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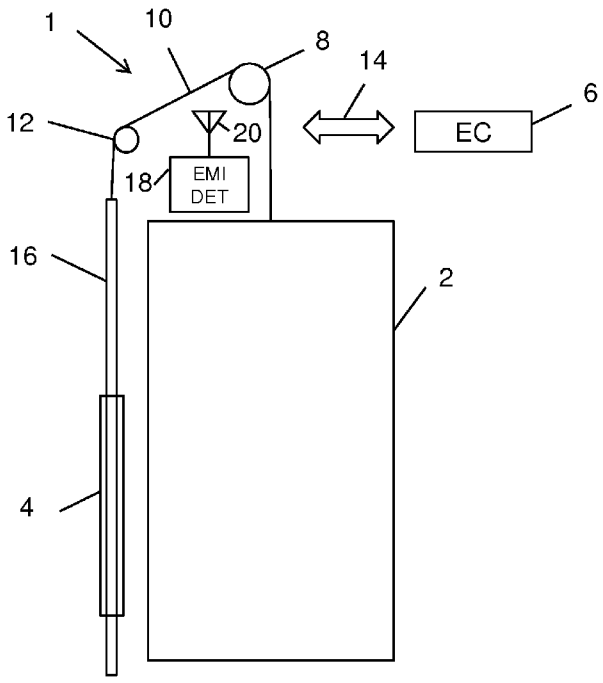

Fig. 1

(57) Abstract: A system includes an elevator installation (1) having an elevator controller (6) configured to operate the elevator installation (1), and a detector system (18, 20) fixedly installed within the elevator installation (1). The detector system (18, 20) is positioned to detect electromagnetic radiation or electromagnetic induction in proximity of the elevator installation (1) and to generate a signal indicative of electromagnetic radiation or electromagnetic induction being present in the proximity of the elevator installation (1).

WO 2014/079686 A1

Elevator installation with EMI detector system

Specification

[0001] The various embodiments described herein generally relate to elevator installations. More particularly, the various embodiments described herein relate to elevator installations operating in environments subject to electromagnetic radiation or electromagnetic induction.

[0002] Multi-story buildings are usually equipped with at least one elevator installation. In a generally known elevator installation, a suspension medium – such as a rope or flat belt-type rope – interconnects a counterweight and a cabin, and an electrical drive motor causes the suspension medium to move in order to thereby move the counterweight and the cabin up and down along a shaft or hoistway. An elevator controller of the elevator installation controls and monitors the operation of the elevator installation, e.g., by processing input signals received via communications network or signaling lines (e.g., from sensors, a safety chain, call input devices, etc.) and by generating control signals, which are fed to the communications network or the signaling lines.

[0003] An elevator installation in these multi-story buildings is subject to a wide variety of electromagnetic radiation or electromagnetic induction, or both, that may interfere with the electronic equipment of the elevator installation, in particular if a frequency of the radiation or induction is in the range of the frequencies used within the electronic equipment. Such interference is referred to as electromagnetic interference (EMI), also referred to as radiofrequency interference (RFI). For example, electromagnetic radiation may originate from nearby mobile phone base stations or from sources within the building (e.g., electric switching supplies or brake circuitry of the elevator installation itself).

[0004] EMI adversely affects, e.g., the electrical signal transmission via the communications network or the signaling lines in an elevator installation. If a malfunctioning (e.g., a failing transmission or degrading transmission quality) is suspected to be caused by electromagnetic radiation or electromagnetic induction, sophisticated test and measurement equipment is usually used to determine if and to what extent EMI is present at a certain location. Common approaches to improve signal transmission in environments affected by EMI include, e.g., shielding electrical components that are sensitive to EMI, or locating these components as far as possible from a potential source of electromagnetic radiation or induction.

[0005] Even though these approaches may alleviate such EMI issues, these approaches may not be feasible under all circumstances, e.g., when extensive shielding is not possible or no flexibility in positioning the components exists. The latter may in particular be the case in an elevator installation where the components are positioned in a confined space, e.g., the elevator shaft. Also, EMI may occur sporadically complicating the detection of a potential EMI source, in particular in situations in which a technician servicing an elevator installation does not have sophisticated test and measurement equipment at hand. There is, therefore, a need for an alternative way of dealing with EMI in an

elevator installation that facilitates servicing the elevator installation, while always maintaining safe operation of the elevator installation.

[0006] Accordingly, on aspect of such an alternative technology involves a system including an elevator installation and a detector system that is fixedly installed within the elevator installation. The elevator installation has a controller that operates the elevator installation. The detector system is positioned to detect electromagnetic radiation or electromagnetic induction in proximity of the elevator installation, and configured to generate a signal indicative of electromagnetic radiation or electromagnetic induction being present in the proximity of the elevator installation.

[0007] Another aspect of the alternative technology involves a method of operating an elevator installation to mitigate adverse effects of electromagnetic radiation or electromagnetic induction on the elevator installation. The method detects electromagnetic radiation or electromagnetic induction in proximity of the elevator installation using a detection system fixedly installed in the elevator installation. The method also generates a signal indicative of electromagnetic radiation or electromagnetic induction being present in proximity of the elevator installation.

[0008] In one embodiment, the detector system includes an antenna and a detector circuit, wherein the antenna converts the electromagnetic radiation or electromagnetic induction into an electrical antenna signal, and wherein the detector circuit receives the electrical antenna signal and generates the signal that is indicative of electromagnetic radiation or electromagnetic induction. It is an advantage that the detector system builds relatively small and can be flexibly positioned, in particular in an elevator shaft where space may be limited.

[0009] In one embodiment, the detector system includes a rectifier circuit coupled to the antenna. The rectifier circuit may in one embodiment include a diode, such as a Schottky diode. Diodes and antennas are commercially available standard components. It is an advantage that such standard components allow the detector circuit to be manufactured at low cost.

[00010] In one embodiment, the detector system includes an indicator circuit that generates, as a function of the generated signal, a signal perceivable by a human. The perceivable signal is at least one of an optical signal and an acoustic signal. It is an advantage that a service technician does not need sophisticated equipment to determine whether or not EMI is present and may be the cause of a malfunctioning of the elevator installation.

[00011] In another embodiment, the detector system is communicatively coupled to the elevator controller to react upon the signal indicative of electromagnetic radiation or electromagnetic induction. This allows the elevator controller to take note of (e.g., to record) any occurring EMI or to react in a variety of ways in response to occurring EMI. With such flexibility, it is an advantage that the system can be configured according to the requirements of a particular elevator installation.

[00012] As one example of how to react, in one embodiment, the elevator controller performs at least one predetermined mitigation strategy in response to the generated signal. The mitigation strategy includes modifying an error correction procedure, modifying a signal transmission speed,

modifying signal levels and executing a reduced operational mode. These strategies assist in maintaining safe operation of the elevator installation as long as possible.

[00013] The alternative technology implemented by the various embodiments of the system and the method provides a variety of advantages and improvements over the known technologies. The technology facilitates servicing an elevator installation that is actually negatively affected by EMI in that it provides direct feedback to a technician; e.g., an LED may indicate that EMI is present in the shaft. In that sense, the technology provides information about a currently existing EMI situation, i.e., at a time when EMI may already have negatively affected the elevator installation.

[00014] The fact that the detector system provides information about the currently existing EMI situation may be beneficial even if EMI is not the cause of a malfunctioning. For example, an elevator installation may malfunction intermittently, the cause of the malfunction, however, may be unknown. In such a situation, the absence of a signal indicative of EMI allows the diagnosis that EMI is likely not the cause of the malfunction. Servicing an elevator installation, in particular performing error diagnosis, is facilitated.

[00015] The technology, however, is not limited to providing information about a current EMI situation. The technology also allows implementation of an early warning function. That is, the detector system continuously monitors the generated signal that is indicative of electromagnetic radiation or electromagnetic induction, and, therefore, is able to track EMI over time and to determine very early if EMI increases. This allows implementing preventive measures such as switching the elevator installation to predetermined safety state.

[00016] In one embodiment, a threshold value may be set above which the system determines that EMI is too high for a safe operation of the elevator installation. The threshold value is set so that the system reacts before operation of the elevator installation is negatively affected. The threshold value, therefore, facilitates implementation of the early warning function.

[00017] The technology described herein may be used to inform travelling or waiting passengers. If the elevator installation is negatively affected by EMI and the elevator controller switched the elevator installation to the reduced operational mode, the elevator installation may inform passengers about the reduced operational mode. For example, the elevator controller may trigger an announcement such as "Operation is safe, but cabin is travelling at a reduced speed," or "Elevator out of service, please use other elevator," or similar. Further, this kind of information may also be sent to a building operator.

[00018] The novel features and method steps characteristic of the invention are set out in the claims below. The invention itself, however, as well as other features and advantages thereof, are best understood by reference to the detailed description, which follows, when read in conjunction with the accompanying drawings, wherein:

Fig. 1 shows a schematic illustration of one embodiment of an elevator installation having an EMI detector system positioned in an elevator shaft;

Fig. 2 is a schematic illustration of one embodiment of the EMI detector system coupled to the elevator controller; and

Fig. 3 is a flow diagram of one embodiment of a method of operating the elevator installation.

[00019] Fig. 1 schematically illustrates – in a side view – one embodiment of an elevator installation 1, e.g., installed in a multi-story building, whereas individual floors are not shown. The elevator installation 1 includes a cabin 2 connected via a suspension medium 10 (e.g., one or more round ropes or flat belt-type ropes) to a counterweight 4, wherein the cabin 2 and the counterweight 4 are movable up and down in opposite directions in a vertically extending shaft or hoistway (not indicated in FIG. 1). Within the shaft or in proximity of the elevator installation 1, a detector system formed by an antenna 20 and a detector 18 for electromagnetic radiation or electromagnetic induction, or both, is provided. The detector system may be viewed as part of the elevator installation 1, or be a standalone system coupled to the elevator installation 1. As indicated in FIG 1 (via a double arrow 14 that represents a communications network), the detector system is coupled to an elevator controller 6 of the elevator installation 1. As the electromagnetic radiation or electromagnetic induction to be detected are the causes of electromagnetic interference (EMI) the detector system and the detector 18 are hereinafter, without any limitation, referred to as EMI detector system and EMI detector 18, respectively.

[00020] Briefly, the EMI detector 18 is configured to detect – via the antenna 20 – any electromagnetic radiation or electromagnetic induction present in the shaft or in proximity of the elevator installation 1, and to generate a signal indicative of such presence. For reasons of brevity, the presence of electromagnetic radiation or electromagnetic induction is hereinafter referred to as EMI, keeping in mind, however, that EMI is the resulting disturbance caused by electromagnetic radiation or electromagnetic induction. Depending on a particular embodiment, the presence of EMI may be indicated by an optical device, e.g., a light emitting diode (LED) or a lamp, activated by the generated signal. An optical indication gives direct feedback information, e.g., to a technician that EMI is present in the shaft; the technician may then use this feedback information to resolve a potential malfunctioning of the elevator installation 1. In addition, the generated signal may be fed to a processor (a separate standalone processor or the elevator controller 6) for further processing to mitigate the adverse effect EMI has, e.g., on the signal transmission occurring in the elevator installation 1, either between components such as between elevator controller 6 and an operating panel, or within a component such as an operating panel. Embodiments of the antenna 20 and the EMI detector 18, their components and functions, are described below in more detail with reference to FIG 2 and FIG 3.

[00021] Referring again to the structure of the elevator installation 1 shown in Fig. 1, the terms "shaft" and "hoistway" are used herein interchangeably. Depending on a particular embodiment, the shaft may be surrounded by walls, e.g., four walls, or may not be completely enclosed as, e.g., in a so-called panorama elevator where a cabin with at least one transparent (e.g., glass) wall moves along only one wall of a building. Also, one of ordinary skill in the art will appreciate that in another embodiment an elevator installation may include more than one cabin, each moving in a separate shaft and coupled via a suspension medium to a counterweight. In yet another embodiment, more than one cabin may move within the same shaft. In these embodiments, at least the antenna 20 of the EMI detector system is positioned in sufficient proximity to the components of the elevator installation 1 that are subject to EMI.

[00022] The exemplary elevator installation of Fig. 1 has guide rails for both the cabin 2 and the counterweight 4. For ease of illustration, Fig. 1 shows a guide rail 16 for the counterweight 4 only, but not for the cabin 2; however, it is contemplated that the cabin 2 is guided by at least one guide rail as well. In a typical embodiment of an elevator installation, the shaft includes two guide rails for the counterweight 4 and two guide rails for the cabin 2.

[00023] A drive 8 is coupled to the suspension medium 10 and configured to act upon the suspension medium 10 to move the cabin 2 and the counterweight 4. These components are arranged in accordance with a 1:1 roping arrangement; however, other roping arrangements (e.g., 2:1) are possible as well. Next to the drive 8, a deflection sheave 12 is positioned above the counterweight 4 to deflect the suspension medium 10 between the drive 8 and the counterweight 4, as shown in Fig. 1, so that the cabin 2 and the counterweight 4 can move along different paths without colliding. It is contemplated that in another embodiment the positions of the drive 8 and the deflection sheave 12 are changed, i.e., the drive 8 is positioned above the counterweight 4 and the deflection sheave 12 above the cabin 2.

[00024] Furthermore, in one embodiment, the elevator installation 1 is a traction-type elevator, i.e., a drive sheave coupled to the drive 8, or a surface of a rotor of the drive 8, acts upon the suspension medium 10 by means of traction between the drive sheave and the suspension medium 10. In such an embodiment, the suspension medium 10 serves as a suspension and traction medium.

[00025] The foregoing illustrates that an elevator installation may have various configurations with regard to the disposition of its components (e.g., drive in overhead space or pit, with or without a deflection sheave, various roping arrangements (e.g., 1:1 or 2:1)) or the type of suspension medium used to move the counterweight 4 and the cabin 2. In yet another configuration, an elevator installation may use a fluid-driven piston acting on a cabin to lift and lower the cabin; such an elevator installation is known as a hydraulic elevator. The skilled person, however, will appreciate that any kind of elevator installation in accordance with one of the various configurations may be used in connection with the EMI detector system described herein. As such, use of the EMI detector system is not limited to a particular configuration of the elevator installation 1.

[00026] The elevator controller 6 (in Fig. 1 labeled as EC for elevator controller) of the elevator installation 1 interacts with various components of the elevator installation 1 via a communications network and/or signaling lines; these communications means are represented in FIG 1 through double arrow 14. It is contemplated, however, that communications also take place and signaling lines exist within individual components of the elevator installation 1, e.g. such as car operating panels (COP) or landing operating panels (LOP). The elevator controller 6 is configured to control and monitor the performance and operation of the elevator installation 1, as is known in the art. In addition, the elevator controller 6 is in one embodiment communicatively coupled to the EMI detector 18 to take an active part in mitigating adverse effects of EMI, as described below in more detail.

[00027] Fig. 2 is a schematic illustration of one embodiment of the detector system including the EMI detector 18 and the antenna 20. In the illustrated embodiment, the EMI detector 18 is coupled to the antenna 20 and – via a controller 28 – to the elevator controller 6. The EMI detector 18 includes a rectifier circuit 22 coupled to the antenna 20 to receive an (AC) antenna signal from the antenna 20 and to rectify the antenna signal. The rectified antenna signal is a DC signal. The antenna signal and hence the rectified signal (in particular their signal strengths (i.e., amplitudes)) are indicative of detected electromagnetic radiation or electromagnetic induction; the rectified antenna signal may therefore be referred to as EMI signal. In one embodiment, the rectifier circuit 22 includes a diode suitable for radio frequency applications and selected for one or more frequency ranges in which EMI typically occurs. One example of a suitable diode is a Schottky diode.

[00028] The EMI detector 18 includes further an indicator circuit 26 coupled to the rectifier circuit 22 to receive the EMI signal and to output a signal that is perceivable by a human (e.g., a technician working in the shaft) as a function of the EMI signal. The perceivable signal may be an optical signal or an acoustic signal, or a combination of these signals, generated by converting the generated electrical signal into an optical signal (e.g., via one or more LEDs) or an acoustic signal (e.g., via a loudspeaker or buzzer). In the embodiment of FIG 2, the indicator circuit 26 generates an optical signal to visually indicate that electromagnetic radiation or electromagnetic induction is present as a function of the generated signal (i.e., the EMI signal derived from the antenna signal). In one embodiment, the indicator circuit 26 includes an LED. The indicator circuit 26 may be configured to indicate the strength of the electromagnetic radiation or electromagnetic induction by means of varying brightness of the LED. If more than one LED is used (e.g., an LED bar), the number of activated LEDs is proportional to the strength of the electromagnetic radiation or electromagnetic induction. As to the kind of visual indicator, it is contemplated that any other visual indicator device (e.g., lamp, display, etc.) may be used. Other signaling devices, such as acoustic devices (e.g., loudspeakers, buzzers), may be used as well.

[00029] In the embodiment of FIG 2, a resistor circuit 24 is interconnected between the rectifier circuit 22 and the indicator circuit 26 to modify the EMI signal. For example, if the indicator circuit 26 includes an LED, the resistor circuit 24 includes a resistor, or a combination of resistors, that limits

the current flowing through the LED to a maximum forward current to avoid thermal damage of the LED. It is contemplated, however, that the resistor circuit 24 may not be necessary if the indicator circuit 26 is rated for a maximum current that is higher than the current output from the antenna 20.

[00030] The EMI signal may not only be used to drive the indicator circuit 26, but also as an input signal to the controller 28 for further processing. The further processing may be used for triggering a mitigation strategy, e.g., when an actual value of the EMI signal exceeds a predetermined threshold value, or any other reaction defined in the elevator installation 1 (e.g., EMI strength tracking for early warning purposes, informing waiting or travelling passengers or informing building operators). For example, in one embodiment, the controller 28 includes an analog-to-digital (A/D) converter that converts the EMI signal to a digital signal having a voltage corresponding to the voltage of the EMI signal. A microprocessor within the controller 28 uses that digital signal to generate signals or messages when a voltage of the digital signal exceeds a certain threshold voltage. The generated signals or messages are forwarded to the elevator controller 6 to activate and execute, e.g., one or more EMI mitigation strategies.

[00031] The antenna 20 may be any kind of antenna that is suitable to detect electromagnetic radiation or electromagnetic induction. For far field electromagnetic radiation, a broadband antenna may be used. The bandwidth of the antenna is selected to extend over the frequencies most likely occurring in proximity of the elevator installation 1 and/or most likely to cause EMI. A broadband antenna can be configured as a slot antenna, a log-periodic array antenna, or a dipole antenna. For near field electromagnetic radiation an inductive loop antenna may be used. Regardless of whether or not a far field or near field situation exists, selecting a suitable antenna for these situations lies within the skill of the ordinary person.

[00032] In one embodiment, the rectifier circuit 22, the resistor circuit 24 and the indicator circuit 26 of the EMI detector 18 are mounted on a printed circuit board (PCB). Depending on particular circumstances, a housing, with an opening for the indicator circuit 26 to be visible from outside, may be provided that shields the components from environmental influences, e.g., dirt or dust. Advantageously, as all components are mounted on a PCB, with or without housing, such an EMI detector 18 builds relatively small and can therefore be flexibly positioned. Also, due to the low number of (commercially available standard) components on the PCB the EMI detector 18 can be manufactured at low cost.

[00033] In addition to these components (22, 24, 26) the controller 28 may be implemented on the PCB of the EMI detector 18 as well. This results in a more compact arrangement in a single housing, for example. It is contemplated, however, that the functionality of the controller 28 may in certain embodiments be integrated into the elevator controller 6. In that case, the EMI detector 18 is communicatively connected to the elevator controller 6. In addition to these options, in certain embodiments, additional components may be integrated into the elevator controller 6; however, the

antenna 20 remains at a location suitable for detecting electromagnetic radiation or electromagnetic induction, and the indicator circuit 26 also remains positioned to be perceived by a technician.

[00034] FIG 3 is a flow diagram of one embodiment of a method of operating the elevator installation 1 having a detector system as described with reference to FIG 1 and FIG 2. The method starts at a step S0, and ends at a step S5.

[00035] Proceeding to a step S1, the method continuously measures if EMI (i.e., electromagnetic radiation and/or electromagnetic induction) is present in proximity of the elevator installation 1. This measurement is performed by the detector system and results in an actual value (e.g., a digital value representing a measured voltage) indicative of the actual intensity of EMI.

[00036] Proceeding to a step S2, the method compares the actual value with a predetermined threshold value. If the actual value does not exceed the threshold value, the method proceeds along a NO branch back to step S1. In that case, any measured EMI is deemed to be too low to cause an adverse effect in the elevator installation 1. If, however, the actual value exceeds the threshold value, the method proceeds along a YES branch to a step S3. In that case, the measured EMI is considered to be so high that an adverse effect might occur.

[00037] In step S3, the method indicates that EMI is present. That indication occurs via a signal generated by the detection system and perceivable by a human. As discussed above, the perceivable signal may be, e.g., an optical signal or an acoustic signal. Advantageously, the indication provides direct feedback information to a technician working at the elevator installation 1. The technician may then use this feedback information for resolving any malfunctioning of the installation 1. In certain embodiments (eg., smaller elevator installations, low traffic elevator installations), it may suffice to indicate the presence of EMI without further processing of that information or involving the elevator controller 6; in that case, the method ends after step S3.

[00038] Proceeding to a step S4, the method initiates a mitigation strategy. Once the mitigation strategy has been initiated, the method ends in step S5. Once the mitigation strategy has been triggered, the elevator controller 6 executes the mitigation strategy. There are several possible mitigation strategies that can be implemented by the elevator controller 6. In one embodiment, only one of these possible mitigation strategies is employed for a particular elevator installation 1. In other embodiments, more than one mitigation strategies may be available to the elevator controller 6. The elevator controller 6 may then execute the mitigation strategy that is most suitable for the current situation.

[00039] A first mitigation strategy affects the transmission speed (e.g., measured in baud/sec) employed for (e.g., serial) communications within the elevator installation 1. More particularly, the transmission speed (or data rate) is adapted to a current situation to achieve optimized signal transmission with respect to speed and quality. For example, at the beginning of a communication between a transmitter and a receiver of a communications system, a defined communications protocol allows the transmitter to set the transmission speed for that communication. According to the first

mitigation strategy, the elevator controller 6 controls transmitters to reduce the transmission speed to lower the impact of EMI on the signal transmission, e.g., the signal quality. Once EMI is no longer present, or deemed to be non-disturbing, the elevator controller 6 may increase the transmission speed again.

[00040] A second mitigation strategy affects the error detection mechanism employed for communications within the elevator installation 1. One example of a known error detection mechanism is referred to as cyclic redundancy check (CRC). CRC is used in digital networks and storage devices to detect accidental changes to data. Briefly, a CRC-enabled device calculates a fixed-length binary sequence (i.e., a check value) for each block of data to be sent and appends it to the data, forming a code word. On a receiving side, when the code word is received, the device either compares its check value with one freshly calculated from the data block, or performs a CRC on the whole code word and compares the resulting check value with an expected residue constant. If the check values do not match, then the block of data contains a data error and corrective measures may be taken. If the check values match, the data is assumed to be error-free. According to the second mitigation strategy, the elevator controller 6 controls transmitters to increase CRC bit lengths to support the employed correction algorithm. The elevator controller 6 may cancel the second mitigation strategy once EMI is, for example, no longer present.

[00041] A third mitigation strategy affects the voltage levels used for the signal transmission within the elevator installation 1. In communications system, in particular digital ones, certain voltage levels are set to represent bits, e.g., about 0 – 0.5 V for a logic "0", and about 4.5 – 5 V for a logic "1". According to the third mitigation strategy, the elevator controller 6 controls transmitters to output signals at higher voltage level, and receivers to "accept" higher voltage levels. This adaptation of the voltage level improves the signal-to-noise ratio (SNR). Again, the elevator controller 6 may cancel the third mitigation strategy once EMI is no longer present, or deemed to be non-disturbing.

[00042] These mitigation strategies allow maintaining operation of the elevator installation 1 for as long as possible despite the threat of EMI. However, under certain circumstances, these mitigation strategies may not be effective to handle high levels of EMI and the elevator installation 1 has to shut down. To avoid a sudden shut down, in a fourth mitigation strategy a step-by-step shut down (or "graceful" degradation) may be implemented. According to this fourth mitigation strategy, the objective still is to keep the elevator installation 1 operable for as long as possible, even in the presence of higher levels of EMI, while still ensuring safe operation of the elevator installation 1. Some functionality may no longer be available when the fourth mitigation strategy is active, and the elevator installation 1 may be in a reduced operational mode, which a passenger may not even notice. For example, if EMI causes malfunctioning of a landing operating panel on a particular floor, that panel may be disabled (e.g., a pressed button is ignored and/or the panel is not powered) and service to that floor may be stopped, or all floors may be served (i.e., the cabin 2 stops at each floor). Similarly, if the drive 8 is negatively affected by EMI, but is still operable, the drive 8 moves the cabin 2 at a

reduced speed and/or acceleration. It is contemplated that such a reduced operational mode is temporary and based on the assumption that any malfunctioning will be checked and repaired as soon as possible.

[00043] As discussed above, the detector system provides intelligent feedback information as to the occurrence of EMI. That information may not only be used by the elevator controller 6 to execute a mitigation strategy, but also by a remote service/call center. In such an embodiment, the remote service/call center may dispatch a technician to the elevator installation 1 if information is received that electromagnetic radiation and/or electromagnetic induction above the predetermined threshold value is present. The technician can then address the root cause of a potential problem before the elevator installation 1 is adversely affected due to that problem.

[00044] The skilled person will appreciate that at least some of the electronic components of the detector system are configured as integrated circuits that are packaged in housings for easy handling and achieving a low form factor. Further, the skilled person will appreciate that such integrated circuits may include other functionalities to shape or amplify the antenna signal.

[00045] It is apparent that there has been disclosed a technology for detecting electromagnetic radiation and electromagnetic induction that fully satisfy the objects, means, and advantages set forth herein before. For example, providing a relatively simple and inexpensive detector system in the elevator installation 1 allows a technician to determine that EMI may be the cause of a malfunctioning. The need for sophisticated testing and measurement equipment is removed.

Claims

1. A system, comprising:

an elevator installation (1) having an elevator controller (6) configured to operate the elevator installation (1); and

a detector system (18, 20) fixedly installed within the elevator installation (1) and positioned to detect electromagnetic radiation or electromagnetic induction in proximity of the elevator installation (1), the detector system (18, 20) further configured to generate a signal indicative of electromagnetic radiation or electromagnetic induction being present in the proximity of the elevator installation (1).

2. The system of Claim 1, wherein the detector system (18, 20) includes an antenna (20) and a detector circuit (18), wherein the antenna (20) is positioned to detect electromagnetic radiation or electromagnetic induction, and to convert the electromagnetic radiation or electromagnetic induction into an electrical antenna signal, and wherein the detector circuit (18) is coupled to the antenna (20) to receive the electrical antenna signal and configured to generate the signal indicative of electromagnetic radiation or electromagnetic induction.

3. The system of Claim 2, wherein the detector circuit (20) includes an indicator circuit (26) configured to generate a signal perceivable by a human as a function of the generated signal.

4. The system of claim 3, wherein the perceivable signal is at least one of an optical signal and an acoustic signal.

5. The system of Claim 3, wherein the detector circuit (18) further includes a rectifier circuit (22) coupled to the antenna (20) and configured to convert the antenna signal to a DC signal that drives the indicator circuit (26).

6. The system of Claim 5, wherein the rectifier circuit (22) includes a diode.

7. The system of any preceding claim, wherein the detector system (18) is communicatively coupled to the elevator controller (6) to react upon the signal indicative of electromagnetic radiation or electromagnetic induction.

8. The system of Claim 7, wherein the elevator controller (6) is configured to perform at least one predetermined mitigation strategy in response to the generated signal.

9. The system of Claim 8, wherein the mitigation strategy includes modifying an error correction procedure, modifying a signal transmission speed, modifying signal levels and executing a reduced operational mode.

10. A method of operating an elevator installation (1) to mitigate adverse effects of electromagnetic radiation or electromagnetic induction on the elevator installation, comprising:

detecting electromagnetic radiation or electromagnetic induction in proximity of the elevator installation using a detection system (18, 20) fixedly installed in the elevator installation (1);

generating a signal indicative of electromagnetic radiation or electromagnetic induction being present in proximity of the elevator installation (1).

11. The method of Claim 10, further comprising generating a signal perceivable by a human as a function of the generated signal.

12. The method Claim 11, wherein the perceivable signal is an optical or acoustic signal.

13. The method of one of Claims 10 to 12, further comprising performing at least one of a predetermined mitigation strategy, which is controlled by the controller.

14. The method of Claim 13, wherein the mitigation strategy includes modifying an error correction procedure, modifying a signal transmission speed, modifying signal levels and executing a reduced operational mode.

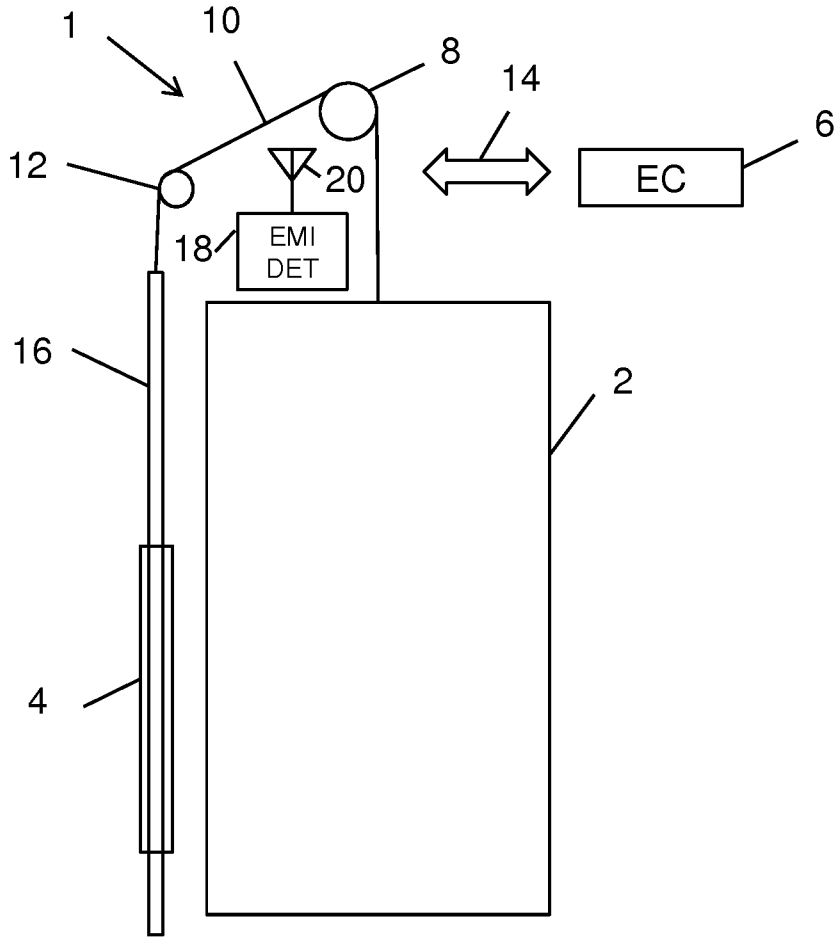

Fig. 1

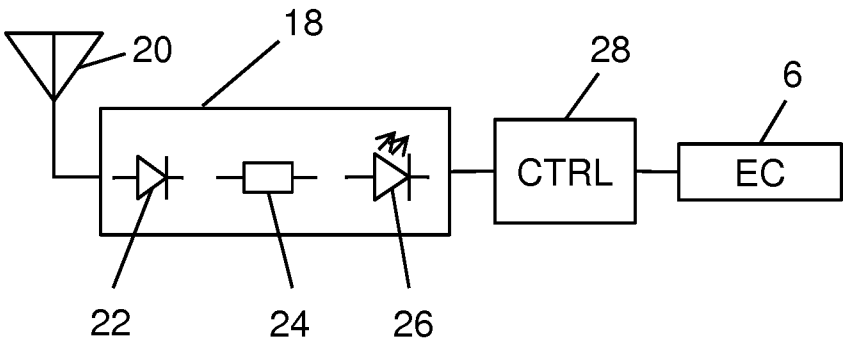

Fig. 2

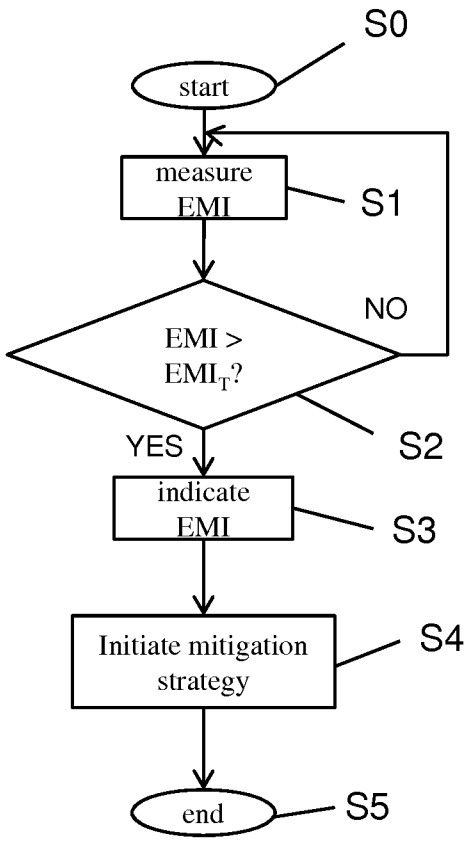
S0
start
measure EMI
S1
NO
EMI > EMI$_T$?
S2
YES
indicate EMI
S3
Initiate mitigation strategy
S4
end
S5

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/073132

A. CLASSIFICATION OF SUBJECT MATTER
INV. B66B5/00 B66B5/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B66B H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AU 2007 100 726 A4 (WILSON PETER; WILSON KENNETH) 30 August 2007 (2007-08-30) page 3, lines 5-20 page 6, lines 11-21; figures 3,4	1-14
A	WO 03/083495 A1 (QINETIQ LTD [GB]; HOAD RICHARD [GB]; MAWDSLEY DAVID LANSDELL [GB]) 9 October 2003 (2003-10-09) abstract	1-14
A	JP H04 197972 A (TAKENAKA KOMUTEN CO) 17 July 1992 (1992-07-17) abstract	1-14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 January 2014	29/01/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Janssens, Gerd

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2013/073132

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
AU 2007100726 A4	30-08-2007	NONE	
WO 03083495 A1	09-10-2003	AU 2003219279 A1	13-10-2003
		WO 03083495 A1	09-10-2003
JP H04197972 A	17-07-1992	JP 2726153 B2	11-03-1998
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