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(54) **Lighting device**

(57) A lighting device (10), of the LED type for example, to be mounted on a mounting surface (S) comprises a planar solid state lighting module (12) having a light radiation emission region (12b) and a frame-like housing (14) for the lighting module (12). The housing (14) can be fixed, with screws (V) for example, to the mounting surface (S), and has a window (14a) to expose the light radiation emission region (12b) of the lighting module (12). The housing (14) has a recess (14d) for the insertion

of the lighting module (12) into the housing (14) whereby, with the housing (14) applied to the mounting surface (S), the lighting module (12) is insertable into housing (14) and removable therefrom by sliding over the mounting surface (S). A set of elastic assemblies (20) acting between the housing (14) and the lighting module (12) enables the lighting module (12) to be urged to bear on the mounting surface (S) and enables it to be held in an inserted position in the housing (14).

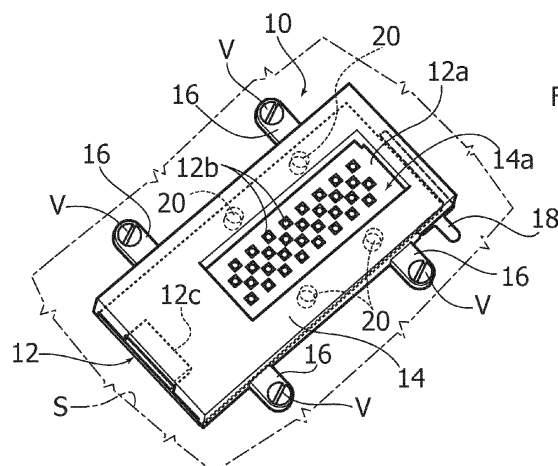


FIG. 1

Description

Technical field

[0001] The present description relates to lighting devices. Various embodiments may relate to solid state lighting devices, for example lighting devices using LED sources as light radiation sources.

Prior art

[0002] In order to mount lighting devices on a mounting surface (for example, the surface of a heat sink), fixing elements such as screws can be used.

[0003] Although they enable the outer structure of the device to be fixed to the mounting surface, these fixing elements do not resolve certain critical problems associated with the fixing of lighting modules.

[0004] For example, in various solutions, the fixing (and replacement, where necessary) of the lighting module may prove to be difficult, for example when the available space is limited.

[0005] The operation of replacing the module, when necessary, may be complicated by the need to dismantle the whole device (by slackening a set of screws, for example).

[0006] Furthermore, operations such as the tightening and/or slackening of screws may require the use of tools which could accidentally damage the module.

Object and summary

[0007] In the context outlined above, it has been observed that there is a requirement for a simple solution for mounting a lighting module, of the LED type for example, on a mounting surface such as the surface of a heat sink, using fixing elements, such as screws, solely for fixing the outer structure.

[0008] Various embodiments have the purpose of meeting this requirement.

[0009] Various embodiments achieve this object by means of a lighting device having the characteristics claimed in the appended claims.

[0010] The claims form an integral part of the technical teachings provided herein in relation to the invention.

[0011] Various embodiments enable the lighting module, of the LED type for example, to be fixed by means of an outer housing.

[0012] In various embodiments, the outer housing can provide a constant uniform contact pressure of the module on the mounting surface (a heat sink, for example), such that correct and effective mechanical and thermal contact is provided.

[0013] Various embodiments enable one or more of the following advantages to be obtained:

- optimal mechanical contact between the lighting module and the mounting surface (a heat sink, for

example),

- rapid and speedy installation of the module, of the LED type for example, on the corresponding lighting device, by using a sliding support for example,
- a simplified operation for replacing the lighting module, since it is possible, for example, to avoid the need to slacken screws in order to disconnect the lighting module electrically and/or mechanically,
- a standardized mounting structure which is stable and reliable in terms of its thermal and other aspects,
- an entirely uniform contact pressure between the lighting module and the mounting surface (a heat sink, for example), such that an optimal thermal connection is provided while the lighting module is held securely in position,
- easy provision of arrays of modules,
- the possibility of easy adjustment and/or absorption of any manufacturing tolerances of components during mounting,
- a reduced risk of damage to the lighting module during installation and/or replacement.

Brief description of the drawings

[0014] Various embodiments will now be described, purely by way of non-limiting example, with reference to the appended drawings, of which:

- Figure 1 is a perspective view of an embodiment,
- Figure 2 is a perspective view of an embodiment shown in partial cutaway form for the sake of clarity,
- Figure 3 is a view on an enlarged scale of the part indicated by the arrow III in Figure 2,
- Figure 4 is a front view of parts of embodiments,
- Figure 5 is a view of an embodiment, and
- Figure 6 illustrates, from a viewpoint similar to that of Figure 1, operations which can be carried out in some embodiments.

Detailed description

[0015] The following description illustrates various specific details intended to provide a deeper understanding of various exemplary embodiments. The embodiments may be produced without one or more of the specific details, or with other methods, components, materials, etc. In other cases, known structures, materials or operations are not shown or described in detail, in order to avoid obscuring various aspects of the embodiments.

[0016] The reference to "an embodiment" in this description is intended to indicate that a particular configuration, structure or characteristic described in relation to the embodiment is included in at least one embodiment. Therefore, phrases such as "in an embodiment", which may be present in various parts of this description, do not necessarily refer to the same embodiment. Furthermore, specific formations, structures or characteristics may be combined in any suitable way in one or more

embodiments.

[0017] The references used herein are provided purely for convenience and therefore do not define the scope of protection or the extent of the embodiments.

[0018] In the figures, the reference numeral 10 indicates a lighting device which can be mounted on a mounting surface S.

[0019] In various embodiments, the lighting device 10 may comprise a planar solid state lighting module indicated by 12.

[0020] In various embodiments, the lighting module 12 can comprise a substrate 12a "populated" by one or more light radiation sources 12b.

[0021] In various embodiments, there may be, for example, an array (in a matrix, quincuncial, or other arrangement) of LED light radiation sources.

[0022] In various embodiments, the substrate 12a may carry a circuit module 12c, mounted at an end position for example, for supplying power to the light radiation sources 12b, and, if appropriate, for carrying out processing operations of various kinds (for example, for the exchange of control signals from and to the array of light radiation sources 12b).

[0023] In various embodiments, the module 12 can be made in accordance with Zhaga specifications. The name "Zhaga" has been given to a collaborative consortium of companies in the lighting technology industry, set up with the aim of facilitating the interchangeability of solid state light sources, for example LED sources, made by different manufacturers, in order to facilitate, for example, general lighting technology applications.

[0024] In various possible applications, the mounting surface S may be formed by the surface of a heat sink HS, which has fins F, more clearly visible in Figure 4, in a position opposite the surface S.

[0025] In various embodiments, the planar lighting module 12 may have a rectangular shape, as shown by way of example in the drawings. In various embodiments, the planar lighting module 12 may have a different shape, such as a square, round, elliptical, mixtilinear or other shape.

[0026] In various embodiments, the module 12 may be mounted on the surface S by means of a housing 14 substantially resembling a frame, which can indeed "frame" the module 12 and keep it pressed against the surface S with a constant uniform pressure. In various embodiments, this may ensure that thermal and mechanical contact is made between the module 12 and the surface S, thus facilitating heat dissipation.

[0027] In various embodiments, the housing/frame 14 may therefore enable the mechanical connection to be made while also protecting the module 12 from accidental contact and the ingress of particles.

[0028] In various embodiments, the housing 14 may have a central opening 14a which, according to the principles described more fully below, leaves the region of generation/emission of light radiation, that is to say the region containing the array of LEDs 12b acting as light

radiation sources, uncovered when the module 12 is inserted into the housing 14.

[0029] In various embodiments, the protective action against additional contact or the ingress of particles may be improved further by providing for the window 14a to be sealed by a cover of "light permeable" (that is to say, transparent) material. In various embodiments, the cover may be a screen of transparent glass or plastic material, applied to the housing 14 (for example by gluing onto the contour of the window 14a) or made in one piece with the housing 14.

[0030] It will be appreciated that the shape of the housing/frame can be adapted (that is to say, "customized") to the shape and dimensions of the module 10 without encountering any particular limitations.

[0031] In various embodiments, the housing/frame 14 (referred to hereafter as a "frame" for the sake of simplicity) may be fixed to the mounting surface S by means of screws V screwed into corresponding holes (not visible in the drawings) provided in the surface S.

[0032] In various embodiments, the fixing elements (for example the screws V) may be intended to pass through openings formed in a plurality of projecting appendages 16 approximately resembling feet, which extend laterally from the frame 14.

[0033] In the embodiments shown by way of example in the drawings, where the frame 14 is of rectangular shape, the appendages 16 extend along the longer sides of the rectangular shape.

[0034] In various embodiments, the appendages 16 may be distributed in any way along the contour of the frame. In various embodiments, the spatial distribution of the appendages 16 may be chosen so as to provide a substantially uniform distribution along the peripheral extension of the frame 14.

[0035] Various embodiments may provide a constant uniform distribution of the pressure with which the frame 14, fixed to the surface S (by means of the screws V for example), presses the substrate 12a of the module 12 onto and against the surface S, as can be seen more clearly in the views of Figures 2, 3 and 4.

[0036] In various embodiments, the module 12 can be inserted into the frame 14 applied to the surface S by causing it to slide- in practice, to rub - over the surface S from one side of the frame 14, for example from the side in the lower lefthand position as seen from the viewpoint of Figures 1 and 6.

[0037] In various embodiments, as can be more clearly seen in Figure 4, the aforesaid sliding insertion movement can be achieved by inserting the module 12 into the frame 14 through a recess 14d in the frame 14 such that an insertion slot is formed with respect to the surface S.

[0038] In various embodiments, the recess 14d may have a height or depth (that is to say, a dimension in a direction orthogonal to the direction of the surface S) which is slightly greater than the homologous dimension of the module 12, that is to say slightly greater than the

thickness of the substrate 12a of the module 12.

[0039] In various embodiments, the recess 14d may have a central portion with a greater height or depth, indicated by 140d, intended to act in such a way that, on completion of the movement of insertion of the module 12 into the frame 14, the component 12c mounted on the substrate 14 is received in the portion of the recess indicated by 140d.

[0040] In various embodiments, by means of the coordinated selection of the height/depth of the recess 14d and the thickness of the substrate 12a (combined, if appropriate, with the equally coordinated selection of the height and depth of the recess portion 140d and the homologous dimension of the circuit element 12c), the module 12 inserted into the frame 14 can "seal" the frame at the position of the recess 14d, thus causing the module 12 to be protected from the penetration of particles.

[0041] An example of the operation of inserting the module 12 into the frame 14 is visible in Figure 5 (viewed in association with Figure 1).

[0042] The frame 14 applied to the surface S resembles, approximately at least, a pocket into which the module 12 can be inserted by sliding, causing the module to penetrate into the frame through the recess 14d. The whole arrangement is such that the module 12 can be extracted from the frame 14 (in order to replace the module 12, for example) by making the module slide backwards so that it can be extracted from the aforesaid insertion pocket formed by the frame 14.

[0043] In various embodiments, in order to facilitate the movement for extracting the module 12, it is possible to provide in the frame 14, in a position opposite the insertion recess 14d for example, an oscillating lever 18 acting as an ejector, this lever being pivoted on the body of the frame 14 and having one end projecting outside the frame 14.

[0044] When inserted into the frame 14, the module 12 can keep the lever 18 pressed (against the body of the frame 14, for example). If the end of the lever 18 projecting outside the frame 14 is acted on (as shown schematically in Figure 6), the lever 18, in turn, pushes the module in the direction of ejection from the frame 14. The movement for extracting the module 12 from the frame 14 can thus be facilitated while avoiding the need to act directly on the module itself, and particularly on the array of light radiation sources 12b (which, in various embodiments, may in any case be inaccessible from outside the frame 14 owing to the presence of the transparent protective cover or screen applied to seal the window 14a).

[0045] As regards the choice of materials, the frame 14 can be made, for example, from a plastic material (such as a polymer), while the module 12 can be made according to the current technology in this field, particularly by making the substrate 12a with a structure substantially resembling the structure of a printed circuit board (PCB).

[0046] In various embodiments, the use of a plastic material (such as a polymer) for the frame 14 can impart

electrical insulation properties to the device 10.

[0047] The reference 20 indicates elastic assemblies which, in various embodiments, can provide a double function, namely that of:

- ensuring that the module 12, for example the substrate 12a of the module, is pressed elastically against the mounting surface S with an elastic force capable of being distributed in a constant and uniform way over the whole extension of the module 12, and
- retaining the module 12 in its inserted position in the frame 14, while preventing it from sliding out of the frame 14 in an accidental and undesired manner.

[0048] In various embodiments, the assemblies 20 can each comprise an engagement element, formed for example by a ball 20a (see in particular the enlarged view of Figure 3), which can engage a cavity 20b (which may be bowl-shaped, for example) formed in the substrate 12a.

[0049] In various embodiments, the ball 20a, acting as an element for engaging the cavity 20b, can be elastically biased by a spring 20c inserted into a cavity 20d formed in the body of the frame 14 on the side of the frame intended to face towards the substrate 20a.

[0050] In various embodiments, the assemblies 20 can be distributed along the contour of the module 12 and of the frame 14, for example in positions at least approximately corresponding to (that is to say, in the proximity of) the appendages 16 by means of which the frame 14 is fixed to the surface S.

[0051] In various embodiments, the assemblies 20 can exert an elastic pressure on the module 12, this pressure being distributed over the contour of the module 12 with a uniform elastic force which presses the module 12 against the surface S. At the same time, the snap-fitting engagement of the balls 20a in the cavities 20b provides the desired action of locking the module 12 in the inserted position in the frame 14.

[0052] In various embodiments, when the module 12 is inserted into the frame 14 (see Figure 5), the balls 20a are slightly raised and run over the surface of the substrate 12a of the module 12 which slides under them. On completion of the movement of inserting the module 12 into the frame 14, the cavities 20b are aligned with the balls 20a and the balls 20a are pushed by the springs 20c into engagement with the cavities 20b so as to provide the desired retaining action.

[0053] In various embodiments, when the module 12 has been inserted into the frame 14, the springs 20d can therefore provide a constant uniform contact pressure of the module 12 on the surface S described above.

[0054] When action is taken to extract the module 12 from the frame 14, for example by acting on the lever ejector 18 as described above (see Figure 6), the force exerted in the direction of extraction is able to overcome the elastic force of the springs 20d, causing the balls 20a

to rise slightly with respect to the cavities 20, thus disengaging them and allowing the sliding movement of the module 12 in the direction of extraction from the frame 14.

[0055] Various embodiments may be used in applications in which the operation of mounting the module 12 would otherwise be difficult.

[0056] In various embodiments, the outer structure, that is to say the frame 14, may be the only part which has to be mounted on the surface S, by means of the screws V for example.

[0057] The operation of mounting the module 12 (as well as the operation of replacing it) is simplified and does not have large requirements in terms of space.

[0058] In various embodiments, in fact, the module 12 may be coupled to the frame 14 only in a step which follows the step of mounting the frame 14 on the surface S.

[0059] The elastic retaining action provided by the assemblies 20 may be beneficial in the case of devices 10 subject to vibration (in the case of exterior mounting, for example, as in road lighting applications).

[0060] In this context it will be appreciated that various embodiments facilitate the mounting and replacement operations even when it is necessary to work at a certain height, for example on lighting devices mounted on standards or suspended on cables several meters above the ground.

[0061] The operations of mounting and replacing the module do not require the use of special tools.

[0062] In various embodiments, the elastic pressure exerted on the module 12 by the springs 20d is substantially constant and invariable, regardless of any thermal expansion effects on the parts concerned: this is because the elastic force is essentially determined by the elastic constants of the springs.

[0063] In various embodiments, the kinematic configuration of the elastic assemblies 20 may be complementary to that which is illustrated, in other words with the balls 20a (or other engagement elements) provided on the module 12 and the cavities 20b provided in the frame. These kinematic arrangements, and other kinematic arrangements not explicitly exemplified herein, make it possible to provide the double action of retaining the module 12 in the frame 14 and providing a regular and constant elastic force for the application of the module 12 against the surface S.

[0064] Provided that the principle of the invention remains the same, the details of construction and the forms of embodiment may therefore be varied to a more or less significant extent with respect to those which have been illustrated purely by way of non-limiting example, without thereby departing from the scope of protection, this scope of protection being defined in the attached claims.

Claims

1. A lighting device (10) for mounting on a mounting

surface (S), the device including:

- a planar solid state lighting module (12) having a light radiation emission region (12b),
- a frame-like housing (14) for the lighting module (12), the housing (14) being fixable (V) to the mounting surface (S) and having a window (14a) to expose the light radiation emission region (12b) of the lighting module (12); the housing (14) having a recess (14d) for the insertion of the lighting module (12) into the housing (14) whereby, with the housing (14) applied to the mounting surface (S), the lighting module (12) is insertable into housing (14) and removable therefrom by sliding over the mounting surface (S), and
- a set of elastic assemblies (20) acting between the housing (14) and the lighting module (12) to urge the lighting module (12) towards the mounting surface (S) and hold the lighting module (12) in an inserted position in the housing (14).

2. The device as claimed in claim 1, wherein the elastic assemblies (20) include an engagement element (20a) elastically biased (20d) towards an engagement cavity (20b).
3. The device as claimed in claim 2, wherein the engagement element (20a) and the engagement cavity (20b) are provided, respectively, in the housing (14) and in the lighting module (12).
4. The device as claimed in claim 2 or 3, wherein the engagement element (20a) is a ball.
5. The device as claimed in any of the preceding claims, wherein the housing (14) has projecting appendages (16) for fixing to the mounting surface (S).
6. The device as claimed in claim 5, wherein the projecting appendages (16) have passage openings for elements, preferably screws (V), for fixing to the mounting surface (S).
7. The device as claimed in any of the preceding claims, wherein said elastic assemblies (20) are distributed over the perimeter of the housing (14).
8. The device as claimed in claim 7 and one of claim 5 and claim 6, wherein the elastic assemblies (20) are located at the position of the appendages (16) of the housing (14).
9. The device as claimed in any of the preceding claims, wherein the housing (14) includes, in a position opposite said insertion recess (14d), an ejector (20) operable to eject the lighting module (12) from the housing (14).

10. The device as claimed in claim 9, wherein the ejector (20) is a lever ejector.

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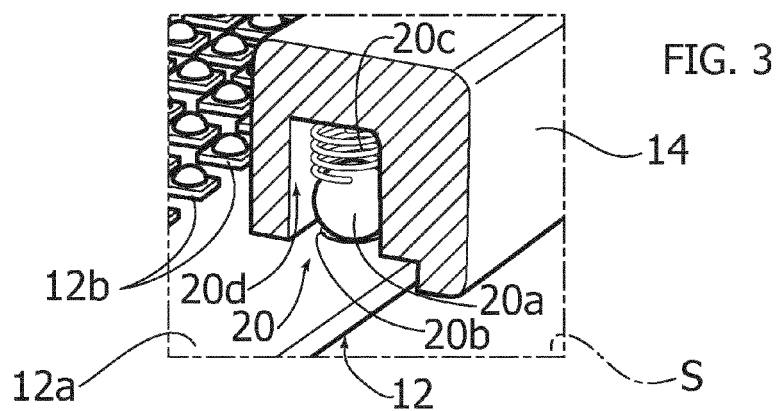
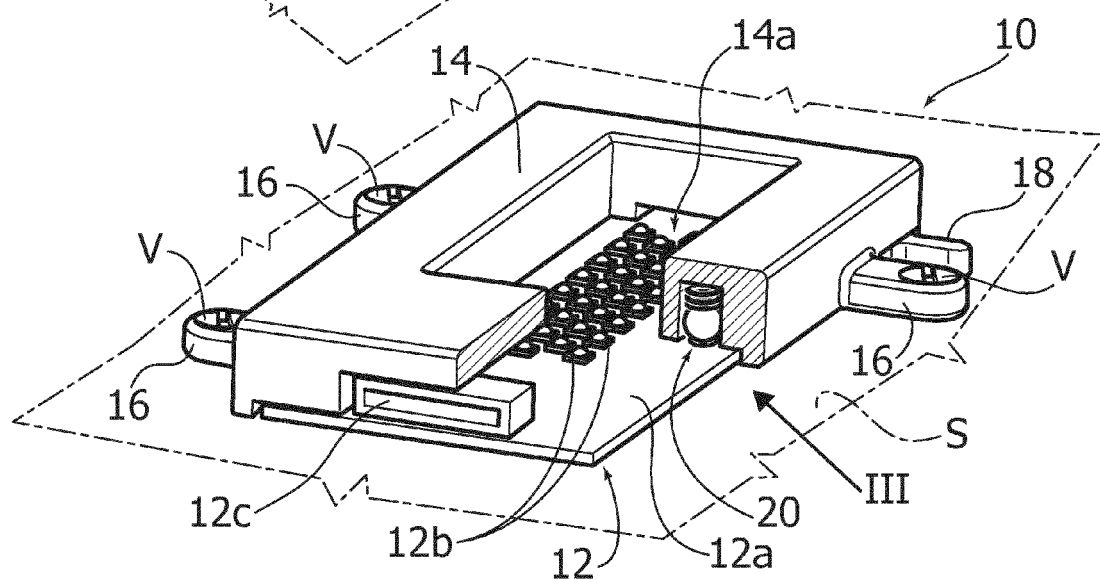
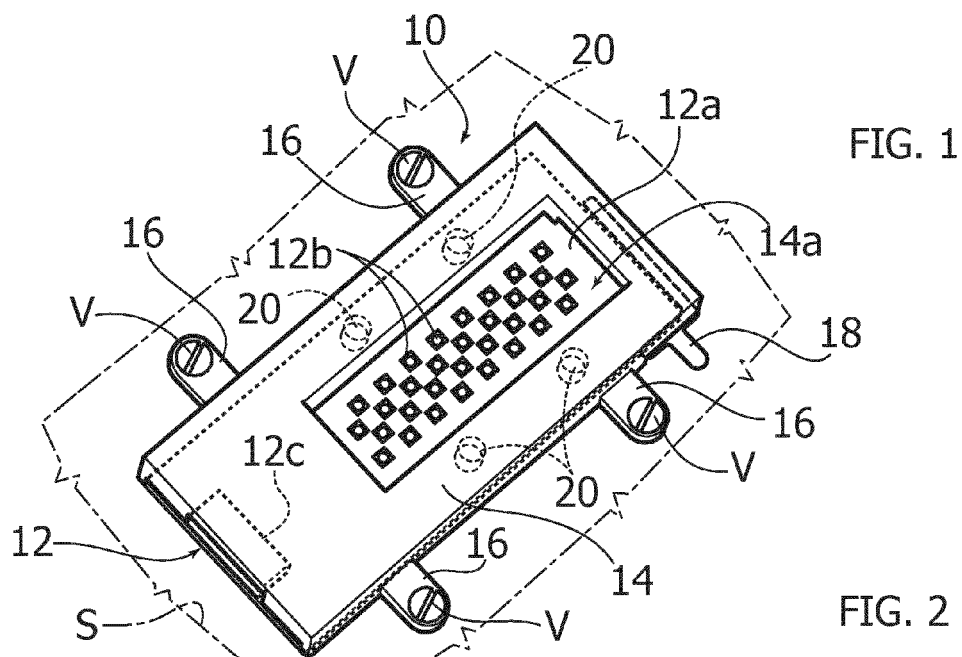
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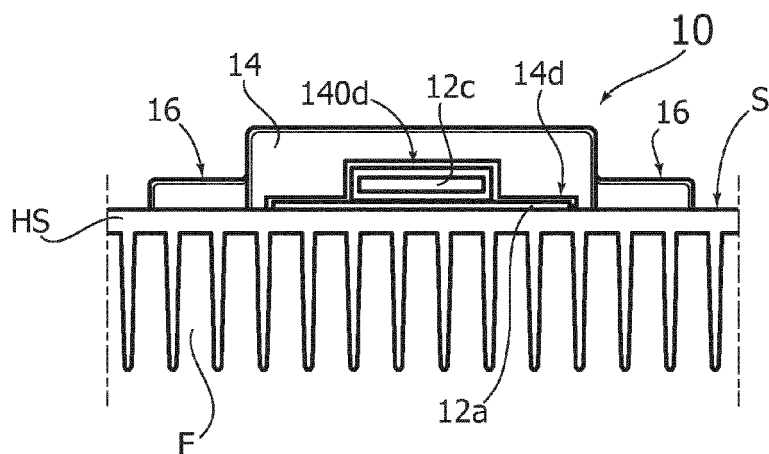


FIG. 4

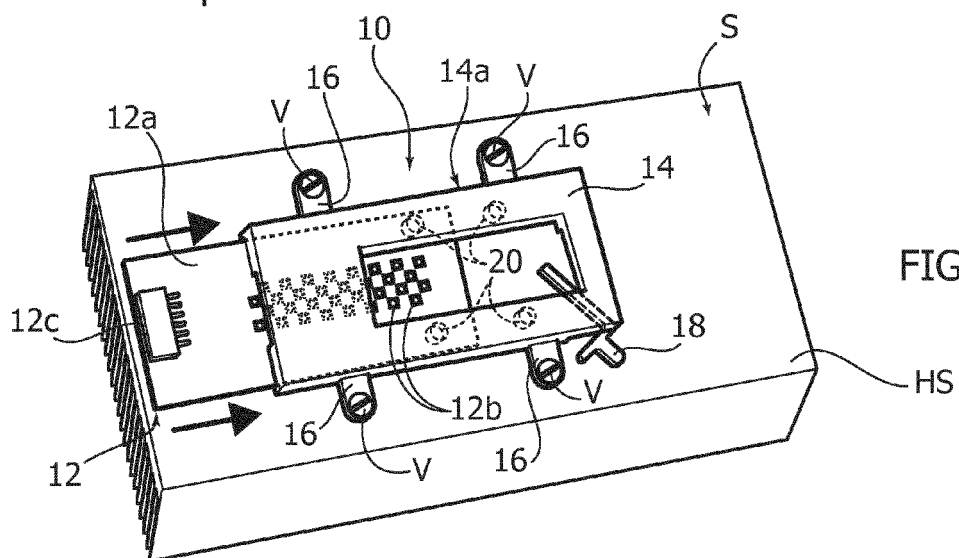


FIG. 5

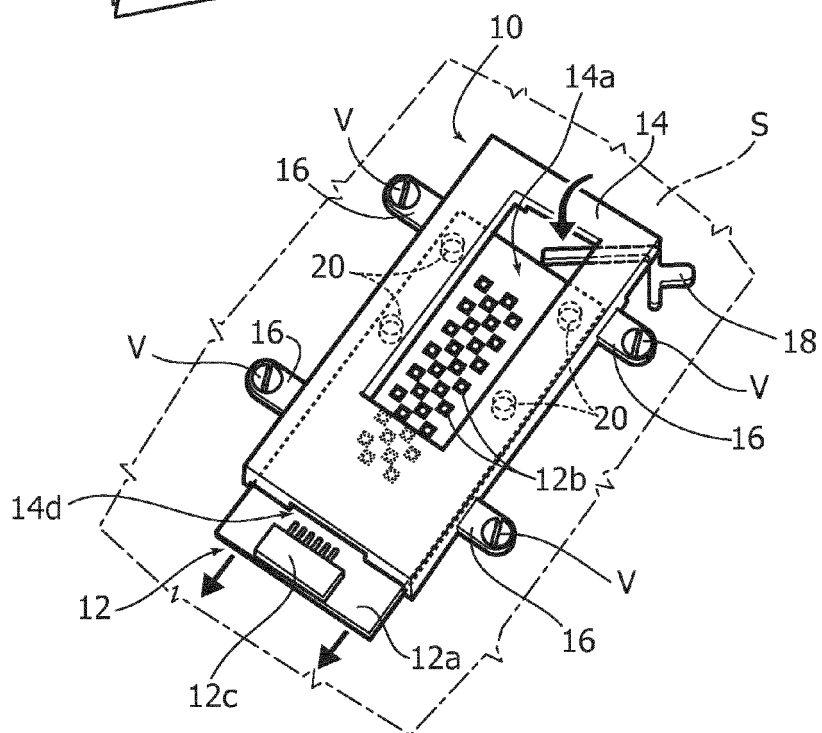


FIG. 6



EUROPEAN SEARCH REPORT

Application Number
EP 13 18 7891

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	US 2011/176308 A1 (WU HSIANG-CHEN [TW] ET AL) 21 July 2011 (2011-07-21) * paragraphs [0030], [0031]; figures 3A-4B *	1,2,4-8	INV. F21K99/00 F21V19/00
X	US 2006/141851 A1 (MATSUI NOBUYUKI [JP] ET AL) 29 June 2006 (2006-06-29) * the whole document *	1,2,4-8	ADD. F21Y105/00
X	US 2010/025721 A1 (SAKAI TAKAAKI [JP] ET AL) 4 February 2010 (2010-02-04) * figures 4-11 *	1,2,5-8	
			TECHNICAL FIELDS SEARCHED (IPC)
			F21K F21V F21Y
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 November 2013	Examiner Chaloupy, Marc
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 18 7891

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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28-11-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011176308 A1	21-07-2011	TW 201126102 A US 2011176308 A1	01-08-2011 21-07-2011
US 2006141851 A1	29-06-2006	AT 474443 T EP 1590996 A1 TW I318461 B US 2006141851 A1 WO 2004071143 A1	15-07-2010 02-11-2005 11-12-2009 29-06-2006 19-08-2004
US 2010025721 A1	04-02-2010	JP 5232555 B2 JP 2010027955 A US 2010025721 A1	10-07-2013 04-02-2010 04-02-2010