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(54) LIGHTING ARRANGEMENT

(57) A lighting arrangement (100) for illuminating in particular a window reveal (202) or a vertical support comprises two luminaires modules (10), each module (10) having a light source (22) and an optical system that produces a beam which is asymmetrically expanded in a first plane and collimated in a second plane, wherein the two planes are perpendicular to each other. Both luminaire modules (10) are symmetrically aligned with respect to the second plane, such that they emit light in substantially opposite directions, wherein both luminaire modules (10) can be operated independently from each other with respect to the intensity and/or color of the emitted light.

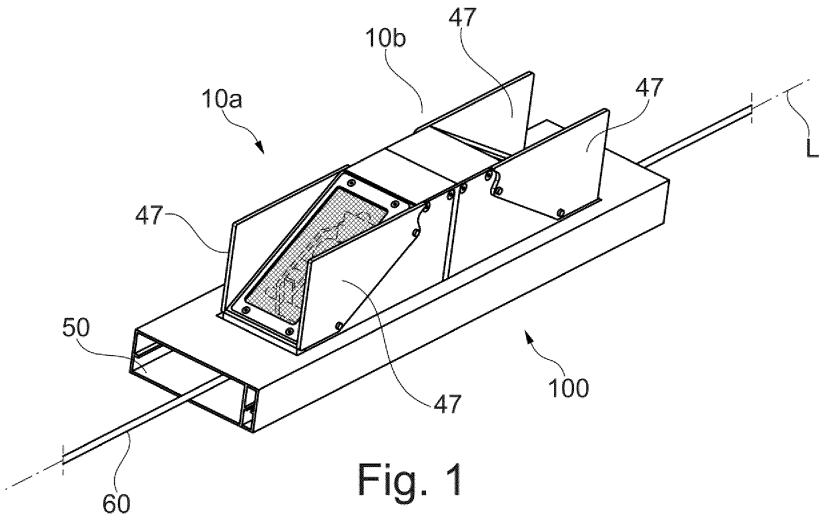

Fig. 1

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Description

[0001] The present invention relates to a lighting arrangement provided, for example, for illuminating window reveals, support structures or facades of a building.

[0002] The illumination of window reveals may be for aesthetic or functional reasons. For aesthetic reasons, the illumination of the reveals may enhance the window and its surroundings and create a pleasant atmosphere in the room. For functional reasons, reveal lighting can help increase ambient light, especially in spaces that receive little natural light. This makes a room brighter and more pleasant, which can have a positive effect on mood and well-being. In addition, window reveal lighting can also serve as pathway lighting to illuminate the path around the window and provide a sense of security.

[0003] In a similar way, also facade lighting can serve several functions. First, it can help highlight the architecture and aesthetics of a building, contributing to its attractiveness. Second, facade lighting can also serve a safety purpose by illuminating dark corners or entrances and making potential hazards visible. In addition, facade lighting can also have a communicative function, for example, by pointing out special events or conveying a certain mood. In advertising, it can be used to draw attention to a particular building or company. Overall, facade lighting can help improve the aesthetics and safety of a building and generate targeted attention.

[0004] Special luminaires for illuminating a window reveal are typically integrated in the window sill. The exact mounting position may vary depending on the design and type of lamp, but typically these luminaires are arranged at the center of the window sill and oriented horizontally to symmetrically illuminate the side walls and the top wall of the window reveal.

[0005] The known solutions have several disadvantages, especially when it comes to illuminating large windows of big buildings. Firstly, optical beams emitted by these luminaires are not optimized for this purpose as light is usually emitted in a narrow beam. Moreover, windows cannot be illuminated in a flexible way and the known luminaires can cause glare that can be perceived from inside the building.

[0006] In addition to the problems mentioned before, the aspect of light pollution becomes more and more important nowadays. Light pollution which is caused be light emitted in the dark sky should be avoided for several reasons. At first, it has a negative impact on wildlife. Artificial light can disrupt the natural patterns of animals and interfere with their ability to navigate, communicate, and find food. It can also disrupt the breeding patterns of some species and affect their health. Further, excessive and unnecessary artificial lighting wastes energy and resources. This can lead to higher energy bills and greenhouse gas emissions, which contribute to climate change. Also, it has been found that exposure to artificial light at night can disrupt the body's natural sleep-wake cycle, leading to sleep disorders and other health problems such as diabetes, obesity, and depression. Consequently, it is important to minimize light pollution and use lighting technology that is energy-efficient, directional, and shields the light source to reduce the amount of light emitted upwards into the sky.

[0007] In view of the above, it is an object of the present invention to provide a lighting arrangement which allows an efficient and flexible illumination of window reveals or support structures whereas at the same time the emission of stray light and increase of light pollution is limited.

[0008] In accordance with the present invention, a lighting arrangement is provided for illuminating for example a window reveal or a vertical support, wherein the inventive lighting arrangement comprises two luminaire modules. Each module has a light source and an optical system that produces a beam which is asymmetrically expanded in a first plane and collimated in a second plane, with both planes perpendicular to each other. The two luminaire modules are symmetrically aligned with respect to the second plane, such that they emit light in substantially opposite directions. Both luminaire modules can be operated independently from each other with respect to the intensity and/or color of the emitted light.

[0009] The inventive asymmetric expansion and collimation of the beams allows for more efficient and targeted illumination of window reveals or vertical supports. Further, the ability to operate the modules independently allows for a greater flexibility in the lighting design, such as the ability to highlight different parts of the window reveal or the building and/or change the color scheme. According to a preferred embodiment of the invention, each luminaire module emits white light, and the color temperature of the emitted light is adaptable, preferably in a range between 2200 K and 6500 K. The adaptable color temperature allows for customization of the lighting to suit the specific building or environment, and can also enhance the visual appearance and ambiance of the building.

[0010] According to another preferred embodiment of the invention, each luminaire module comprises a housing for accommodating the light source and at least parts of the optical system. Each housing forms a light emission opening which is covered by a transparent cover. Preferably, the covers are oriented at an angle with respect to a horizontal mounting plane such that the light emission directions of the two modules, which are each oriented approximately perpendicular to the transparent covers, point in directions away from each other, with the light emission directions enclosing an angle of about 70 to 110 degrees. The housing and transparent cover provide protection for the light source and the optical system against dust and humidity while allowing for efficient and targeted light emission wherein in particular the angled orientation of the covers and light emission directions allows for a more precise and controlled

illumination of the window reveals or vertical supports.

[0011] In accordance with another preferred embodiment of the invention, the optical system of each luminaire module comprises an exchangeable frame which surrounds the transparent cover and in particular restricts a light emission in a vertical direction with respect to the first plane. This exchangeable frame allows for a further customization and optimization of the light emission, wherein in particular a vertical cutoff between the two illuminated window halves can be adjusted according to the user's preferences.

[0012] In accordance with another preferred embodiment of the invention, the optical system of each luminaire module comprises an optional external shield which is adapted to restrict a light emission with respect to the second plane. This external shield advantageously comprises a plurality of blades which extend parallel to each other, and preferably parallel to the first plane. This optional external shield provides additional control over the light emission, wherein the blades represent precise and adjustable means for controlling the light emission and reducing glare or light pollution. Preferable, the external shield can be attached to the housing of the luminaire module without the need of additional tools, for example by means of a snap-fit connection.

[0013] Preferably, both luminaire modules are arranged on a common carrier element which provides structural stability and ease of installation for the lighting arrangement on a building facade.

[0014] In accordance with the present invention, also a building facade is provided comprising a window with a reveal and a lighting arrangement as explained above to illuminate the window reveal. Preferably, the lighting arrangement is arranged on the center bottom of the window reveal in order to ensure a homogeneous illumination of the window reveal. In particular, the lighting arrangement is arranged recessed in the window sill, preferably integrated in the window sill.

[0015] In the following, the present invention will be explained in more detail with reference to the accompanying drawings:

Figure 1	shows a perspective view of a preferred embodiment of the inventive lighting arrangement.
Figure 2	schematically shows the illumination of a large window by the inventive lighting arrangement.
Figures 3 to 5	show different views of a luminaire module which forms one half of the inventive lighting arrangement.
Figure 6	shows the light source and the optical components of the luminaire module.
Figure 7	schematically shows the light emission produced by one luminaire module.
Figure 8	shows the combination of light emissions provided by the two luminaire modules of the inventive lighting arrangement.
Figures 9a and 9b	show the possibility to further influence the light emission characteristics by using a frame-like cover.
Figures 10a and 10b	show the influence of the overall illumination of a window depending on the used cover frame.
Figure 11	shows the possibility to further influence the light emission by using an optional shield.
Figures 12 and 13	schematically show the influence of different external shields on the light emission of one luminaire module.

[0016] In the following, the inventive concept is explained with reference to the example of the illumination of a window reveal, which represents the preferred application case for the inventive lighting arrangement. As explained above, the lighting arrangement according to the present invention has been developed in particular in order to illuminate windows having a width, which is significantly larger than the window height. However, the present invention is not restricted to this application case and the lighting arrangement also could be used to illuminate support structures or even facades of a building. Due to the optical properties and the possibility to adapt the illumination in a flexible way, the inventive solution also provides positive effects when illuminating other structures than windows or window reveals.

[0017] Figure 1 at first shows a perspective view of a preferred embodiment of the inventive lighting arrangement, which generally is assigned by reference number 100. The lighting arrangement 100 extends in a longitudinal direction L and comprises two luminaire modules 10a and 10b arranged adjacent to each other along this longitudinal direction. Both luminaire modules 10a and 10b are located on a common support element 50, which forms a longitudinal tube or channel with a rectangular cross section. This support element 50 - which could form part of a building structure or a

window sill - preferably allows to guide corresponding power supply lines 60 - and optionally also communication lines - which extend in longitudinal direction and could be used to supply power and/or control signals to several lighting arrangements 100 arranged to illuminate a sequence of windows of a building. As explained below, the luminaire modules 10a and 10b also partially extend into the interior of the support element 50 allowing for a secure and reliable positioning of the luminaire modules 10a, 10b.

[0018] Using the lighting arrangement 100 as shown in figure 1, a window 200 can be illuminated as it is schematically shown in figure 2. The lighting arrangement 100 here is arranged in the center of the window sill 201 and in particular illuminates the reveal 202 of the window 200 as well as optional vertical supports. In the example shown, the light emitted by the inventive lighting arrangement 100 also illuminates external venetian blinds 210.

[0019] As explained afterwards in more detail, both luminaire modules 10a and 10b roughly illuminate separate halves 200a, 200b of the window 200. Since it is possible to operate both luminaire modules 10a and 10b independent from each other with respect to the intensity and the color of the emitted light, the inventive lighting arrangement 100 provides the possibility to illuminate the window 200 in a more flexible way. As an example, figure 2 shows the situation wherein both halves 200a and 200b of window 200 are illuminated with white light of a different color temperature. Besides this increased flexibility to enhance the visual appearance of an illuminated window, the light emission of luminaire modules 10a and 10b also has been improved in order to ensure an illumination of the window reveal 202 in high quality, wherein the emission of undesired stray light is avoided. This will be explained in the following in more detail with reference to a single luminaire module, which is shown in figures 3 to 6.

[0020] The luminaire module 10 shown in theses figures has a wedge-shaped housing 15, which accommodates the light source and optical components to emit the light in a desired way as well as the electronics required to drive the light source. The luminaire module 10 is preferably adapted to be integrated in a lighting system and thus to be controlled by a central control unit by means of digital control signals. This opens the possibility to illuminate several windows of a building complex coordinated with each other. Alternatively, also an individual operation of the lighting arrangement 100 independent from other lighting arrangements would be possible.

[0021] The casing 15 of the luminaire module 10 has the already mentioned wedge-like shape with an inclined upper surface 17, which has a rectangular light emission opening 18 covered by a transparent light emission element 19 to emit the light provided by the light source. The horizontal bottom portion 16 of the casing is arranged to by inserted via a corresponding opening into the interior portion of support element 50 as can be seen in figure 1. This bottom portion 16 also provides connecting means 16a which are used to connect the luminaire module 10 to the power supply line 60 and also - if necessary - to communication lines allowing to send analog or digital control data to the lighting arrangement 100.

[0022] The light source 22 located on a corresponding heatsink 23 within the housing 15 of the lighting module 10 is a light source comprising one or more LEDs, wherein preferably several LEDs are provided emitting white light with a specific color temperature. By adapting the dimming levels of the individual color temperatures, mixed white light with any desired color temperature within a wide range can be finally obtained, wherein preferably the lighting module 10 allows to select the desired color temperature starting from a very warm white of 2200K to a very cool white of 6500K. Obviously, also the use of RGB-LED-modules would be possible allowing to emit light in any desired color wherein in both cases the use of a so-called mixing chamber has proved to be of advantage in order to ensure a homogeneous light emission.

[0023] Nevertheless, even more important is the way how the light produced by the corresponding light source 22 is emitted by the luminaire module 10. According to the present invention, the optical system provided by the luminaire module 10 is arranged to emit the light as shown in figures 4, 5 and 7. In these figures, figure 4 shows the light emission in a first plane following the longitudinal L direction of the luminaire arrangement 100 and further being vertically oriented (this plane is defined by axes x and z of the coordinate system indicated in figure 3), whereas figure 5 shows the light emission in a second plane, which is perpendicular to the first plane (and thus defined by axes y and z). The resulting light emission characteristic is also represented by the two polar curves shown in figure 7.

[0024] As can be seen from these figures, the light beam provided by the luminaire module 10 is spread longitudinally to form a relatively wide beam in the first plane, which is, however, asymmetrically directed to only one side in longitudinal direction. This light emission characteristic - represented by curve A in figure 7) ensures that the beam emitted by luminaire module 10 indeed illuminates the corresponding window half in its entirety as it is shown in figure 2. Light emission is, however, cut off in a vertical direction as the other half of the window is then illuminated by the second luminaire module 10. The light emission direction of the luminaire module 10 is thus defined approximately by the perpendicular to the transparent light emission element 19.

[0025] In the other hand, in the second plane, the light emitted by luminaire module 10 is concentrated to a very narrow beam, which is slightly inclined with respect to the vertical direction. This emission characteristic (represented by curve B in figure 7) ensures that the light is focused on the window reveal and the window itself whereas no - or at least only few - light is emitted into the room or through the window into the sky. Stray light which might negatively influence the lighting situation within a room as well as light pollution resulting from a light emitted into the sky thus can be avoided.

This also ensures that the amount of light required to illuminate a window is limited.

[0026] As can be seen in figure 6, this specific light distribution of the luminaire module 10 is achieved with the help of reflector parts 25 and 26, which are arranged in the module housing 15 close to the light source 22. Part 25 is the main reflector, a so-called free-form reflector, which is specially shaped for the light distribution described above. Part 26 is an additional flat reflector element arranged adjacent to the second light module. Of course, other optical elements could be used to emit the light according to the disclosure in figures 4, 5 and 7.

[0027] As one luminaire module 10 only is responsible to illuminate one half of a window, the second luminaire module 10 will have to illuminate the corresponding second half. However, as it is shown in figure 8, the light emission characteristic of the second luminaire module (right variant) is not identical to the characteristic of the first luminaire module (left variant) but symmetrical with respect to the second plane. Accordingly, in the first plane, now the light emitted by the second module is distributed over a relatively wide angular range in the opposite direction wherein again light emission is cut off vertically. Both light emission directions (as mentioned before approximately defined by the perpendicular to the corresponding transparent light emission element 19) roughly enclose an angle between 70° and 110°.

[0028] In the second plane, the light beam is again concentrated to a narrow angular range lightly inclined with respect to a vertical direction in order to ensure that the light illuminates the window and the window reveal. In combination, the light emitted by both luminaire modules 10 perfectly illuminates the whole window area. This is even true for relatively large windows of having a width of for example up to 5 meters.

[0029] As mentioned before, the light emitted by one luminaire module 10 is cut off with respect to a vertical direction since this light should not significantly overlap with the light emitted by the other luminaire module 10. This cut off is obtained by the second reflector part 26 and preferably additionally by a cover frame 30, which is attached to the luminaire housing 15 in the area of the light emission opening 18. This frame 30 covers the surrounding of the transparent light emission element 19 wherein according to a preferred embodiment different cover frames 30 could be used to influence the light emission finally obtained.

[0030] This concept is shown in figures 9 and 10 wherein in figures 9a and 9b two different cover frames 30 are attached to the luminaire module housing 15. The cover frame 30 used in figure 9b is broader compared to the frame in figure 9a. Whereas the light emitted by both luminaire modules 10 in combination will almost directly combine or even slightly overlap in vertical direction, as it is shown in figure 10a, the broader cover frame 30 of figure 9b results in a sharp cut-off in vertical direction appearing as a dark portion C in the middle of the window (see figure 10b). Accordingly, by providing different frame covers, the user can fine tune the cut-off between the two light beams.

[0031] While the exchangeable cover frame 30 allows to adapt the light emission in the first plane, another optional light influencing element can be used to adapt the light emission in the perpendicular direction.

[0032] As shown in figures 11 to 13, an external accessory shield 40 could be used to additionally focus the light beam in the second plane. This shield 40 consists of several blades 45 which extend parallel to each other in longitudinal direction L and are arranged to additionally avoid the emission of stray light. The blades 45 are optimized in length, inter distance and angle according to a specific situation and product implantation and can for example be used in case of a narrow window reveal where the light emission of the lighting arrangement 100 without the shield 40 would still produce stray light resulting in light pollution and an undesired illumination of the adjacent room. As further shown in figures 12 and 13, the blades 45 can be arranged vertical (figure 12) are even slightly inclined (figure 13) wherein in the later case the light beams in the opposite direction (with respect to the inclination) are additionally cut off.

[0033] Preferably, this shield 40 forms an optional accessory element which can be attached to the luminaire module in case the user intends to further influence the light emission. In particular, the shield 40 is attached to the exterior of the housing 15 of the luminaire modules 10 without the need of any additional tools in order to allow a fast and flexible mounting. A preferred solution would be a snap-fit or another form-fitting connection.

[0034] Finally, as shown in figure 1, the light emission also could be further influenced by optional vertical sidewalls 47 which are arranged on both sides of the light emission opening 18 of the corresponding luminaire module 10. Although the impact of these walls 47 is smaller compared to the shield element 40 explained with respect to figures 11 to 13, also these walls 47 can be used to positively influence the emission of the inventive lighting arrangement 100.

[0035] Overall, the present invention provides a new concept for illuminating a window and the corresponding window reveal with a high quality wherein also larger windows now can be illuminated and the possibilities to flexibly influence the light emission are further increased.

Claims

1. Lighting arrangement (100) for illuminating in particular a window reveal (202) or a vertical support,

the lighting arrangement (100) comprising two luminaires modules (10), each module (10) having a light source (22) and an optical system that produces a beam which is asymmetrically expanded in a first plane and collimated

in a second plane, wherein the two planes are perpendicular to each other;
wherein both luminaire modules (10) are symmetrically aligned with respect to the second plane, such that they emit light in substantially opposite directions;
and wherein both luminaire modules (10) can be operated independently from each other with respect to the intensity and/or color of the emitted light.

2. Lighting arrangement (100) according to claim 1,
wherein each luminaire module (10) is adapted to emit white light, wherein preferably the color temperature of the emitted light is adaptable, in particular in range between 2200 K and 6500 K.

3. Lighting arrangement (100) according to one of the preceding claims,
wherein each luminaire module (10) comprises a housing (15) for accommodating the light source (22) and at least parts of the optical system, wherein each housing (15) forms a light emission opening (18) which is covered by a transparent light emission element (19).

4. Lighting arrangement (100) according to claim 3,

wherein the transparent light emission elements (19) are oriented at an angle such that light emission directions of the two luminaire modules (10), which are each oriented perpendicular to the transparent light emission elements (19), point in directions away from each other,
the two light emission directions enclosing in particular an angle of about 70 to 110 degrees.

5. Lighting arrangement (100) according to claim 3 or 4,
wherein the optical system of each luminaire module (10) comprises an exchangeable cover frame (30) which surrounds the transparent light emission element (19) and in particular restricts a light emission in a vertical direction with respect to the first plane.

6. Lighting arrangement (100) according to one of the preceding claims,
wherein the optical system of each luminaire module (10) comprises an optional external shield (40) which is adapted to restrict a light emission with respect to the second plane.

7. Lighting arrangement (100) according to claim 6,
wherein the external shield (40) comprises a plurality of blades (45) which extend parallel to each other, and preferably parallel to the first plane.

8. Lighting arrangement (100) according to one of claims 6 and 7,
wherein the external shield (40) is attachable to the housing by a form-fitting connection , preferably by a snap-fit connection.

9. Lighting arrangement (100) according to one of the preceding claims,
wherein both luminaire modules (10) are arranged on a common carrier element.

10. Facade of a building, comprising a window (200) with a reveal (202) and a lighting arrangement (100) according to one of the preceding claims to illuminate the window reveal (202).

11. Facade of a building according to claim 10,
wherein the lighting arrangement (100) is arranged on the center of the window sill (201).

12. Facade of a building according to claim 11,
wherein the lighting arrangement (100) is arranged recessed in the window sill (201), preferably integrated in the window sill (201).

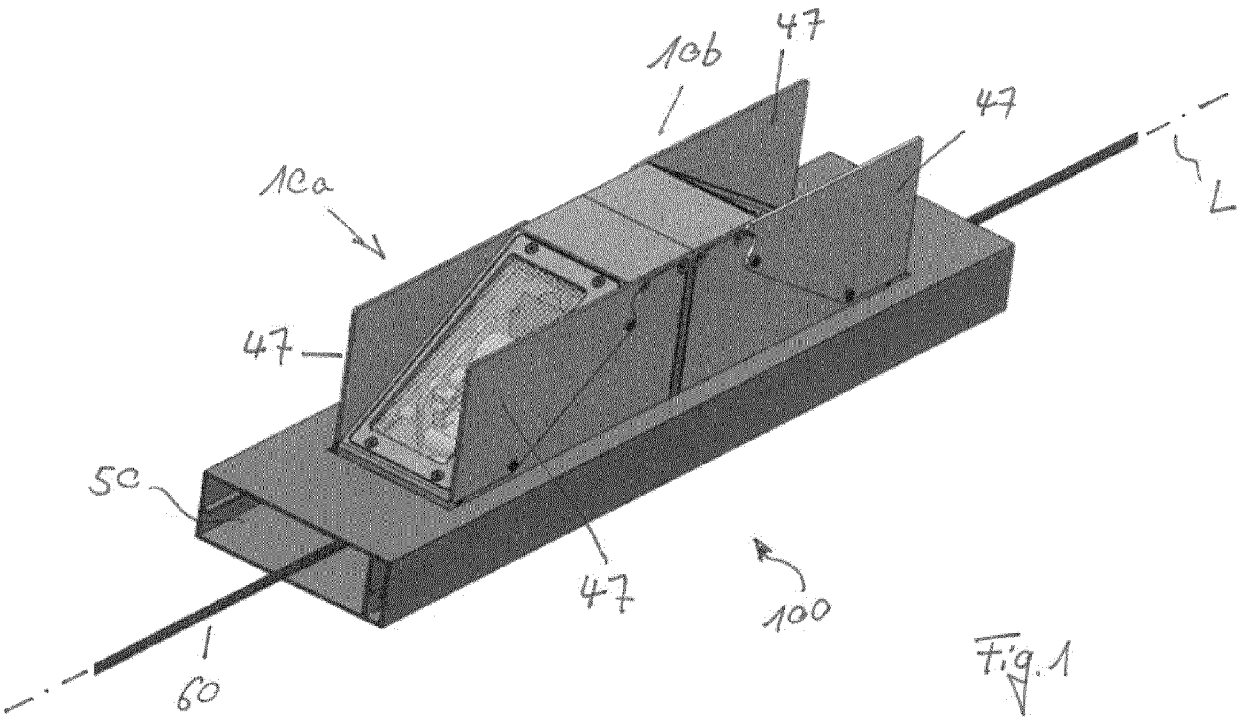


Fig. 1

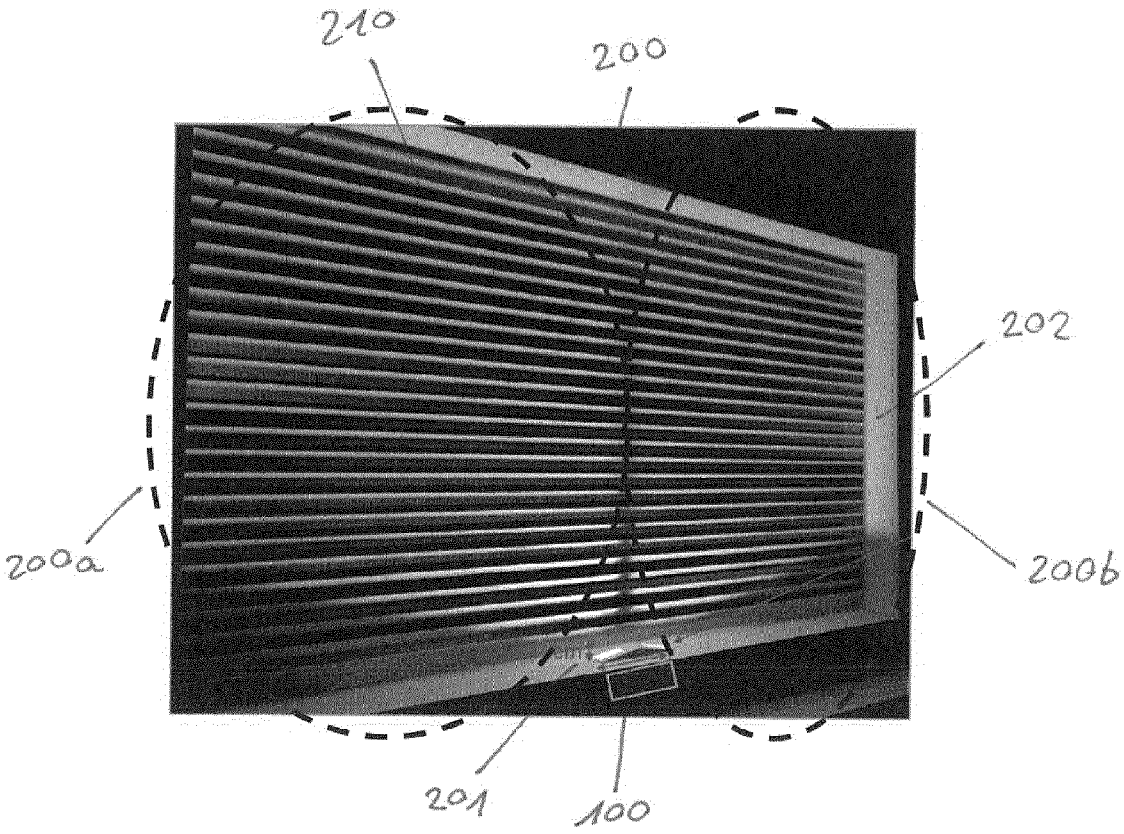


Fig. 2

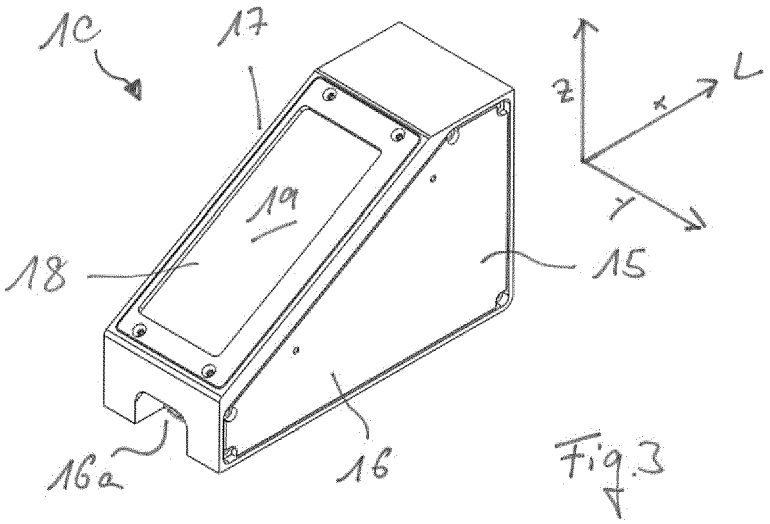


Fig.3

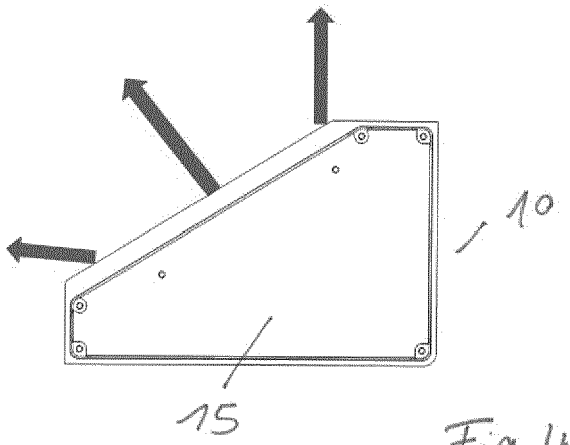


Fig.4

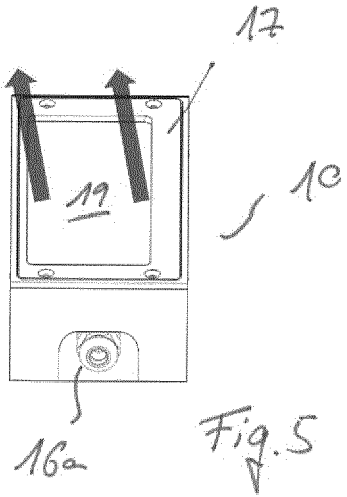


Fig.5

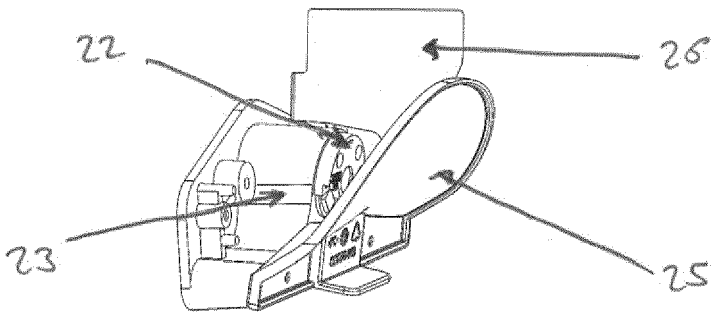


Fig.6

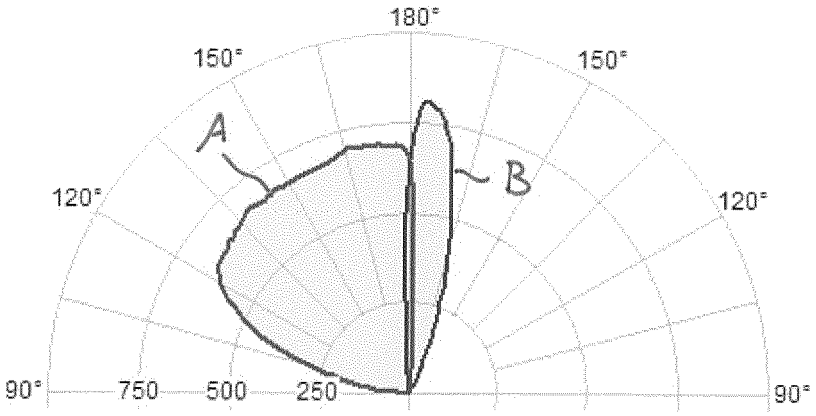
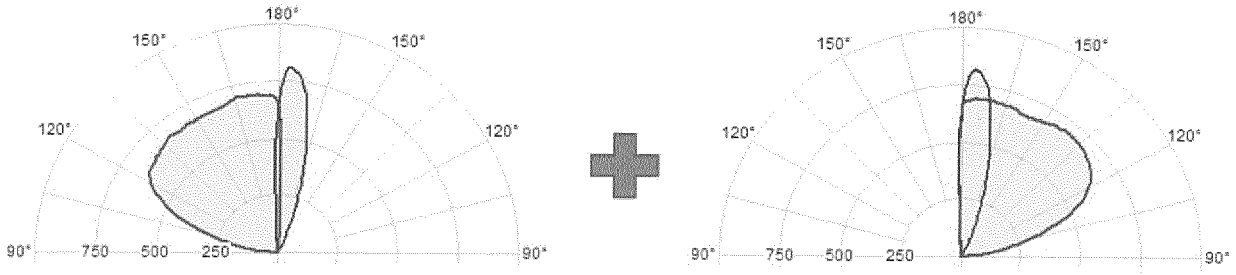


Fig. 7



Left variant

Right variant

Fig. 8

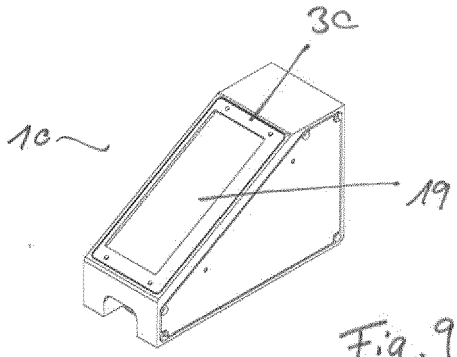


Fig. 9a

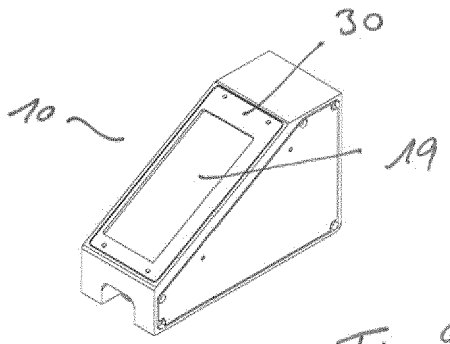


Fig. 9b

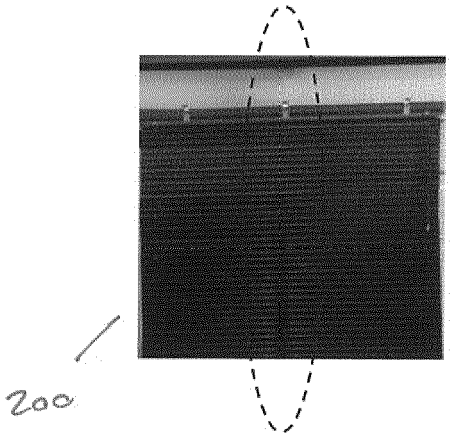


Fig. 10a

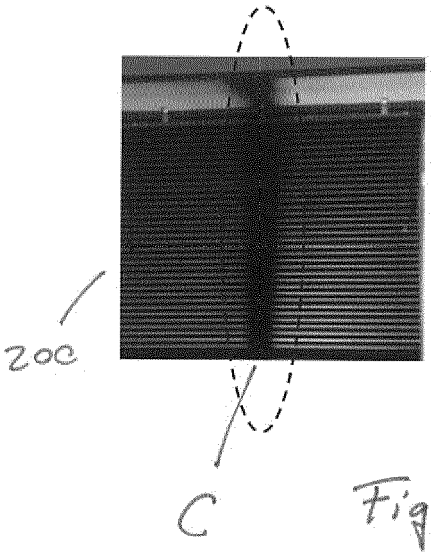


Fig. 10b

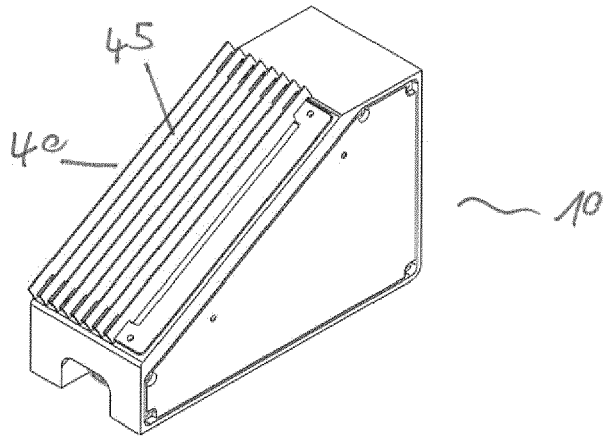


Fig. 11

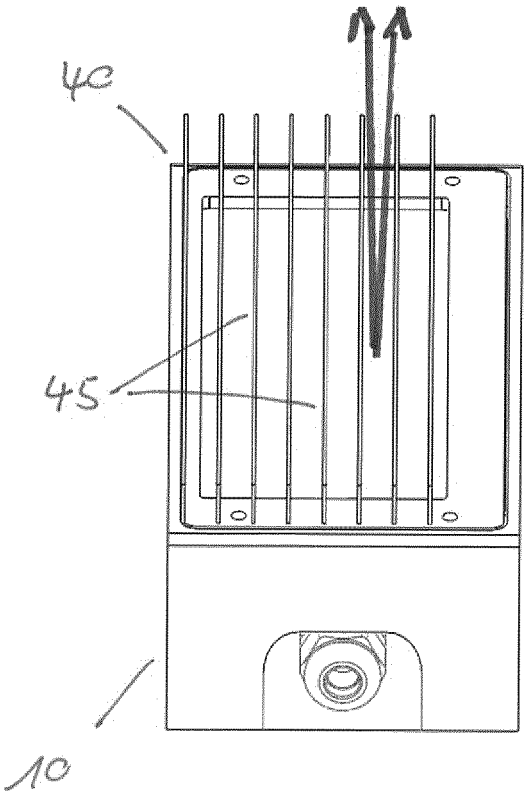


Fig. 12

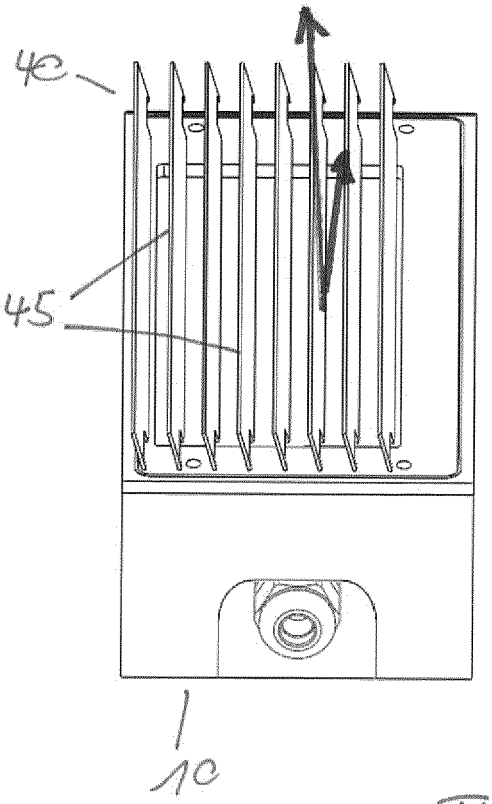


Fig. 13

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EUROPEAN SEARCH REPORT

Application Number
EP 23 16 9348

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	DE 20 2010 001465 U1 (SILL FRANZ GMBH [DE]) 22 April 2010 (2010-04-22)	1-12	INV. F21V33/00
Y	* paragraphs [0024] - [0036]; figures 2-8 *	7,8	F21V7/00 F21S8/00 E06B1/70
Y	US 5 390 092 A (LIN SHARMING [TW]) 14 February 1995 (1995-02-14) * column 2, lines 13-55; figures 1-3 *	7,8	E06B7/28 ADD. F21S2/00 F21V11/02 F21W131/107 F21Y113/10 F21Y115/10 E06B1/34 E06B9/24

TECHNICAL FIELDS SEARCHED (IPC)

F21S
F21V
F21W
F21Y
E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 September 2023	Menn, Patrick

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
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 16 9348

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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20-09-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 202010001465 U1	22-04-2010	NONE	
US 5390092 A	14-02-1995	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82