruction received to facilitate debugging work of the service personnel.

[0025] According to a refinement, the elevator controller 3 comprises a manual input 14, such as touchscreen, a button set or a keyboard, for receiving a debug command. The elevator controller 3 is configured to send an energizing command to the power stage 8 responsive to receiving a debug command. This way operation of the emergency rescue device 2 may be tested.

[0026] The invention is described above by the aid of exemplary embodiments. It is obvious to a person skilled in the art that the invention is not limited to the embodiments described above and many other applications are possible within the scope of the inventive concept defined by the claims.

Claims

1. An elevator, comprising:

an elevator car (1) vertically movable in an elevator shaft (4);
 an elevator hoisting machinery (9) disposed in the elevator shaft (4);
 an emergency rescue device (2) disposed in the elevator shaft (4);
 an elevator controller (3) disposed at an elevator landing (5);
 a communication channel (6) between the elevator controller (3) and the emergency rescue device (2);
 wherein the emergency rescue device (2) comprises:

a battery (7) acting as a voltage supply of the emergency rescue device (2) during an operational anomaly of the elevator;
 a power unit (8) connected to the battery (7) and configured for energizing at least one of elevator hoisting motor (19) and hoisting machinery brakes (10) to relocate the elevator car (1) to a landing (5) during an operational anomaly of the elevator;
 a sensor array (11) comprising at least one sensor configured for measuring one or more operational parameters of the emergency rescue device (2);

a processing unit (12) connected to the sensor array (11) and configured to generate a rescue device performance indicator based on the information received from sensor array (11) and to send the performance indicator to the elevator controller (3).

2. The elevator according to claim 1, wherein the emergency rescue device comprises a contactor (17) for separating the emergency rescue device (2) from the mains, and the operational parameter of the emergency rescue device (2) is one of contactor status, status of a power transistor of the power unit (8), temperature of the power unit (8), battery current, battery voltage, battery power, output voltage of the power unit (8), output current of the power unit (8), phase failure of the power unit (8).
3. The elevator according to claim 1 or 2, wherein the elevator controller (3) is configured to display a fault code based on the performance indicator.
4. The elevator according to any of the preceding claims, wherein the elevator controller comprises a manual input (14) for receiving a debug command, and wherein the elevator controller (3) is configured to send an energizing command to the power unit (8) responsive to receiving a debug command.
5. The elevator according to any of the preceding claims, wherein the elevator controller (3) comprises a remote connection (15) to a cloud or to a remote server (16).
6. The elevator according to claim 5, wherein the elevator controller (3) is configured to send a performance indicator or a sequence of performance indicators to a cloud or a remote server (16) via a remote connection (15) to schedule a service request before failure of the emergency rescue device (2).
7. The elevator according to claim 5 or 6, wherein the elevator controller (3) is configured to receive a fault code or maintenance instruction as a response from the cloud or remote server (16), and to display said fault code or maintenance instruction received.

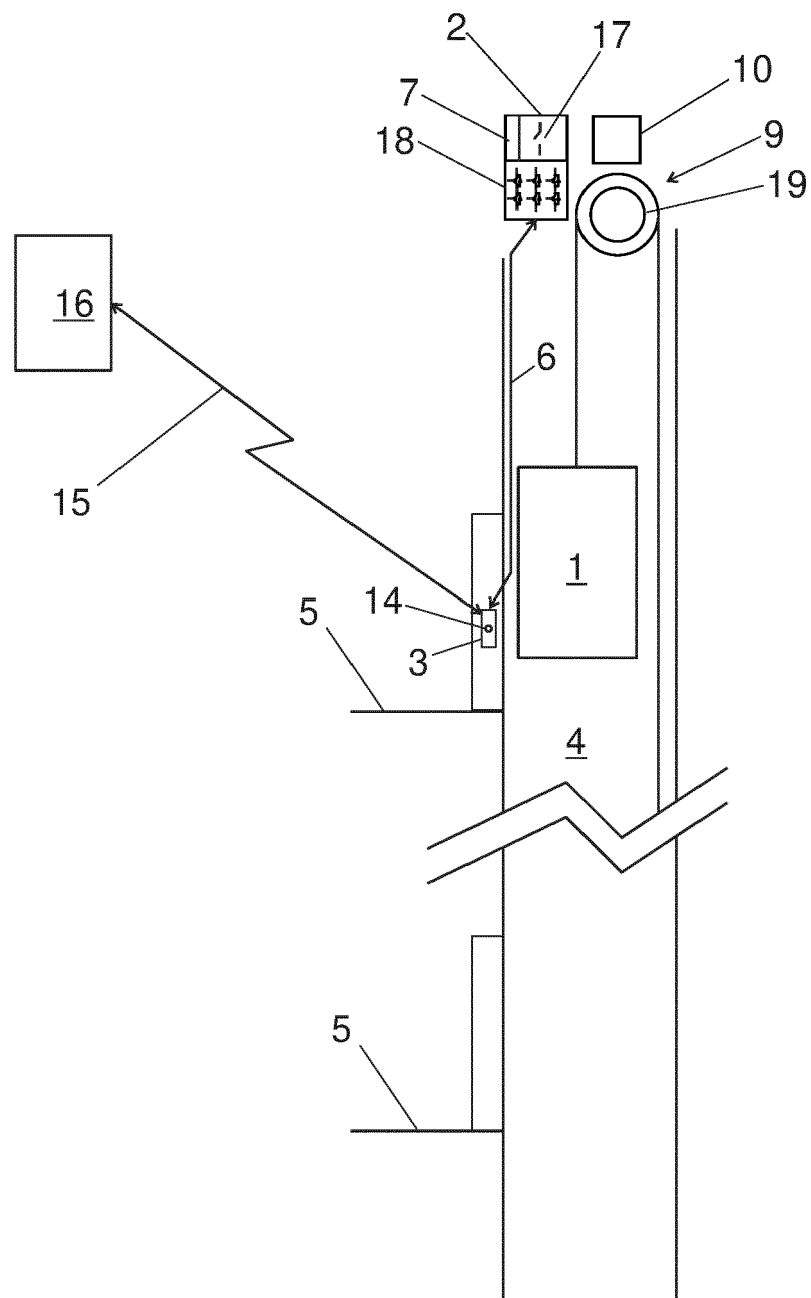


Fig. 1

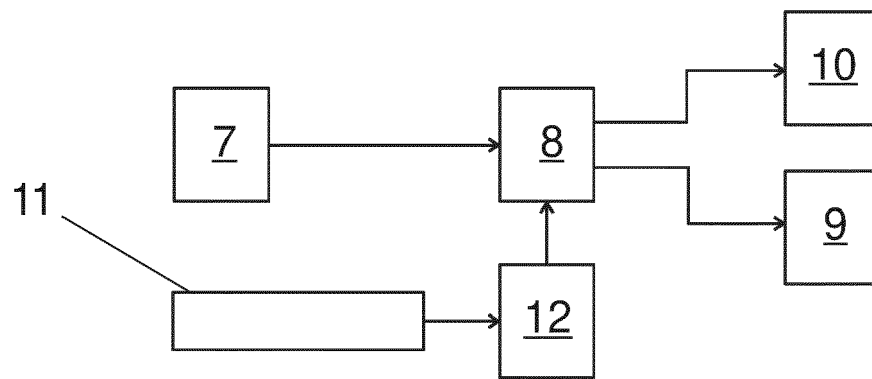


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 21 17 5227

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Y	* pages 1-3, paragraph 0012-0031 -	5-7	
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 6 September 2021	Examiner Lohse, Georg
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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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