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(54) **EMERGENCY LIGHTING DEVICES**

(57) The invention relates to an emergency device for lighting means (1), having a driver stage (5) and terminals (3, 3') to drive emergency lighting means (2) based on a DC power supply (4, 4'). The emergency device for lighting means (1) comprises a wireless commu-

nication unit, wherein the wireless communication unit is designed to receive a first signal from a neighboring emergency device for lighting means (13) and to transmit a second signal to the neighboring emergency device for lighting means (13).

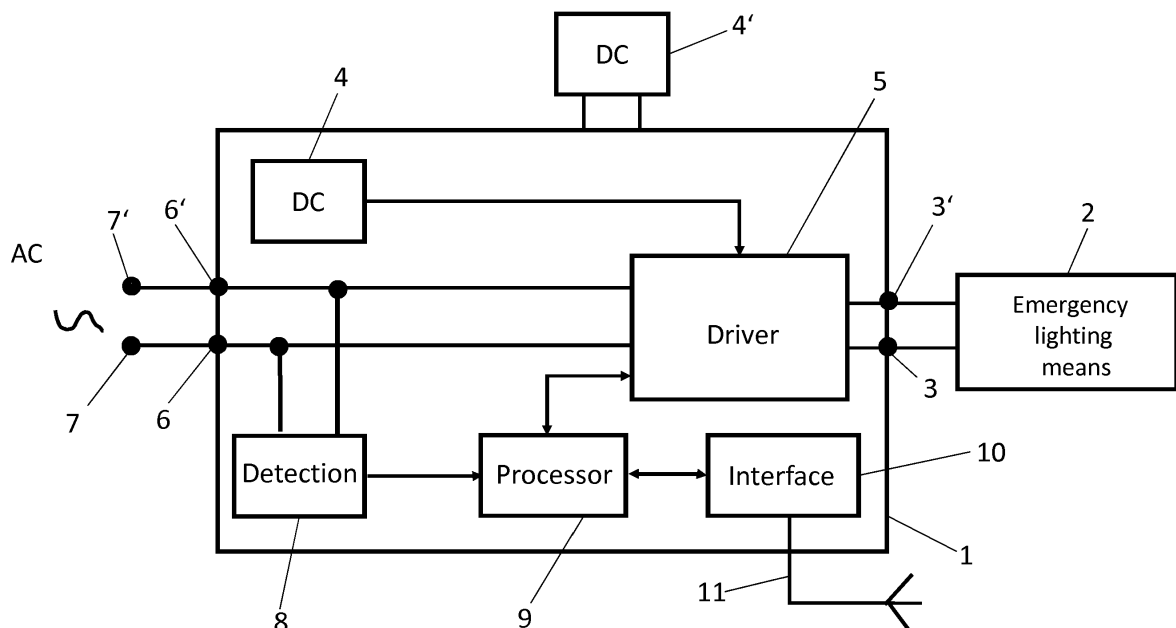


Fig. 1

Description

TECHNICAL FIELD OF THE INVENTION

[0001] The invention relates to the field of emergency lighting devices, such as emergency lighting devices using LEDs.

BACKGROUND OF THE INVENTION

[0002] Frequently, homes, offices, and industrial plant facilities experience many types of emergency situations involving power failures where an interior or exterior area has no light. The power failures may be caused by electrical short circuits, brownouts, fire, accidents, natural disasters (i.e., floods, hurricanes, tornadoes, etc.), or a planned shutoff of electricity to a facility or dwelling.

[0003] In order to face this situation, for example, emergency lighting devices with rechargeable central or de-central batteries are designed for use with LED emergency lighting means and can be operated as part of a combined system with electronic LED drivers.

[0004] However, in the prior art, emergency devices for lighting means, such as LEDs, present some disadvantages related, for example, to the duration of their batteries or the efficiency of the testing of their operational status.

[0005] Thus, it is an objective of this invention to provide for an improved emergency device for lighting means, such as LEDs.

SUMMARY OF THE INVENTION

[0006] According to a first aspect the invention relates to an emergency device for lighting means, having a driver stage and terminals to drive emergency lighting means based on a DC power supply. The emergency devices for lighting means comprises a wireless communication unit. The wireless communication unit is designed to receive a first signal from at least one neighboring emergency device for lighting means and to transmit a second signal to at least one of the neighboring emergency device for lighting means.

[0007] When in the following an (one) emergency device is mentioned, it is to be understood that this encompasses a plurality of devices, especially when several devices are located in a room or office. In addition each emergency device in the office or room can preferably contain the data for all other emergency devices in the area/room/office. The inter-device communication according to the invention is not limited to one adjacent device. It can be extended to 1- n devices only limited by memory and proximity, n being the total number of devices.

[0008] Using a device-to-device wireless communication has the advantage of improving the reliability and performance of an emergency system.

[0009] Normally, a wireless communication is used in

order to enable devices to communicate with a base station for controlling and reporting. According to the invention, the emergency device-to-emergency device communication is facilitated in order to improve system performance and reliability.

[0010] Moreover, by using wireless communication unit to exchange information between emergency devices, instead of just with a base station, the emergency devices can instigate the exchange of information between each other in order to facilitate their communication.

[0011] The neighboring emergency device can be defined either via pre-configuration, signal strength, time of flight or other means.

[0012] In a preferred embodiment of the emergency device for lighting means according to the first aspect, the emergency device for lighting means further comprises a processor, wherein the first signal comprises a request for the status of the emergency device, and wherein the processor is designed to extract a first information about the status of the emergency device for lighting means, to extract a second information about the status of the neighboring emergency device for lighting means and to command the wireless transmission thereof to at least one neighboring emergency device for lighting means.

[0013] In a further preferred embodiment of the emergency device for lighting means according to the first aspect, the first information comprises first data about a scheduling of an automatic testing of the emergency device for lighting means and the second information comprises second data about a scheduling of an automatic testing of the neighboring emergency device for lighting means.

[0014] This provides the advantage of avoiding simultaneous self-testing in a given area and, thereby, avoiding risks due to flat batteries, when an emergency event actually occurs. Moreover, the synchronization of automatic testing has the advantage of avoiding that more than one emergency device in an area can test together. This also avoids the possibility that the system is not ready to respond to an emergency event, because several units have exhausted batteries after a testing event in the same area. This is also defined by the standard IEC62034, although the method to guarantee this is not defined by the standard. Local device-to-device communication would identify where a test is ongoing or where a test has just been completed and the battery is empty. It would then be possible to block or pend tests that were scheduled in that area.

[0015] In a preferred embodiment of the emergency device for lighting means according to the first aspect, the emergency device for lighting means further comprises a black box unit and the processor is designed to store first black box data of the emergency device and second black box data of at least one neighboring emergency device for lighting means in the black box unit.

[0016] This provides the advantage that all local de-

vices, such as the emergency device for lighting means and the neighboring emergency device for lighting means hold the black box data or critical parameters of the other devices in the same area, so that in event of failure the data can be sent back to explain why the event occurred without need for near field communication (NFC) or other interface. Moreover, if local devices can store information from each other, they can hold events such as overvoltage protection (OVP) or thermal events and report back even when the device experiencing the event has failed.

[0017] In fact, from a failure analysis of neighboring devices, when communication is blocked from multiple neighboring units, it can be deduced that the unit has stopped working as opposed to a loss of coms through one medium.

[0018] In a preferred embodiment of the emergency device for lighting means according to the first aspect, the wireless communication unit is based on a wireless communication protocol, wherein the wireless communication protocol allows for a mesh architecture.

[0019] In general, failures in the device-to-device communication are often identified by loss of communication with an emergency device (no answer to a query), although this could also be related to the connection infrastructure.

[0020] An important feature of a wireless emergency system employing a mesh network is that a communication path is available and several local devices can hold data about neighboring devices. This provides the advantage that, by local device-to-device communication, it is possible to identify when an emergency device was broken because several local devices would be sharing data.

[0021] In a preferred embodiment of the emergency device for lighting means according to the first aspect, the emergency device for lighting means is configured to store in a memory configuration data of at least one neighboring emergency device.

[0022] This provides the advantage that, if it is possible to know and communicate with neighboring emergency devices, then multiple configurations could be stored in emergency devices that would enable replacements to be automatically configured according the replaced part.

[0023] Moreover, this has the advantage that a replacement support by storage of neighboring emergency device configurations can be done, so that, when an emergency device is detected as failed, a new emergency device can be programed from the neighboring emergency devices.

[0024] According to a second aspect, the invention relates to a system comprising at least an emergency device for lighting means according to the first aspect and a neighboring emergency device for lighting means, wherein the neighboring emergency device for lighting means has a driver stage and terminals to drive emergency lighting means based on a DC power supply. The neighboring emergency device for lighting means further comprises a wireless communication unit, wherein the

communication unit is designed to receive a first signal from the emergency device for lighting means and to transmit a second signal to the emergency device for lighting means.

[0025] According to a third aspect, the invention relates to a method for communicating using an emergency device for lighting means according to the first or second aspect or any one of the implementation forms thereof, the method comprising the steps of receiving a first signal from a neighboring emergency device for lighting means and transmitting a second signal to the neighboring emergency device for lighting means.

[0026] In an implementation form of the method according to the third aspect, the first signal comprises a request for the status of the emergency device for lighting means, and the method further comprises the steps of extracting a first information about the status of the emergency device for lighting means, extracting a second information about the status of the neighboring emergency device for lighting means and commanding the wireless transmission thereof to the neighboring emergency device for lighting means.

[0027] In a further implementation form of the method according to the third aspect, the first information comprises first data about a scheduling of an automatic testing of the emergency device, and the second information comprises second data about a scheduling of an automatic testing of the neighboring emergency device for lighting means.

[0028] In a further implementation form of the method according to the third aspect, the method further comprises the step of storing first black box data of the emergency device and second black box data of the neighboring emergency device for lighting means in the black box unit.

[0029] In a further implementation form of the method according to the third aspect, the method further comprises the step of storing in a memory configuration data of at least one neighboring emergency device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030]

Fig. 1 shows an embodiment of an emergency device for lighting means according to an embodiment;

Fig. 2 shows a system comprising an emergency device for lighting means and a neighboring emergency device for lighting means according to an embodiment;

Fig. 3 shows an exemplary embodiment of a system comprising an emergency device for lighting means according to an embodiment; and

Fig. 4 shows a method for communicating using an emergency device for lighting means according

to an embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] Aspects of the present invention are described herein in the context of an emergency lighting device, a system comprising an emergency device for lighting means or a method for communicating using an emergency device for lighting means.

[0032] The present invention is described more fully hereinafter with reference to the accompanying drawings, in which various aspects of the present invention are shown. This invention however may be embodied in many different forms and should not be construed as limited to the various aspects of the present invention presented through this disclosure. Rather, these aspects are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the present invention to those skilled in the art. The various aspects of the present invention illustrated in the drawings may not be drawn to scale. Rather, the dimensions of the various features may be expanded or reduced for clarity. In addition, some of the drawings may be simplified for clarity. Thus, the drawings may not depict all of the components of a given apparatus.

[0033] Various aspects of an emergency device for lighting means will be presented. However, as those skilled in the art will readily appreciate, these aspects may be extended to aspects of emergency devices for lighting means without departing from the invention.

[0034] It is further understood that the aspect of the present invention might contain integrated circuits that are readily manufacturable using conventional semiconductor technologies, such as complementary metal-oxide semiconductor technology, short "CMOS". In addition, the aspects of the present invention may be implemented with other manufacturing processes for making optical as well as electrical devices. Reference will now be made in detail to implementations of the exemplary aspects as illustrated in the accompanying drawings. The same reference signs will be used throughout the drawings and the following detailed descriptions to refer to the same or like parts.

[0035] Now referring to figure 1, an emergency device for lighting means 1 is shown according to an embodiment.

[0036] The emergency device 1 comprises a driver 5, a detection unit 8, a processor 9, a wireless transmission interface 10, an antenna 11, AC supply terminals 6, 6' or terminals for being supplied from an external (e.g., central) DC power supply 4', light means supply terminals 3, 3', and an internal DC supply 4.

[0037] The emergency device 1 typically monitors the states of an alternating current AC and is connected to emergency lighting means 2. Moreover, the emergency device 1 may be connected to the external DC supply 4'.

[0038] In order to better explain the functionality of the

different components of the emergency device 1, we refer to an embodiment of the emergency device 1, wherein the emergency device 1 is one or more light-emitting diodes (LEDs).

[0039] LEDs require specialized devices called LED drivers 5 to operate. LED drivers 5 (also known as LED power supplies) are similar to ballasts for fluorescent lamps or transformers for low-voltage bulbs: they provide LEDs with the electricity they require to function and perform at their best.

[0040] Furthermore, LED drivers 5 also protect LEDs from voltage or current fluctuations. A change in voltage could cause a change in the current being supplied to the LEDs. LED light output is proportional to its current supply, and LEDs are rated to operate within a certain current range (measured in amps). Therefore, too much or too little current can cause light output to vary or degrade faster due to higher temperatures within the LED.

[0041] In summary, the LED driver 5 supplies, in a controlled manner, the lighting means 2 with electrical power.

[0042] Moreover, in one embodiment, the detection unit 8 is configured to detect if there is an alternating current supply and, in case of an AC power supply failure, the emergency device 1 is driven by a DC power supply from the internal DC supply 4 or the external DC supply 4' in order to operate the lighting means 2 in such an emergency condition.

[0043] Moreover, the emergency device 1 comprises a wireless communication unit, wherein the wireless communication unit comprises the interface 10 and the antenna 11 and is designed to receive a first signal from a neighboring emergency device for lighting means 13 and to transmit a second signal to the neighboring emergency device for lighting means 13.

[0044] Figure 2 shows an exemplary embodiment of a system 200 comprising an emergency device for lighting means 1 and a neighboring emergency device for lighting means 13 at different times (t1 and t2).

[0045] In this embodiment, the neighboring emergency device 13(t1) sends the first signal comprising a request for the status of the emergency device 1 to the emergency device 1.

[0046] In one embodiment, the processor of the emergency device 9 is designed to extract a first information about the status of the emergency device for lighting means 1. In one embodiment, the first information comprises data about a duration test of the emergency device 1.

[0047] Moreover, the wireless communication unit is configured to send, at a second time t2, the second signal comprising the first information to the neighboring emergency device 13(t2).

[0048] The neighboring emergency device 13 can comprise a processor as well, which can be configured to perform a test duration of the neighboring emergency device 13, if the emergency device 1 is not performing a test duration at the same time.

[0049] Figure 3 shows the system 200 comprising the

emergency device for lighting means 1 and the neighboring emergency device for lighting means 13 according to an embodiment.

[0050] In this embodiment, the system 200 is an office 12 which comprises five emergency devices for lightning means (1, 13, 14, 15, 16). Furthermore, the emergency devices for lightning means 1, 13, 14, 15, 16 comprise an antenna each 11, 13', 14', 15', and 16".

[0051] Moreover, in this embodiment, the emergency device 1, 13, 14 and 15 comprise each a memory 8', 13", 14", and 15".

[0052] In one embodiment, the memory 8', for example, comprises a black box unit and the processor 9 is designed to store first black box data of the emergency device 1 and second black box data of the neighboring emergency device for lighting means 13 in the black box unit.

[0053] Moreover, the emergency device for lighting means 1 can be configured to store in the memory 8' configuration data of the neighboring device.

[0054] According to an embodiment, the wireless communication units of the emergency devices 1, 13, 14, 15 and 16 are based on a wireless communication protocol, wherein the wireless communication protocol allows for a mesh architecture.

[0055] Figure 4 shows a method 400 for communicating using the emergency device for lighting means 1 according to an embodiment.

[0056] The method 400 comprises the following step:

- receiving 402 a first signal from the neighboring emergency device for lighting means 13; and
- transmitting 404 a second signal to the neighboring device for lighting means 13.

[0057] All features of all embodiments described, shown and/or claimed herein can be combined with each other.

[0058] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only and not limitation. Numerous changes to the disclosed embodiments can be made in accordance with the disclosure herein without departing from the spirit of scope of the invention. Thus, the breadth and scope of the present invention should not be limited by any of the above-described embodiments. Rather, the scope of the invention should be defined in accordance with the following claims and their equivalence.

[0059] Although the invention has been illustrated and described with respect to one or more implementations, equivalent alternations and modifications will occur to those skilled in the art upon the reading of the understanding of the specification and the annexed drawings. In addition, while a particular feature of the invention may have been disclosed with respect to only of the several implementations, such features may be combined with

one or more other features of the other implementations as may be desired and advantage for any given or particular application.

5 Reference Signs

[0060]

1	Emergency device
2	Emergency lighting means
3	Terminal
3'	Terminal
4	DC supply
4'	DC supply
5	Driver
6	Terminal
6'	Terminal
7	Terminal
7'	Terminal
8	Detection unit
8'	Memory
9	Processor
10	Interface
11	Antenna
12	Office
13	Neighboring emergency device
13(t1)	Neighboring emergency device 1 at time t1
13(t2)	Neighboring emergency device 1 at time t2
13'	Antenna
13"	Memory
14	Emergency device
14'	Antenna
14"	Memory
15	Emergency device
15'	Antenna
15"	Memory
16	Emergency device
16'	Antenna
200	System
400	Method
402	Method step
404	Method step

45 Claims

1. Emergency device for lighting means (1), having a driver stage (5) and terminals (3, 3') to drive emergency lighting means (2) based on a DC power supply (4, 4'), comprising:
a wireless communication unit, wherein the wireless communication unit is designed to receive a first signal from at least one neighboring emergency device for lighting means (13) and to transmit a second signal to at least one of said neighboring emergency devices for lighting means (13).
2. Emergency device for lighting means (1) according

- to claim 1, wherein the emergency device for lighting means (1) further comprises a processor (9), wherein the first signal comprises a request for the status of the emergency device (1), and wherein the processor (9) is designed to extract a first information about the status of the emergency device for lighting means (1), to extract a second information about the status of the neighboring emergency device for lighting means (13) and to command the wireless transmission thereof to the neighboring emergency device for lighting means (13).
3. Emergency device for lighting means (1) according to any one of the preceding claims, wherein the first information comprises first data about a scheduling of an automatic testing of the emergency device for lighting means (1) and wherein the second information comprises second data about a scheduling of an automatic testing of the neighboring emergency device for lighting means (13).
4. Emergency device for lighting means (1) according to any one of the preceding claims, wherein the emergency device for lighting means (1) further comprises a black box unit and wherein the processor (9) is designed to store first black box data of the emergency device (1) and second black box data of the neighboring emergency device for lighting means (13) in the black box unit.
5. Emergency device for lighting means (1) according to any one of the preceding claims, wherein the wireless communication unit is based on a wireless communication protocol, wherein the wireless communication protocol allows for a mesh architecture.
6. Emergency device for lighting means (1) according to any one of the preceding claims, wherein the emergency device for lighting means (1) is configured to store in a memory (8') configuration data of at least one neighboring emergency device (13).
7. System (200) comprising at least an emergency device for lighting means (1) according to claim 1 and a neighboring emergency device for lighting means (13), wherein the neighboring emergency device for lighting means (13) has a driver stage and terminals to drive emergency lighting means based on a DC power supply, comprising:
a wireless communication unit, wherein the communication unit is designed to receive a first signal from the emergency device for lighting means (1) and to transmit a second signal to the emergency device for lighting means (1).
8. Method for communicating (400) using an emergency device for lighting means (1) according to any one of the preceding claims, the method (400) comprising the steps of:
receiving (402) a first signal from at least one neighboring emergency device for lighting means (13); and
transmitting (404) a second signal to at least one of said neighboring emergency devices for lighting means (13).
9. Method (400) according to claim 8, wherein the first signal comprises a request for the status of the emergency device for lighting means (1), and wherein the method (400) further comprises the steps of:
extracting a first information about the status of the emergency device for lighting means (1);
to extract a second information about the status of the neighboring emergency device for lighting means (2); and
commanding the wireless transmission thereof to the neighboring emergency device for lighting means (13).
10. Method (400) according to claim 8 or 9, wherein the first information comprises first data about a scheduling of an automatic testing of the emergency device (1), wherein the second information comprises second data about a scheduling of an automatic testing of the neighboring emergency device for lighting means (13).
11. The method (400) of any one of the preceding claims 8 to 10, wherein the method (400) further comprises the step of:
storing first black box data of the emergency device (1) and second black box data of the neighboring emergency device for lighting means (13) in the black box unit.
12. The method (400) of any one of the preceding claims 8 to 11, wherein the method (400) further comprises the step of:
storing in a memory (8') configuration data of at least one neighboring emergency device (13).

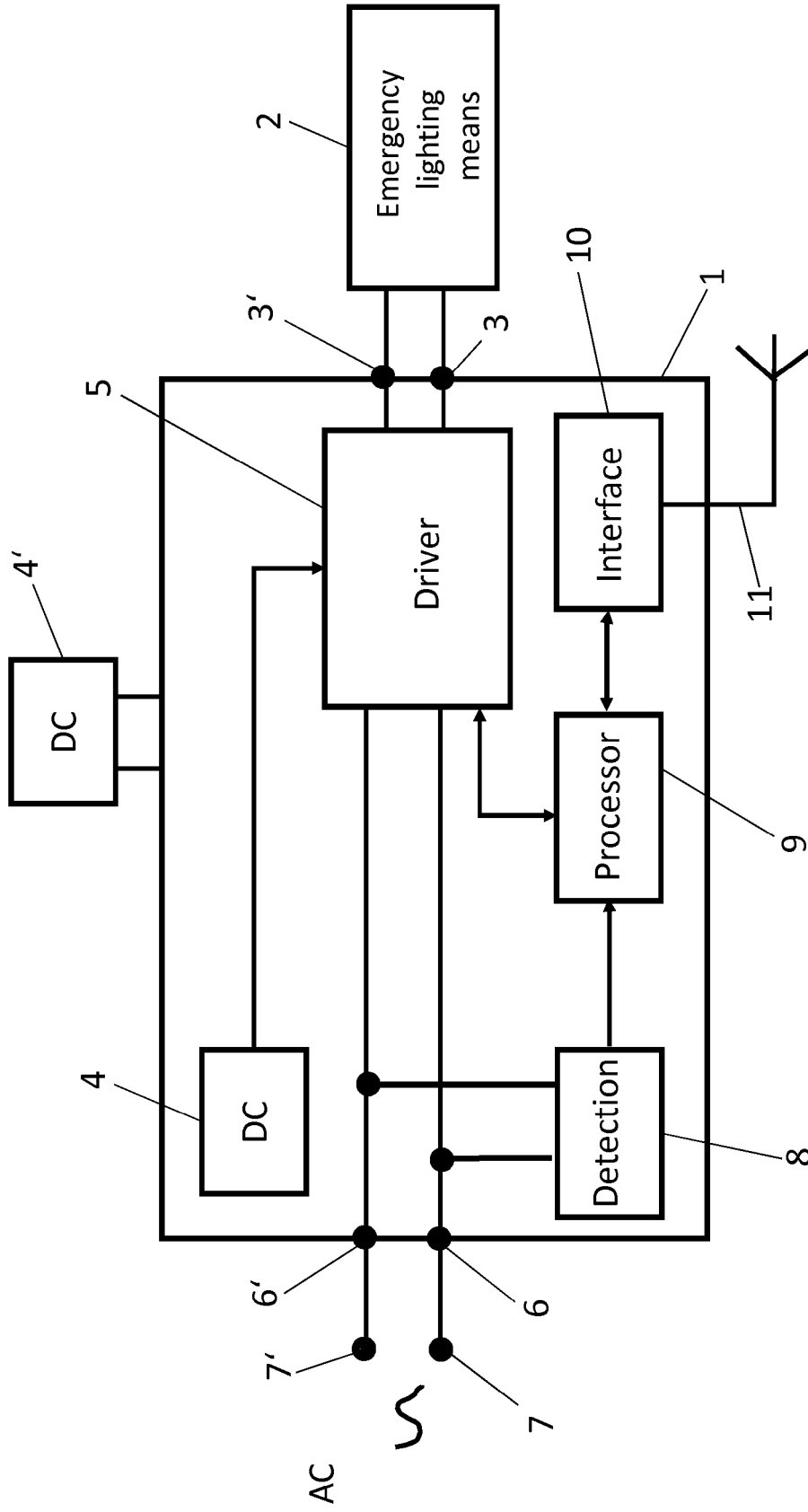


Fig. 1

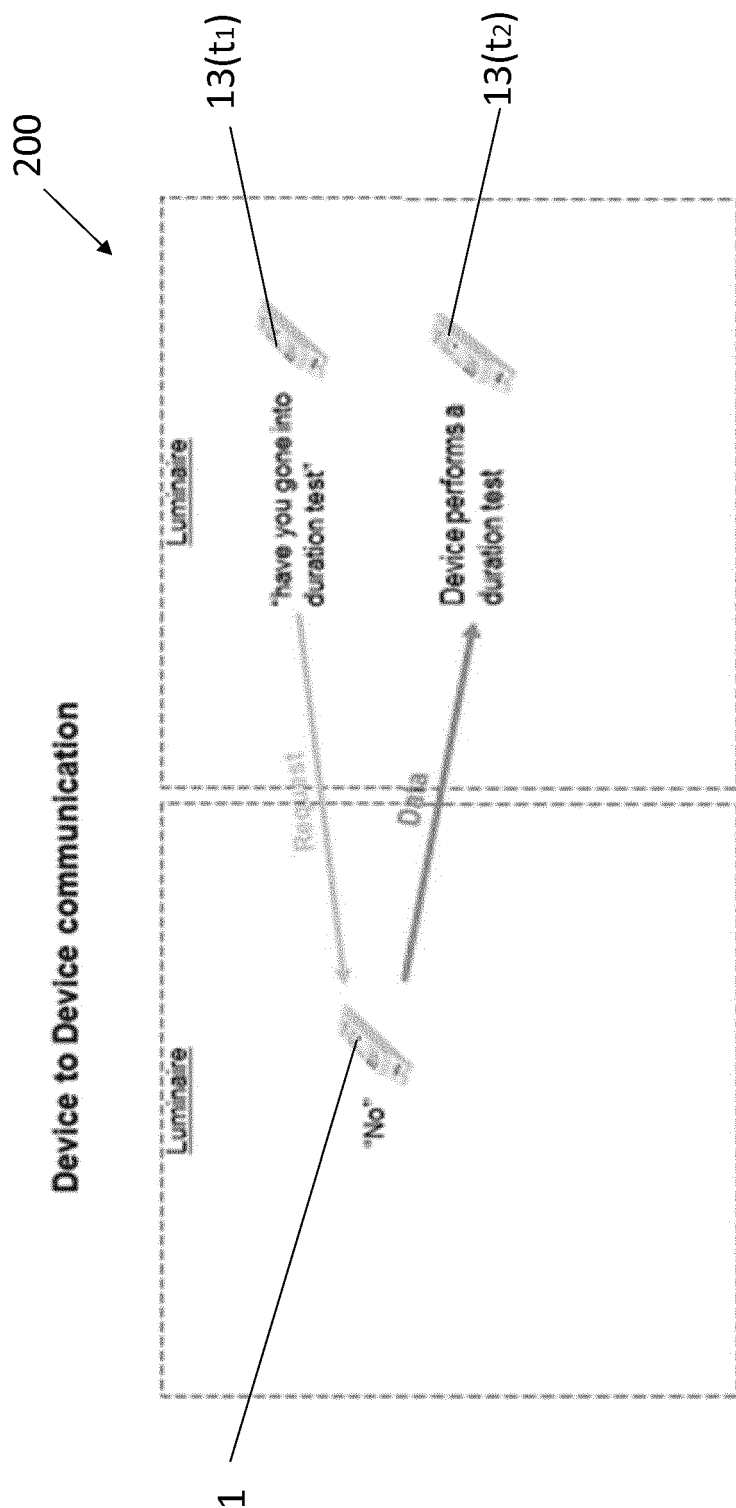


Fig. 2

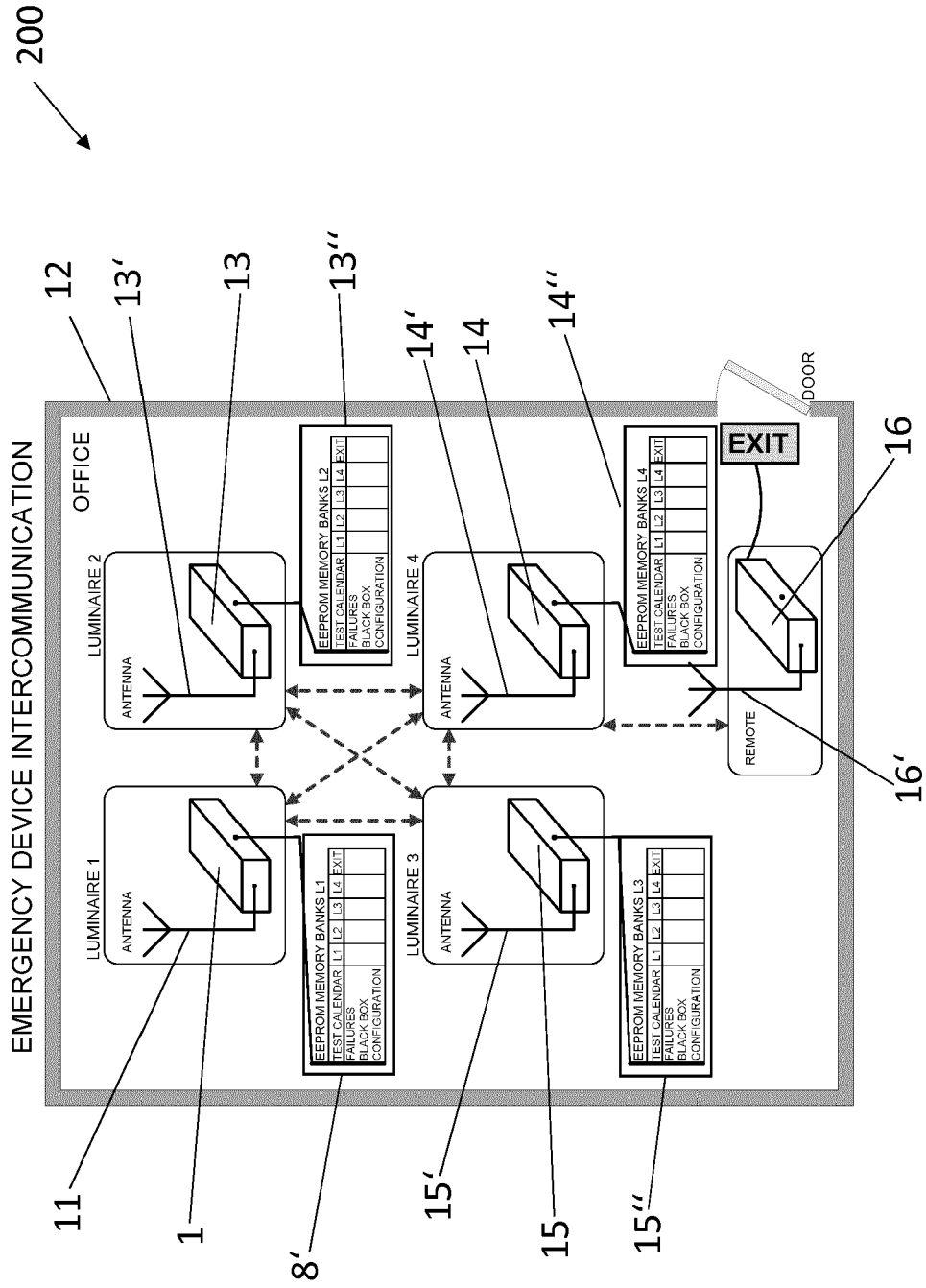


Fig. 3

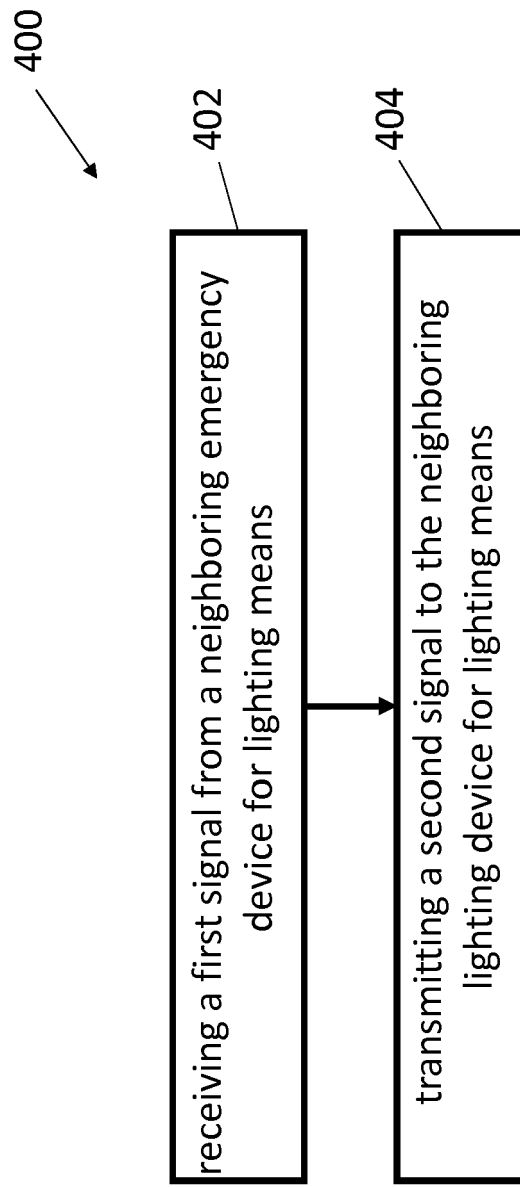


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 19 16 3343

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X A	EP 1 885 039 A2 (THOMAS & BETTS INT [US]) 6 February 2008 (2008-02-06) * paragraph [0051] - paragraph [0056]; figures 3-5 *	1,4,5,7, 8,11 2,3,6,9, 10,12	INV. H05B37/03 H05B37/02 H05B33/08
X A	WO 2012/089355 A1 (SCHNEIDER ELECTRIC IND ITALIA S P A [IT]; MONTAGUTI ALBERTO [IT]) 5 July 2012 (2012-07-05) * page 6, line 24 - page 8, line 18; figure 2 *	1,2,6-9, 12 3-5,10, 11	
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 July 2019	Examiner Plamann, Tobias
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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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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