(19) Europäisches Patentamt
European Patent Office
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(11) **EP 4 240 116 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.09.2023 Bulletin 2023/36

(21) Application number: **22159709.9**

(22) Date of filing: **02.03.2022**

(51) International Patent Classification (IPC):
H05B 47/19 *(2020.01)*

(52) Cooperative Patent Classification (CPC):
H05B 47/19

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(54) EMERGENCY LIGHTING UNIT WITH VARIABLE OPTICS

(57) The invention relates to an emergency lighting unit. The emergency lighting unit, comprises a control circuit, a preferably LED based lighting module, an optics module configured to define an output angle of a light emitted by the lighting module, an output angle command generator, and an electrically or electronically variable optics module configured to vary or set the output angle as a reaction to receiving a command signal generated by the output angle command generator electrically or electronically connected to the variable optics module.

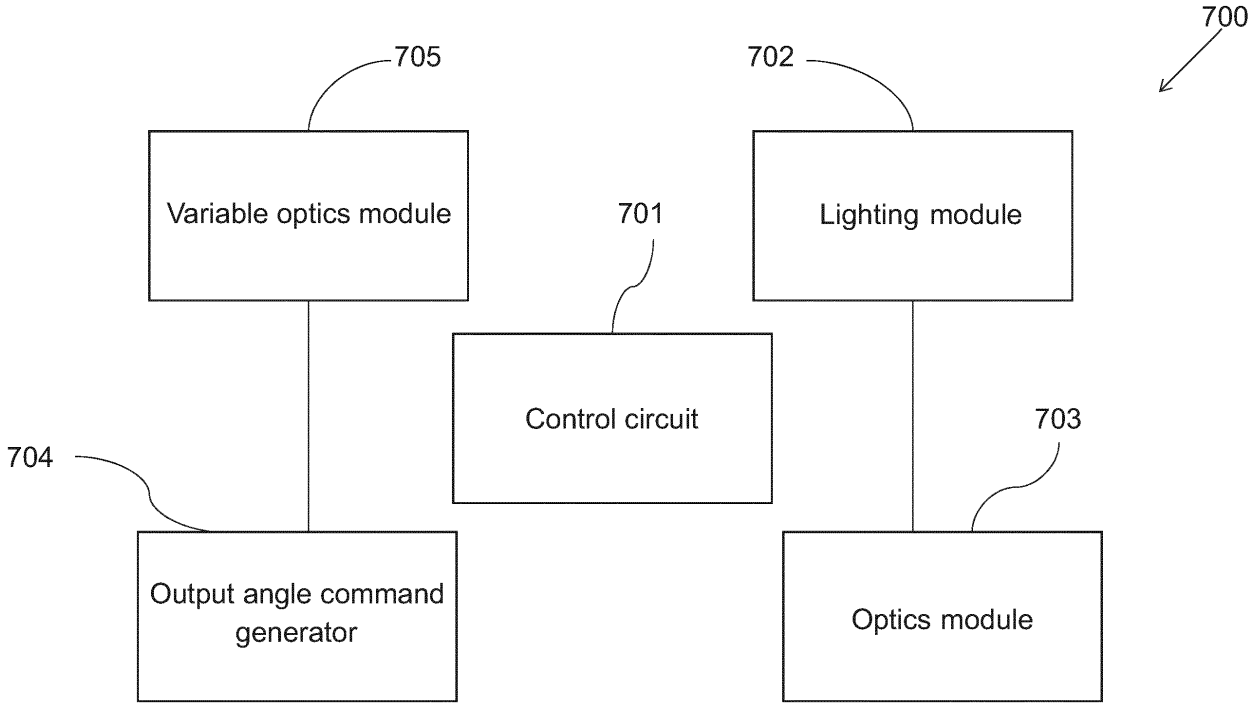


Fig. 3

EP 4 240 116 A1

Description

TECHNICAL FIELD OF THE INVENTION

[0001] The invention relates to an emergency lighting unit, which is configured, for example, to provide an emergency lighting in order to help people to escape from a building in case of an emergency.

BACKGROUND OF THE INVENTION

[0002] A typical emergency lighting unit comprises optics in order to emit light from an LED luminaire with a defined characteristic and, especially, with a defined output angle.

[0003] Some known emergency lighting units allow to releasably mount one out of a set of lenses with different output angles in front of an LED lighting module. Thus, by manually exchanging the lens, the output angle of the emergency lighting unit can be changed. Typically, the release of the lens is quite cumbersome as external or internal latches have to be released, for example, by using screwdrivers.

[0004] Figs. 1 and 2, show examples of how a lens in such emergency lighting units can be replaced manually by means of a screwdriver. In the example shown in Fig. 2, a backpack of the lighting unit also needs to be removed to reach the optics. Exchanging lenses in this way is a laborious and timeconsuming process.

[0005] Practice has shown that the exchange of the lenses to achieve different output angles of the emergency lighting beam has to be done several times during the life cycle of an emergency lighting unit.

[0006] Thus, it is an objective to provide an improved emergency lighting unit, which allows a reduction of the effort required to change the output angle of the emergency lighting beam.

SUMMARY OF THE INVENTION

[0007] The object of the present invention is achieved by the solution provided in the enclosed independent claims. Advantageous implementations of the present invention are further defined in the dependent claims.

[0008] According to a first aspect of the invention, an emergency lighting unit is provided. The emergency lighting unit comprises: a control circuit, a preferably LED based lighting module, an optics module configured to define an output angle of a light emitted by the lighting module, an output angle command generator, and an electrically or electronically variable optics module configured to vary or set the output angle as a reaction to receiving a command signal generated by the output angle command generator electrically or electronically connected to the variable optics module.

[0009] This provides the advantage that a single optic is offered for anti-panic, escape route, and spot light. Moreover, the laborious process of manually changing a light head for different emergency lighting applications is avoided.

[0010] In a preferred embodiment, the variable optics module is configured to vary the output angle discretely or continuously over a predefined angle.

[0011] This provides the advantage that predefined, light distributions, e.g. different spot sizes, can easily be set.

[0012] In a preferred embodiment, the emergency lighting unit further comprises an interface and the output angle command generator is configured to supply a wired or wireless signal to the interface of the emergency lighting unit.

[0013] This provides the advantage that the signal can easily be supplied to the interface in a wired or wireless manner.

[0014] In a preferred embodiment, the variable optics module comprises a lens.

[0015] This provides the advantage that well-known optics, such as lenses, can be used to set the output angle.

[0016] In a preferred embodiment, the emergency lighting unit comprises a lens digital motor and the lens is a motorized lens.

[0017] This provides the advantage that the lens can easily and precisely be moved by means of a motor. In this way, the output angle can be adapted.

[0018] In a preferred embodiment, the emergency lighting unit further comprises a focusing mirror, configured to reflect at least a part of the light emitted by the lighting module.

[0019] This provides the advantage that at least a part of the light can be fed back to the lighting unit, e.g. to provide a feedback control of the variable optics module.

[0020] In a preferred embodiment, the emergency lighting unit further comprises a sensor configured to detect the light reflected by the mirror and to feed back the detected light to a control logic of the lens digital motor.

[0021] This provides the advantage that the output angle of the light through the lens can better be controlled according to the case. In particular, a feedback mechanism for controlling the output angle can be provided in this way.

[0022] In a preferred embodiment, the output angle command generator is connected to a floor plan software comprising a location of the emergency lighting unit in a building and the output angle command generator is configured to generate an output angle distribution depending on the location of the emergency lighting unit in the building.

[0023] In a preferred embodiment, the output angle command generator comprises an interface for a human operation input.

[0024] This provides the advantage that the output angle can easily be set by a human.

[0025] In a preferred embodiment, the emergency lighting unit comprises a casing and the human operation input is performed by means of a switch button.

[0026] This provides the advantage that the output angle can easily be set by means of a switch.

[0027] In a preferred embodiment, the output angle command generator comprises an interface for an electronical input command performed by a wired or wireless communication channel.

[0028] This provides the advantage that the output angle can easily be set by means of an electronic signal.

[0029] In a preferred embodiment, the emergency lighting unit comprises a battery charger or battery discharger.

[0030] In a preferred embodiment, the emergency lighting unit comprises a LED driver configured to drive the LED based lighting module.

[0031] In a preferred embodiment, the emergency lighting unit comprises an AC/DC converter.

[0032] According to a second aspect, the invention relates to an emergency lighting system, comprising an emergency lighting unit according to the first aspect and the implementation forms thereof as well as a computing unit configured to run a lighting floor plan software being configured to communicate with the emergency lighting unit in order to supply the emergency lighting unit with output angle commands.

[0033] The emergency lighting system of the second aspect provides the same advantages as the emergency lighting unit of the first aspect and the preferred embodiments thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] The invention will be explained in the followings together with the figures.

Fig. 1 shows a schematic representation of replacing/removing a lens in an emergency lighting unit according to prior art;

Fig. 2 shows a schematic representation of replacing/removing a lens in an emergency lighting unit according to prior art;

Fig. 3 shows an emergency lighting unit according to an embodiment;

Fig. 4 shows an emergency lighting unit according to an embodiment;

Fig. 5a shows light distributions of an emergency lighting unit according to an embodiment;

Fig. 5b shows light distributions of an emergency lighting unit according to an embodiment;

Fig. 6 shows a schematic representation of a system architecture for commissioning an emergency lighting unit according to an embodiment;

Fig. 7 shows an emergency lighting unit according to an embodiment;

Fig. 8 shows a flow diagram of an emergency lighting unit installation procedure according to an embodiment; and

Fig. 9 shows a floor plan distribution of emergency lighting units in a building according to an embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0035] Aspects of the present invention are described herein in the context of an emergency lighting unit.

[0036] The term "LED luminaire" shall mean a luminaire with a light source comprising one or more LEDs or OLEDs. LEDs are well-known in the art, and therefore, will only briefly be discussed to provide a complete description of the invention.

[0037] Now referring to Fig. 3, an emergency lighting unit 700 according to an embodiment is shown.

[0038] The emergency lighting unit 700 comprises: a control circuit 701, a preferably LED based lighting module 702, an optics module 703 configured to define an output angle of a light emitted by the lighting module 702, an output angle command generator 704, and an electrically or electronically variable optics module 705 configured to vary or set the output angle as a reaction to receiving a command signal generated by the output angle command generator 704 electrically or electronically connected to the variable optics module 705.

[0039] The different light distributions (e.g. three different angles for the applications "anti-panic", "escape route", and "spot") which can be emitted by the emergency lighting unit 700 are, for example, shown in Fig. 4 and Fig. 5a.

[0040] For instance, the different light distributions are designed to illuminate dangerous areas (spot), to reduce stress and panic levels (anti-panic) and to ensure that escape routes are clearly illuminated (escape route) (see Fig. 4 and Fig. 5a).

[0041] The emergency lighting unit 700 can be set to a respective mode for each one of these selectable light distributions, e.g., a spot mode, an anti-panic mode, and an escape route mode.

[0042] In particular, the emergency lighting unit 700 can comprise a battery (or be supplied from a remote central battery), a main supply, the control circuit 701, the lighting module 702, preferably having one ore more LEDs, and an optics in order to emit light from the LEDs according to a defined characteristics and, especially, a defined output angle.

[0043] The different output angles can be, for example, plus/minus 10 degrees for spot lighting, plus/minus 50 degrees for escape lighting and plus/minus 65 degrees for anti-panic-emergency-lighting applications.

[0044] Fig. 5b shows an example of the relative light intensity emitted by the emergency lighting unit 700 as a function of the output angle for different modes of the lighting unit 700 (e.g., spot, escape lighting, anti-panic).

[0045] The optics module 703 can comprise a lens. The lens can be a focusing lens. For example, the lens is a convex, in particular a biconvex, lens. The output angle can be at least partially defined by a distance between the lens and the lighting module 702. This distance cane be varied e.g. by an electric motor.

[0046] Note that other optics, controlled by an electric or electronic signal and varying the output angle may be used.

[0047] Fig. 6 shows a schematic representation of a system architecture for commissioning an emergency lighting unit 700 according to an embodiment.

[0048] The system architecture or emergency lighting system 900 comprises the emergency lighting unit 700 as well as a computing unit 901 configured to run a lighting floor plan software 902 being configured to communicate with the emergency lighting unit 700 in order to supply the emergency lighting unit 700 with output angle commands.

[0049] Fig. 7 shows an emergency lighting unit 700 according to an embodiment.

[0050] In the example shown in Fig. 7, the variable optics can be a variable lens 1001 in front of an LED lighting module 1002, driven by an LED driver 1005, wherein, the lens 1001 can be electrically and/or electronically controlled in order to achieve a variable output angle. One example is a motorized variable lens 1001, which is controlled by a digitally controled motor 1003. The digital motor 1003 can be controlled by a control logic 1004.

[0051] The digital motor 1003 can be configured to change a distance between the LED lighting module 1002 and the variable lens 1001, which can be a biconvex lens as shown in Fig. 10. Via the distance between lens 1001 and LED module 1002, the output angle can be controlled.

[0052] The output angle may be varied according to pre-programmed discrete output angles (which can, for example, be cycled through upon input of a control signal) or can be varied continuously. The setting of the output angle and, thus the state, e.g. position, of the electronically or electrical variable lens 1001, can be controlled based on an electronic and/or human/mechanic input command to the emergency lighting unit 700.

[0053] A manual input command can be based on the provision of a switch button, etc., e.g. on the casing of the emergency lighting unit 700. Preferably, the command is input electronically and externally, using a wire-bound or wireless communication channel.

[0054] According to an embodiment of the invention, the command setting the output angle of the lens 1001 may not require a human intervention, rather, when designing the lighting/floor plan of a building, the required command is automatically sent from the floor plan/lighting plan software to one or more emergency lighting units 700 having a wireless of wire-bound interface for receiving a command setting the output angle of the variable lens 1001.

[0055] Moreover, the emergency lighting unit 700 can comprise an AC/DC converter 1006 configured to convert the AC signal into a DC signal, a battery charger/discharger unit 1007, and/or an IC control unit 1008.

[0056] Furthermore, the emergency lighting unit 700 can comprise a focusing mirror 1009, configured to reflect at least a part of the light emitted by the LED lighting module 1002, and a sensor 1010 configured to detect the light reflected by the mirror 1009 and to feed back the detected light to the control logic 1004 of the lens digital motor 1003.

[0057] This provides the advantage that a feedback mechanism can be provided to define the desired output angle of the light can more accurately.

[0058] Therefore, as shown in Fig. 7, the emergency lighting unit 700 can be equipped with a digital technology such as the variable optics module in order to control the lens offering spot, escape route and anti-panic mode for emergency. It is a digitized approach, i.e. no manual process is involved. The feed for the selection of optics can come from a wireless communication with the control unit 701 (see also Fig. 9).

[0059] Fig. 8 shows a flow diagram of an emergency lighting unit installation procedure according to an embodiment.

[0060] In a 1st step, a planning takes place, wherein an installer gets a floor plan of the building and basic details on luminaire or emergency lighting unit 700 installations;

[0061] In a 2nd step, an installation takes place, wherein the instructed luminaires or emergency lighting units are just located and installed;

[0062] In a 3rd step, an auto commissioning takes place, wherein the emergency lighting unit 700 gets powered and, automatically, the system gets a print of the floor plan 1200 (Fig. 9).

[0063] Then, the right optics mode can be chosen and this information can be sent to the emergency lighting unit 700 wirelessly using the control circuit 107 (see also Fig. 9).

[0064] In a 4th step, a periodic inspection is performed by the control circuit 107 by means of a wireless communication, if the optic mode needs to be changed due, for example, to a change in the floor plan.

[0065] Advantageously, the new improved process eliminates the existing manual process for emergency optics selection and eliminates the additional steps of inspection using auto commissioning. These obsolete steps, which are carried out in the prior art, are crossed out in the flow diagram of Fig 11.

[0066] All features of all embodiments described, shown and/or claimed herein can be combined with each other.

[0067] While various embodiments of the present invention have been described above, it should be under-

stood 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.

[0068] 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.

Claims

1. Emergency lighting unit (700), comprising:

a. a control circuit (701);
b. a preferably LED based lighting module (702);
c. an optics module (703) configured to define an output angle of a light emitted by the lighting module (702); and

characterised by:

- an output angle command generator (704); and
- an electrically or electronically variable optics module (705) configured to vary or set the output angle as a reaction to receiving a command signal generated by the output angle command generator (704) electrically or electronically connected to the variable optics module (705).

2. The emergency lighting unit (700) of claim 1, wherein the variable optics module (705) is configured to vary the output angle discretely or continuously over a predefined angle.

3. The emergency lighting unit (700) of claim 1 or 2, wherein the emergency lighting unit (700) further comprises an interface and wherein the output angle command generator (704) is configured to supply a wired or wireless signal to the interface of the emergency lighting unit (700).

4. The emergency lighting unit (700) of any one of the preceding claims, wherein the variable optics module (705) comprises a lens (1001).

5. The emergency lighting unit (700) of claim 4, wherein the emergency lighting unit (700) comprises a lens digital motor (1003) and the lens is a motorized lens.

6. The emergency lighting unit (700) of any one of the preceding claims, wherein the emergency lighting unit (700) further comprises a focusing mirror (1009), configured to reflect at least a part of the light emitted by the lighting module (1002,702).

7. The emergency lighting unit (700) of claim 5 or 6, wherein the emergency lighting unit (700) further comprises a sensor (1010) configured to detect the light reflected by the mirror (1009) and to feed back the detected light to a control logic (1004) of the lens digital motor (1003).

8. The emergency lighting unit (700) of any one of the preceding claims, wherein the output angle command generator (704) is connected to a floor plan software comprising a location of the emergency lighting unit (700) in a building and wherein the output angle command generator (704) is configured to generate an output angle distribution depending on the location of the emergency lighting unit (700) in the building.

9. The emergency lighting unit (700) of any one of the preceding claims, wherein the output angle command generator (704) comprises an interface for a human mechanical operation input.

10. The emergency lighting unit (700) of claim 9, wherein the emergency lighting unit (700) comprises a casing and wherein the human mechanical operation input is performed by means of a switch button.

11. The emergency lighting unit (700) of any one of the preceding claims 1 to 8, wherein the output angle command generator (704) comprises an interface for an electronical input command performed by a wired or wireless communication channel.

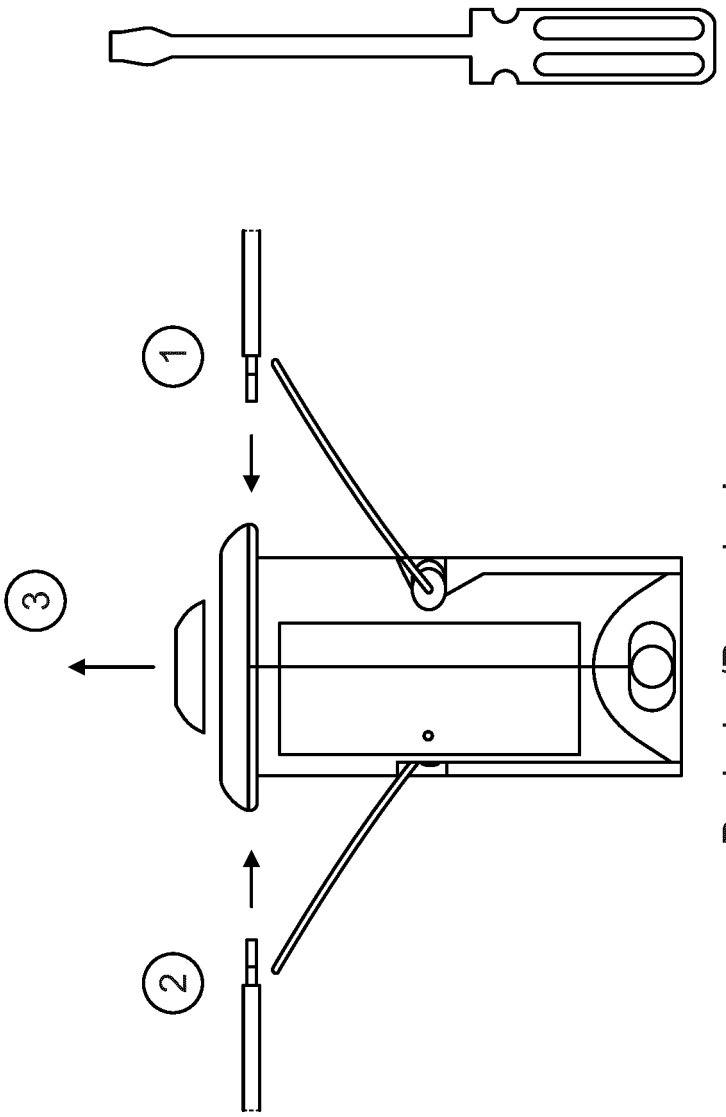
12. The emergency lighting unit (700) of any one of the preceding claims, wherein the emergency lighting unit (700) comprises a battery charger or battery discharger (1007).

13. The emergency lighting unit (700) of any one of the preceding claims, wherein the emergency lighting unit (700) comprises a LED driver (1005) configured to drive the LED based lighting module (1002).

14. The emergency lighting unit (700) of any one of the preceding claims, wherein the emergency lighting unit (700) comprises an AC/DC converter (1006).

15. An emergency lighting system, comprising an emer-

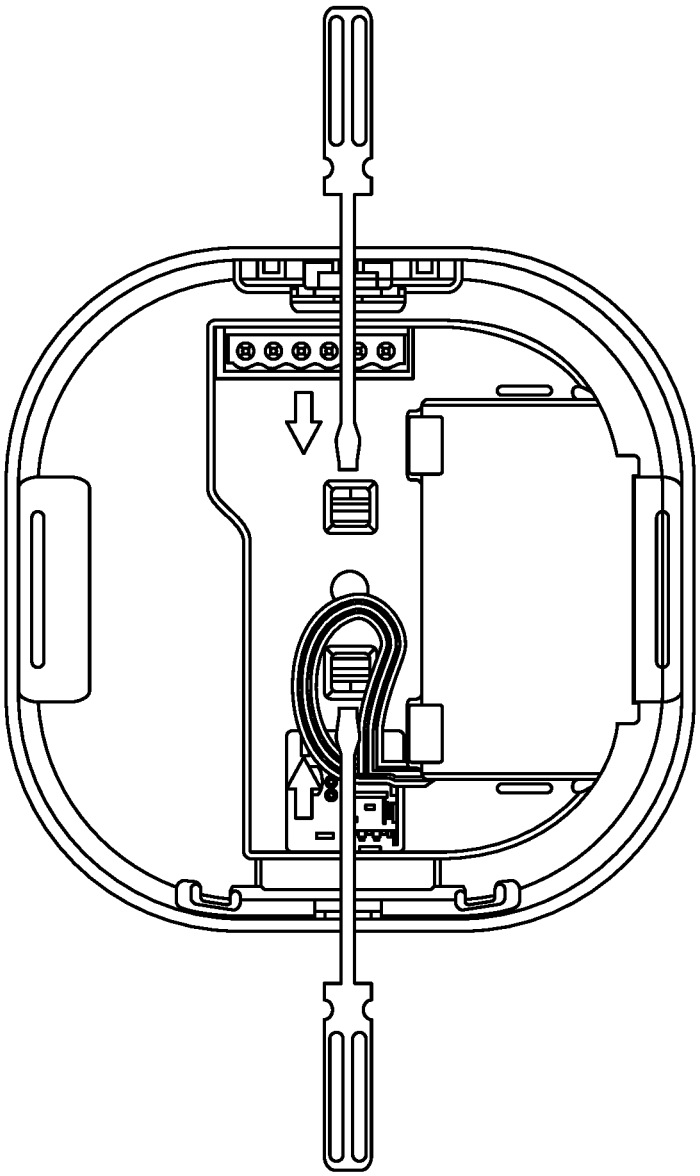
gency lighting unit (700) according to any one of the preceding claims 1 to 14 as well as a computing unit configured to run a lighting floor plan software being configured to communicate with the emergency lighting unit (700) in order to supply the emergency lighting unit (700) with output angle commands.



Replacing/Removing Lens

Fig. 1

P58657/EP



Replacing/Removing Lens

Fig. 2

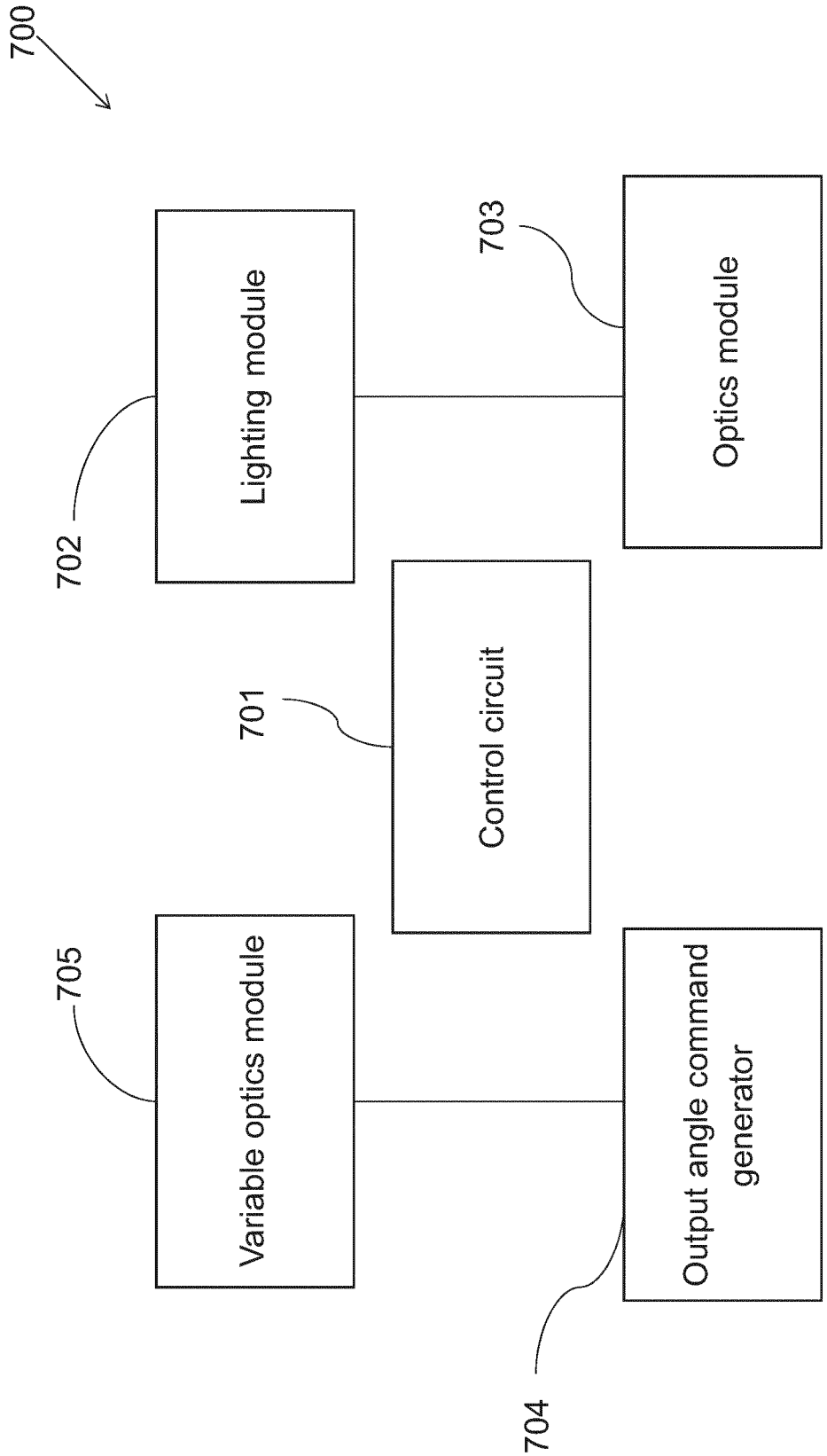

700
Lighting module
702
Optics module
703
Control circuit
701
Variable optics module
705
Output angle command generator
704

Fig. 3

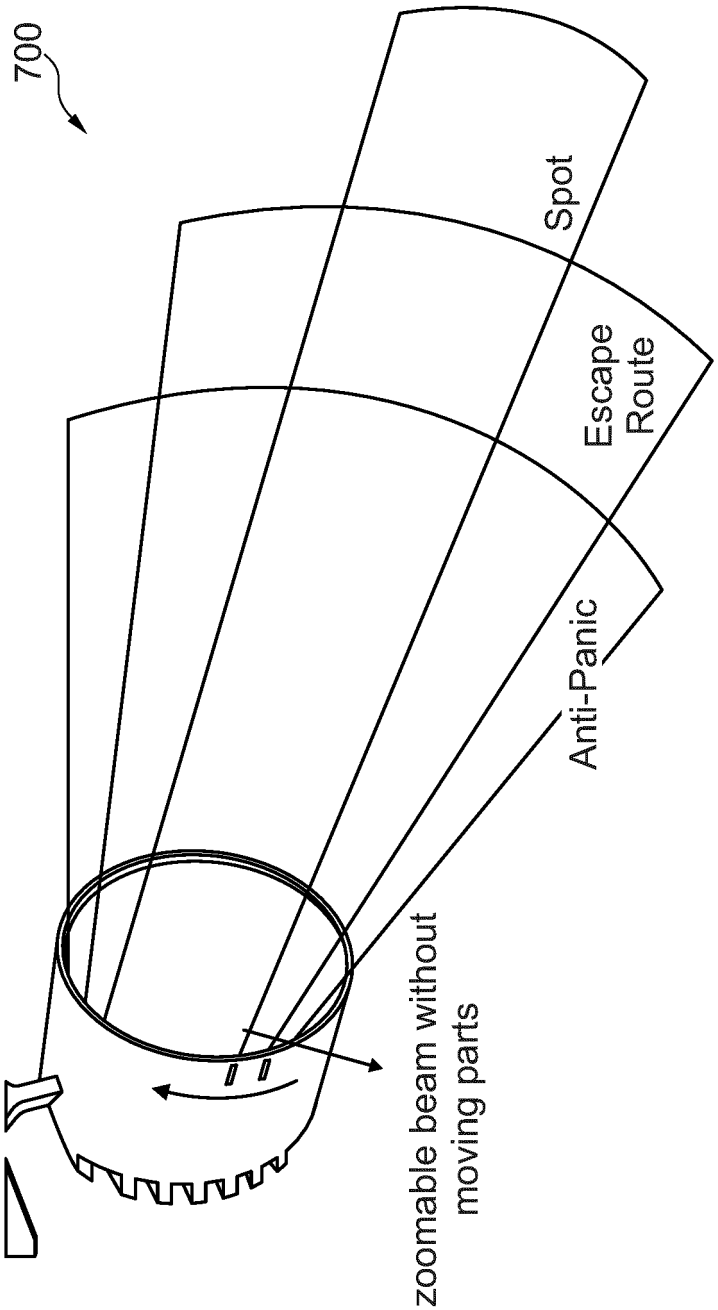

700
Spot
Escape Route
Anti-Panic
zoomable beam without moving parts

Fig. 4

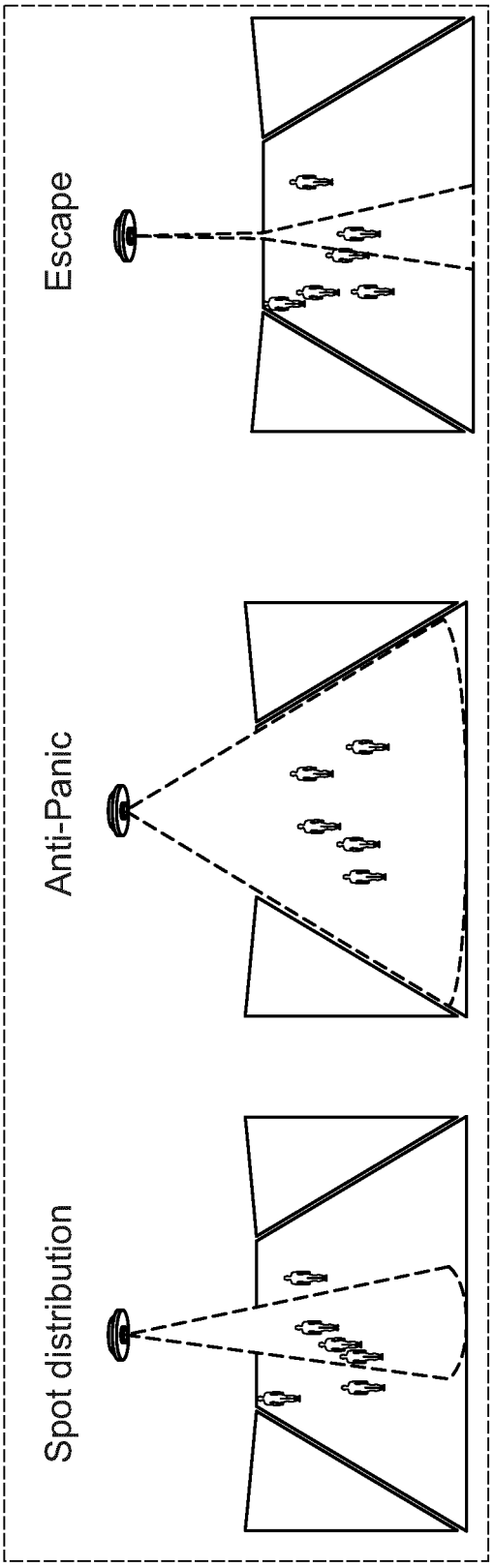
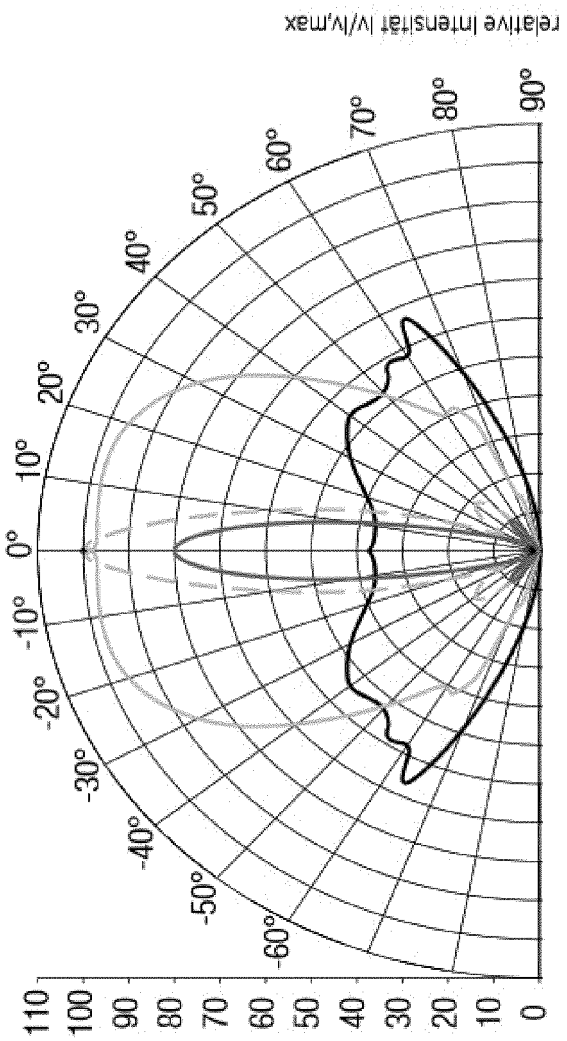


Fig. 5a


relative Intensität Iv/Iv,max
90°
80°
70°
60°
50°
40°
30°
20°
10°
0°
-10°
-20°
-30°
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100
90
80
70
60
50
40
30
20
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0

Fig. 5b

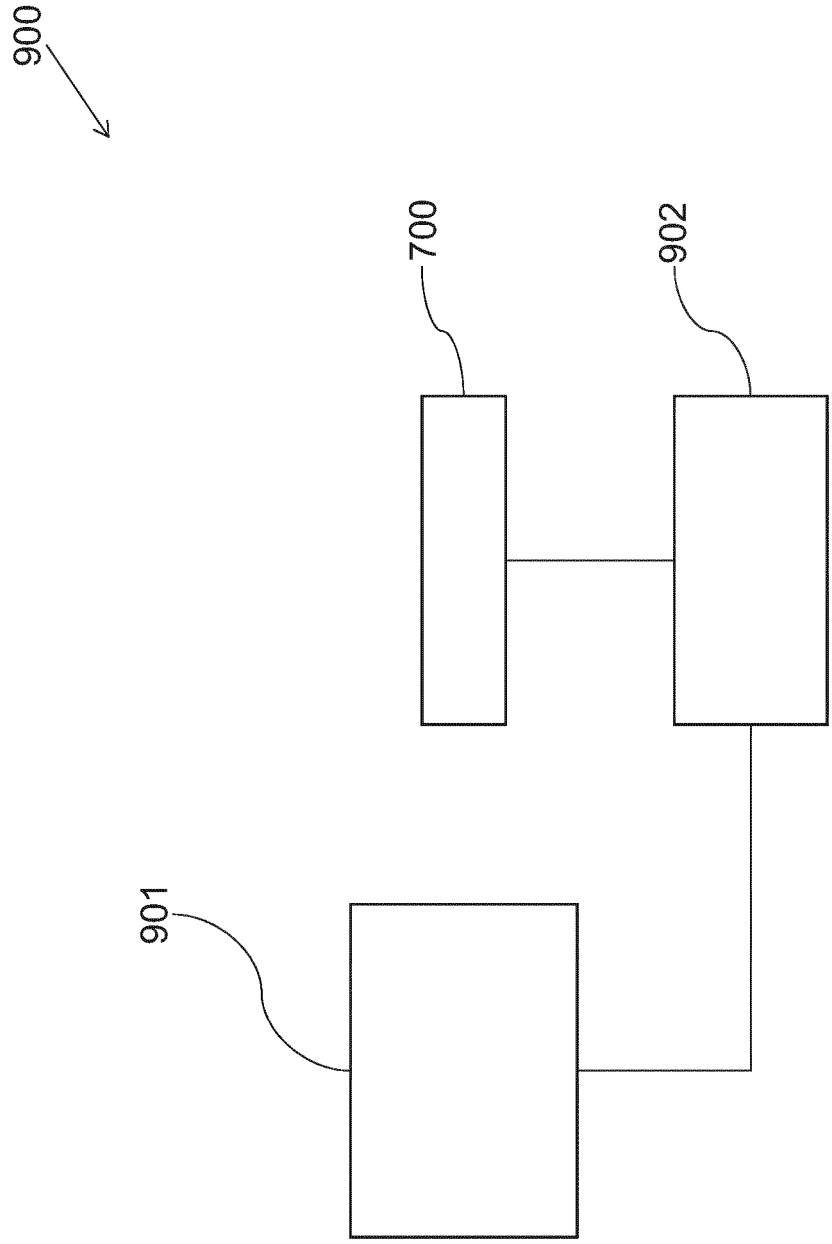

Fig. 6

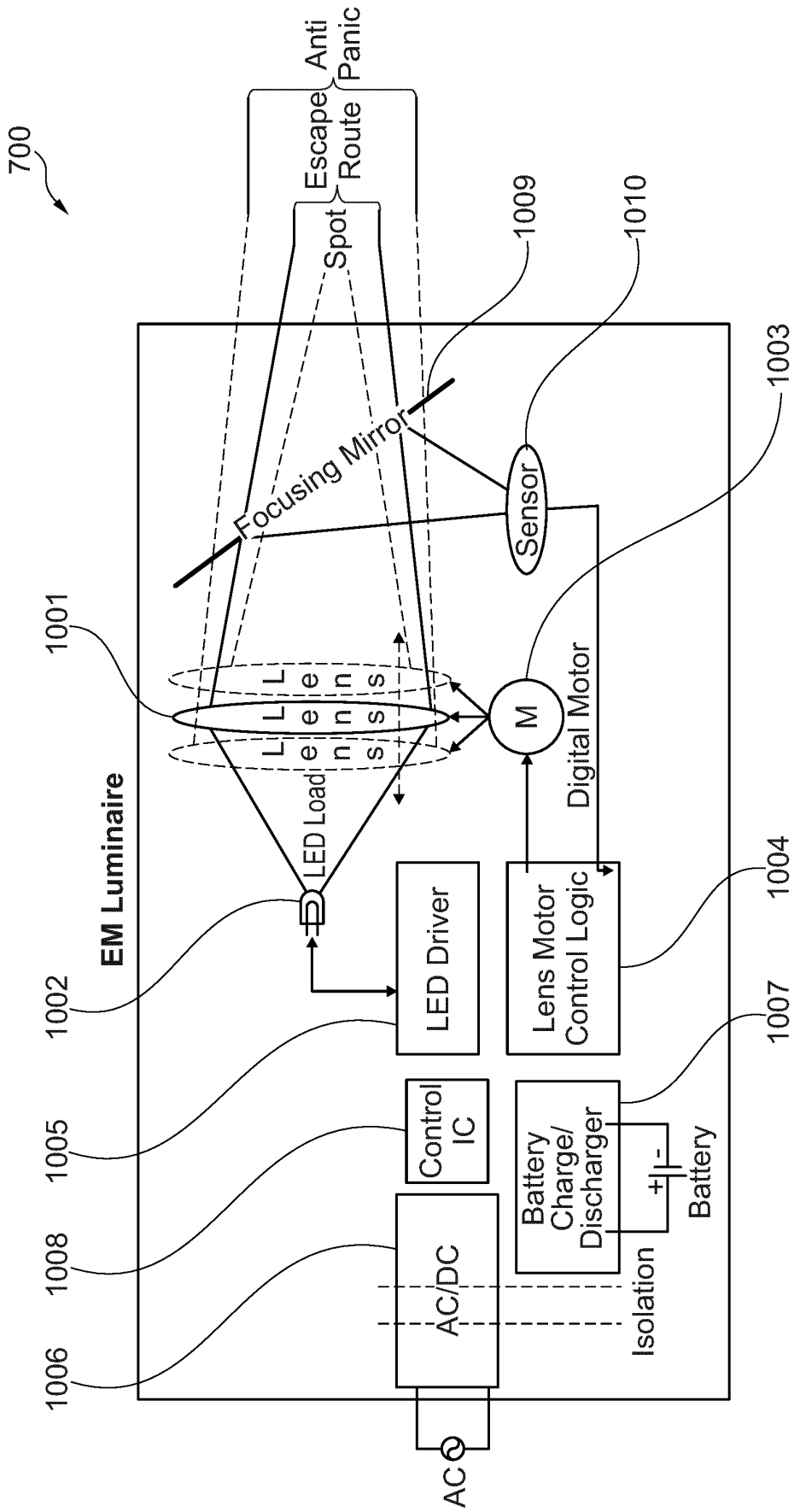
700
Anti Panic
Escape Route
Spot
1009
1010
1003
Focusing Mirror
Sensor
1001
Lenses
M
Digital Motor
LED Load
EM Luminaire
1002
LED Driver
Lens Motor Control Logic
1004
1007
1005
Control IC
Battery Charge/ Discharger
Battery
1008
AC/DC
Isolation
1006
AC

Fig. 7

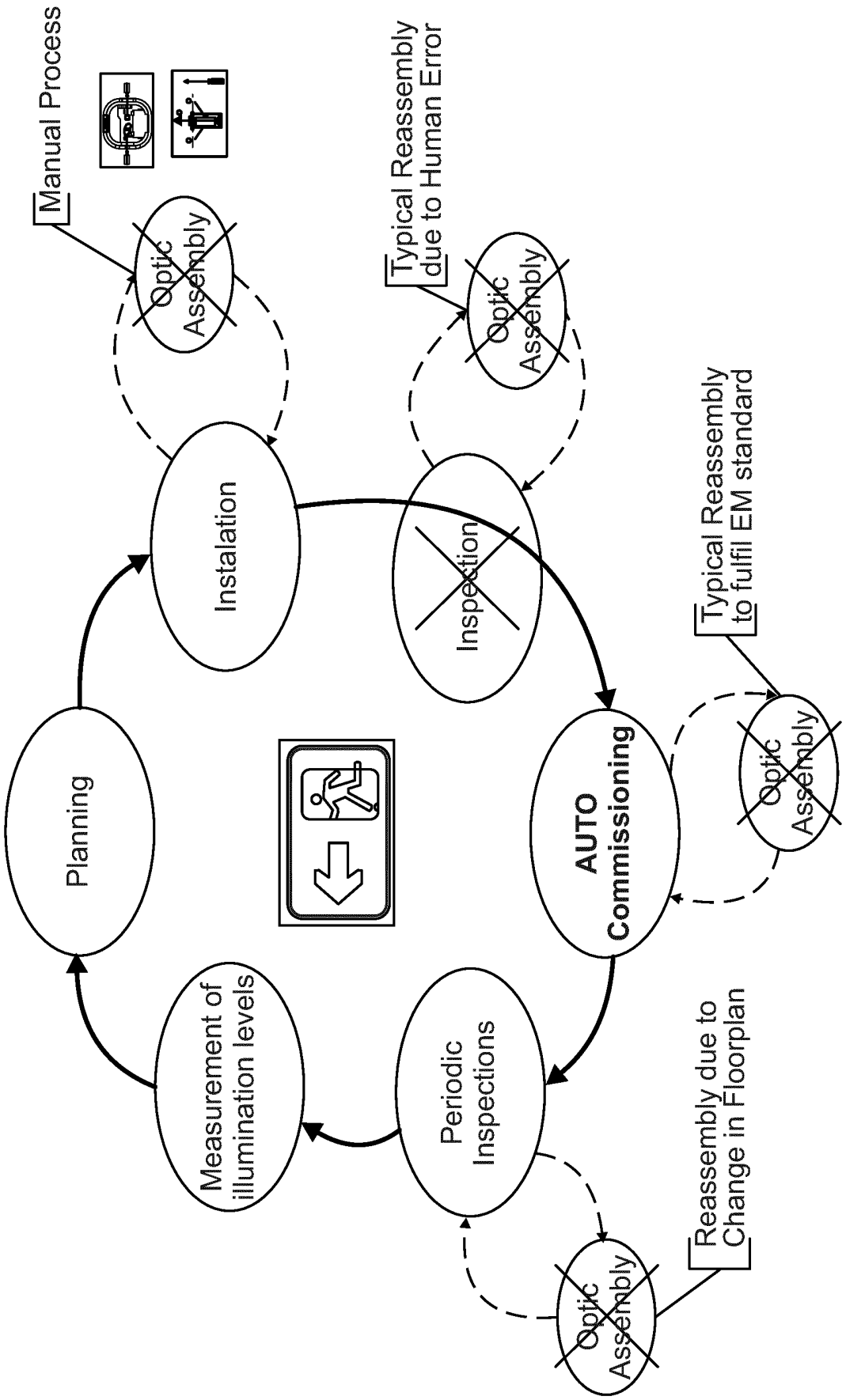
Manual Process
Optic Assembly
Instalation
Typical Reassembly due to Human Error
Optic Assembly
Inspection
Typical Reassembly to fulfil EM standard
Optic Assembly
AUTO Commissioning
Reassembly due to Change in Floorplan
Optic Assembly
Periodic Inspections
Measurement of illumination levels
Planning

Fig. 8

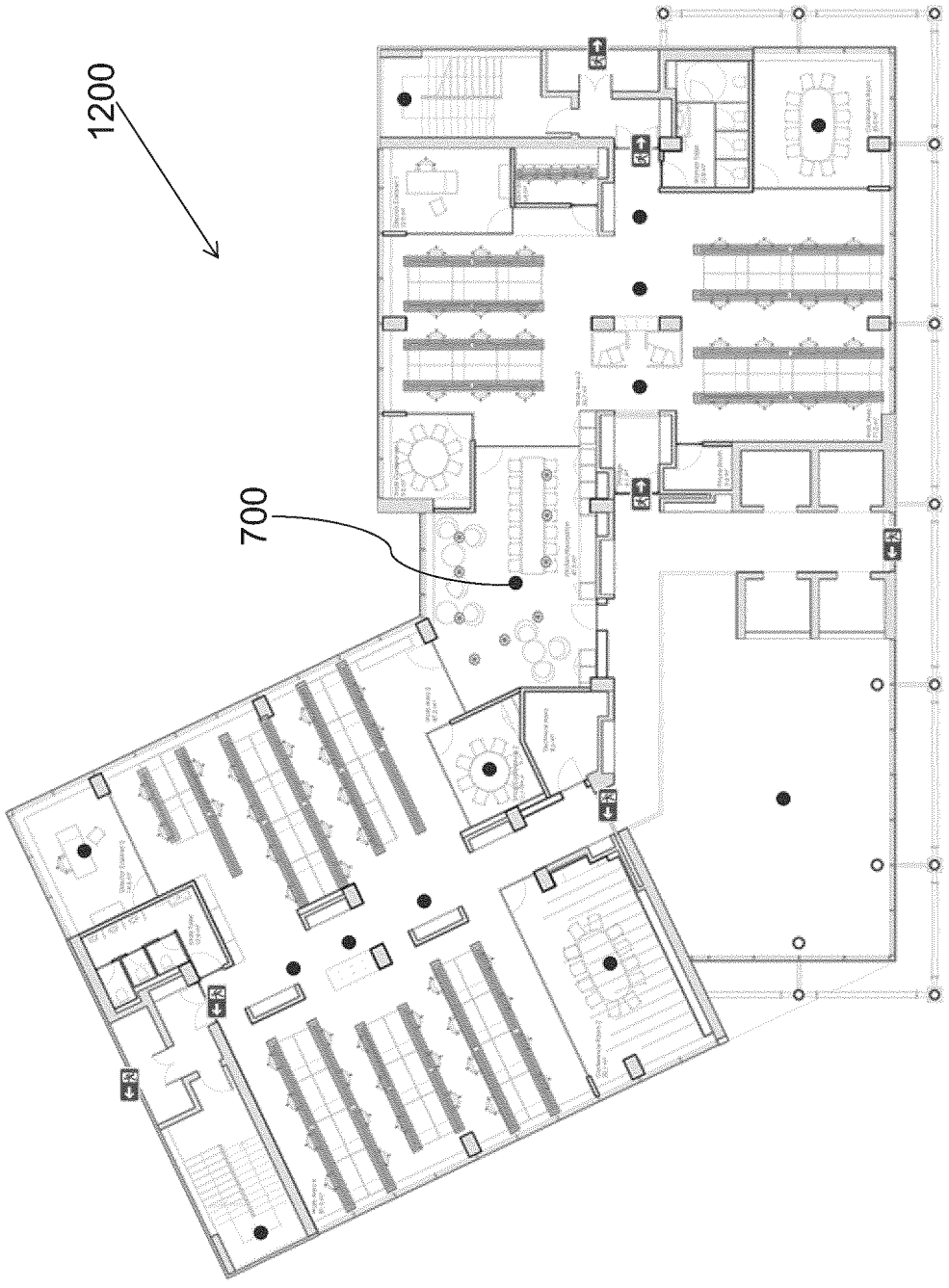

Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 22 15 9709

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	WO 03/055273 A2 (COLOR KINETICS INC [US]) 3 July 2003 (2003-07-03)	1-7,9-14	INV. H05B47/19
Y	* page 1, line 21 - page 2, line 22; figures 1-7,10,33 * * page 21, line 4 - page 34, line 26 *	8,15	
Y	US 10 438 462 B1 (KUO MICHAEL [US] ET AL) 8 October 2019 (2019-10-08) * column 3, line 47 - column 9, line 55; figures 1-3,6 *	8,15	

TECHNICAL FIELDS SEARCHED (IPC)

H05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 August 2022	Henderson, Richard

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 15 9709

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18-08-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03055273 A2	03-07-2003	AU 2002360721 A1	09-07-2003
		EP 1459600 A2	22-09-2004
		ES 2451271 T3	26-03-2014
		JP 2005528733 A	22-09-2005
		JP 2009152213 A	09-07-2009
		WO 03055273 A2	03-07-2003
US 10438462 B1	08-10-2019	US 10438462 B1	08-10-2019
		US 2020051408 A1	13-02-2020

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