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[Continued on next page]

(54) Title: A MOUNTING ARRANGEMENT FOR LIGHT SOURCES AND CORRESPONDING METHOD

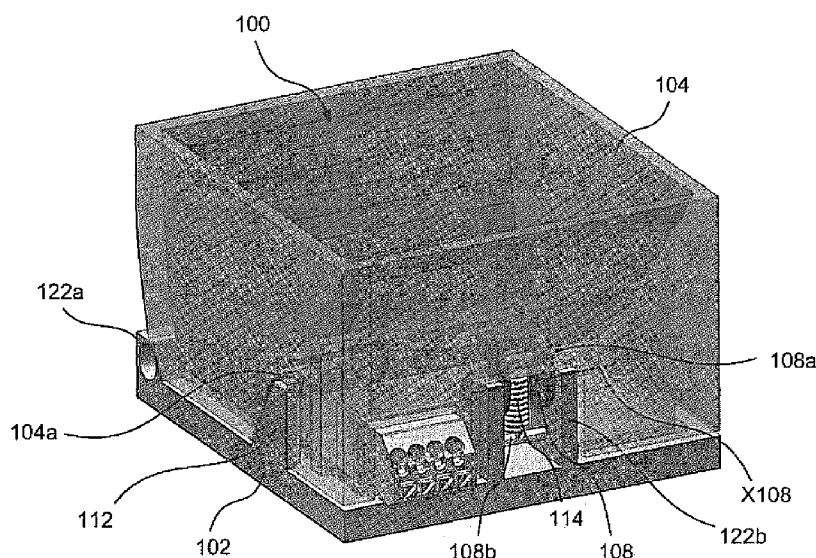


Fig. 1

(57) Abstract: A mounting arrangement (100) for light sources such as LEDs (106), includes a base, plate (102) for fixing to a mounting surface, and a lamp (104) carrying one or more light sources (106). The base plate (102) and the lamp (104) carry complementary formations (108, 110) for releasably coupling the lamp (104) to the base plate (102). These complementary formations (108, 110) include a tooth (110) and a spring (114) loaded hook (108) rotatable between a closed position wherein the hook (108) engages the tooth (110) and the lamp (104) is secured against the base plate (102) and an open position wherein the hook (108) disengages the tooth (110) and the lamp (104) is released from the base plate (102).





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DESCRIPTION of the industrial invention entitled:

"A mounting arrangement for light sources and corresponding method"

in the name of: OSRAM Gesellschaft mit beschränkter Haftung, German nationality, Hellabrunner Str. 1 - 81543 München, Germany;

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TEXT OF THE DESCRIPTION

Field of the invention

This disclosure relates to mounting arrangements for light sources.

This disclosure was devised with specific attention paid to its possible application to mounting arrangements for arrays of high power LED modules for use e.g. in street lighting systems.

Description of the related art

In conventional arrangements, coupling of the light engine (i.e. the "lamp") of a lighting appliance to an associated support structure or base is obtained via screws or other standard fixing items. An intrinsic drawback of these solutions lies in that they make it almost inevitable to use fixing devices and tools, while the placement/displacement of the light modules may turn out to be an uncomfortable and difficult operation.

The related art includes, under the provisions of Art. 54.3 EPC, EP applications 08168026 and 08168028, filed in the name of the same Applicants.

Object and summary of the invention

The object of the invention is to provide a mechanical coupling system which allows to insert/extract easily a general application light-engine (e.g. a streetlight application) into/from a fixed base structure, by avoiding the need for additional fixing devices or assembly phases, while guaranteeing an adequate pressure between the two parts when they are connected

According to the present invention, such an object is achieved by means of an arrangement having the features set forth in the claims that follow.

The invention also relates to a corresponding method.

The claims are an integral part of the disclosure of the invention provided herein.

An embodiment of the arrangement described herein includes a base plate adapted to be fixed to an external structure (e.g. a metal base plate to provide good heat dissipation toward the structure) as well as a light engine, namely a structure integrating a light source (possibly including the associated electronic components) and the optical system (e.g. a reflector+lenses).

In an embodiment, such a structure is provided with a primary snap-in/flexural spring system to hold a Printed Circuit Board (PCB), such as a metal core PCB) carrying one or more light sources.

In an embodiment, a hook device is provided for coupling the light-engine and the base plate. In an embodiment, the hook device is a rotatably mounted hook guided by a fix pin and a spring/elastic component.

Embodiments of the arrangement described herein provide a stable and smart mounting structure permitting a light engine to be hand-inserted in the related base plate without using any coupling devices or tools, while also avoiding additional operational phases such as e.g. screwing.

Embodiments of the arrangement described herein provide a stable mounting structure integrating optical and electronic functions which is easy and practical to assemble and disassemble, thus permitting i.a. a simple and fast coupling process, easy replacement and "smart" handling of a light engine.

Additional advantages related to the arrangement described herein include compactness, the possible availability a multifunctional fixing structure, simpler manufacturing and quality assurance.

Brief description of the annexed views

The invention will now be described, by way of example only, with reference to the enclosed views, wherein:

- Figure 1 is a general perspective view of an arrangement as described herein;
- Figures 2 to 6 are representative of a sequence of steps in assembling/disassembling an arrangement as described herein; and
- Figure 7 is a partly broken view showing certain details of the arrangement described herein.

Detailed description of embodiments

In the following description, numerous specific details are given to provide a thorough understanding of embodiments. The embodiments can be practiced without one or more of the specific details, or with other methods, components, materials, etc. In other instances, well-known

structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the embodiments.

Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

The headings provided herein are for convenience only and do not interpret the scope or meaning of the embodiments.

The embodiment illustrated in the figures is a fixing structure 100 for a LED lighting module for use e.g. in a street lighting system. The structure is thus adapted for mounting e.g. at the head of a pole without re-cabling or screwing.

In the embodiment illustrated herein, the structure 100 includes:

- a thermally conductive (i.e. heat dissipative) base plate 102 adapted to be mounted e.g. at the head of a pole in a street lighting system, and
- a (replaceable) LED lamp 104.

The lamp 104 may include one or more LED lighting sources 106 such as high-power LED lighting sources, the LED lighting sources 106 being carried by a Printed Circuit Board or PCB 116. In an embodiment, the lamp 104 includes an array of three LED sources 106.

In the embodiment illustrated, the lamp 104 includes a vat-shaped body with a bottom portion where the LED sources 106 are arranged with respective lenses associated therewith. Further details of the mounting arrangement of the LED sources and the lenses can be found in the two earlier EP applications by the same applicants already cited in the introductory portion of this description.

As illustrated, the heat dissipative (e.g. metal) base plate 102 is in the form of a shaped body adapted to be fixed to a support surface (as provided e.g. at the head of a pole). Fixing may be via screws or by any other means.

In the embodiment illustrated, the structure or module 100 is thus comprised of two elements, namely:

- the base plate 102, to be fixed (or possibly incorporated) to an external support structure, and
- the lamp 104, removably coupled to the base plate 102 as better detailed in the following.

In an embodiment, the base plate 102 is a metal base plate adapted to act as a heat sink to convey heat from the light sources 106 towards the external support structure that carries the base plate 102.

In the embodiment illustrated, the base plate 102 has an approximate channel-like shape overall, including a flat web portion to lie against the mounting support surface, and two side portions or formations 122a and 122b extending upwardly from the web portion so that the lamp 104 can be inserted therebetween.

In the embodiment illustrated, angled guides 112 are also provided extending upwardly from the base plate to contain laterally the lamp 104.

Complementary mechanical coupling formations giving rise to a hinge-like coupling between the base plate 102

and the lamp 104 can be possibly provided as described in EP applications 08168026 and 08168028 (already cited). Similarly, complementary electrical coupling formations providing electrical connection for the light sources 106 simultaneously with mechanical connection of the lamp 104 to the base plate 102 can be provide as describe in a parallel EP application filed on even date by the same Applicants.

In the embodiment illustrated, the lamp is urged and secured against the base plate by means of a hook 108 carried by the base plate 102 and adapted to engage a complementary tooth formation 110 formed in the body of the lamp 104. Alternatively, the hook 108 could be carried by the body of the lamp 104 with the complementary tooth formation 110 formed in the base plate 102.

In either case the hook 108 is a rotary hook adapted to rotate about an axis X108. In the embodiment illustrated, the formation 122b extending from the base plate 102 is fork-shaped and the hook 108 is rotatably supported in the tongs of the fork-shaped formation 122b.

The hook 108 is elastically biased towards the tooth 110 by a spring 114 acting between a pin 108a fixed distally of the hook 108 (i.e. eccentrically of the axis X108) and a pin 108b whose extremities are supported by the tongs of the fork-shaped formation 122b.

This embodiment of the hook 108, the double central support on the base plate 102 and the complementary tooth 110 in the reflector of the lamp 105 comprises a latch arrangement admitting two (stable) end positions, namely:

- an open (unlatched) position, permitting the lamp 104 to be mounted onto and removed from the base plate 102, and

- a closed (latched) position, where the lamp 104 is secured to and urged against the base plate 102.

The sequence of Figures 2 to 6 shows an entire cycle of the assembling/disassembling of the light module 100, by highlighting the role of the spring 114.

Figure 2 shows the system in its operative configuration, with the hook 108 urged by the spring 114 inwardly of the module 100, that is in the closed position against the tooth 110 and the lamp (light engine) 104 secured to the base plate 102.

The light engine 104 can be removed from the base plate 102 as schematically shown in Figure 3, i.e. by clutching and pulling it away from the base plate 102. As shown, this action is performed in the direction of the angled guides 112 provided on the base plate 102, so that removal of the light engine 104 from the base plate 102 is in fact guided by these guides.

Pulling the light engine 104 away from the base plate 102 causes the hook 108 to rotate about the fixed axis X108 against the force of the spring 114.

As illustrated, the rotary hook 108 is spring loaded by the spring 114 which acts between two points (i.e. the pins 108a, 108b) and is rotatable about a rotation axis X108 located intermediate the two points 108a, 108b. Rotation of the hook 108 about the rotation axis X108 includes a dead centre when said the two points 108a, 108b and the rotation axis X108 are aligned (i.e. lie on a common notional line). On one side of the dead centre the hook 108 is thus urged towards the closed position. On the other side of the dead centre the hook 108 is urged towards the open position.

Specifically, rotation of the hook 108 about the fixed axis X108 produced by moving the light engine 104 away from the base plate 102 is first against the force of the spring 114 urging the hook towards the closed position until the hook 108 reaches the dead centre intermediate position as illustrated in Figure 3. Further rotation of the hook 108 beyond this dead centre away from the tooth 110 is no longer contrasted but rather promoted by the spring 114.

At this point (see Figure 4) the spring 114 in fact pulls the hook 108 outwardly of the module 100, thus causing the hook to completely disengage the tooth 110 in the light engine 104 and tilt towards the open position. The light engine 104 can thus be removed from the base plate 108 by further sliding it along the guides 112 until the light engine is completely released from the base plate 108.

The reverse operation (assembly of the module, e.g. in order to replace a light engine 104 just removed with a new one) starts with coupling both sides of the light engine 104 (complementary cavities 104a as shown in Figure 1 can be provided to facilitate this action) the lateral angled guides 112 in the base plate 102.

Then (see figure 5) the light engine 104 is advanced towards the base plate 102 while the tooth 108 is rotated from the open position back towards the closed position, by reaching again the "dead centre" position considered in the foregoing. This may result either from a positive action by an operator or by the body of the light engine 104 including a "cam-like" cavity 128 adapted to engage the back side of the tooth as the light engine 104 is advanced towards the base plate 102 to cause the tooth 108 to rotate from the open position towards the closed position.

After the hook 108 reaches the "dead centre" equilibrium point, the spring 114 urges again the tooth 108 towards the tooth 110 to re-establish the assembled condition illustrated in Figure 6 (which is essentially identical to Figure 2), where the elastic force of the spring 114 is transmitted via the hook 108 and the tooth 110 to the light engine 104. The PCB 116 carrying the light sources 106 is thus elastically urged towards and against base plate 102, thus ensuring both mechanical and the thermal coupling therebetween. Thermal coupling ensures that heat generated by the light sources 106 flows efficiently away from the light sources 106 through the base plate 102 and on to the external supporting structure.

The elastic force of the spring 114 can be calculated as schematically depicted in Figure 7, where the force generated by the spring F_M imposes a torque M_s on the hook 108. This torque is transmitted through the hook 108 and in the contact point between the hook 108 and the tooth 110, thus generating a force F_H acting on the light engine 104. The "vertical" component of this force urges the PCB 116 against the base plate 102, thus generating a desired pressure force to ensure a good thermal coupling between the metal PCB 116 and the metal base plate 102.

With reference to the symbols reproduced in Figure 7, the following relationships apply:

$$M_s = F_M \cdot a = F_M \cdot \sin(\beta)$$

$$F_H = \frac{M_s}{b} = \frac{F_M \cdot \sin(\beta)}{b} \Rightarrow F_{HY} = F_H \cdot \cos(\gamma) = \frac{F_M \cdot \sin(\beta)}{b} \cdot \cos(\gamma)$$

The spring force to obtain a desired pressure force F_{HY} of the PCB 116 against the base plate 102 can thus be expressed as

$$F_M = \frac{F_{HY} \cdot \sin(\beta)}{b} \cdot \cos(\gamma)$$

Without prejudice to the underlying principles of the invention, the details and the embodiments may vary, even appreciably, with respect to what has been described by way of example only, without departing from the scope of the invention as defined by the annexed claims.

CLAIMS

1. A mounting arrangement (100) for light sources (106), including:

- a base plate (102) for fixing to a mounting surface,
- a lamp (104) carrying at least one light source (106),

- said base plate (102) and said lamp (104) carrying complementary formations (108, 110) for releasably coupling said lamp (104) to said base plate (102), wherein said complementary formations (108, 110) include at least one tooth (110) and at least one spring (114) loaded hook (108) rotatable between a closed position wherein said hook (108) engages said tooth (110) and said lamp (104) is secured against said base plate (102) and an open position wherein said hook (108) disengages said tooth (110) and said lamp (104) is released from said base plate (102).

2. The arrangement of Claim 1, wherein said hook (108) is spring loaded by a spring (114) acting between two points (108a, 108b) and is rotatable about a rotation axis (X108) whereby rotation of said hook (108) about said rotation axis (X108) includes a dead centre when said two points (108a, 108b) and said rotation axis (X108) are aligned and said hook (108) is urged towards said closed position and said open position on either side of said dead centre, respectively.

3. The arrangement of Claim 2, wherein said rotation axis (X108) of said hook (108) is intermediate said two points (108a, 108b).

4. The arrangement of either of Claims 2 or 3, wherein said two points are defined by pins (108a, 108b) cooperating with opposite ends of said spring (114).

5. The arrangement of any of Claims 1 to 4, wherein said hook (108) is rotatably supported by the tongs of a fork-like formation (122b).

6. The arrangement of any of the previous claims, wherein said tooth (110) has an associated cam-like surface (128) to cooperate with said hook (108) as said lamp (104) is advanced towards said base plate (102) to promote rotation of said hook (108) towards said closed position.

7. The arrangement of any of the previous claims, wherein at least one of said lamp (104) and said base plate (102) includes guide formations (112, 104a) to guide movement of said lamp (104) towards and away from said base plate (102).

8. The arrangement of any of the previous claims, wherein said hook (108) and said tooth (110) are carried by said base plate (102) and said lamp (104), respectively.

9. The arrangement of any of the previous claims, wherein:

- said lamp (104) includes a printed circuit board (116) carrying said at least one light source (106) said,
- said printed circuit board (116) is located facing said base plate (102) and is elastically urged against said base plate (102) in a heat transfer relationship when said lamp (104) is secured against said base plate (102) as a result of the spring loading of said spring (114) loaded hook (108).

10. The arrangement of any of the previous claims, wherein said at least one light source (106) is a LED lighting source.

11. A method of mounting light sources (106), including:

- providing a base plate (102) for fixing to a mounting surface, and a lamp (104) carrying at least one light source (106),

- providing said base plate (102) and said lamp (104) with complementary formations (108, 110) for releasably coupling said lamp (104) to said base plate (102), wherein said complementary formations (108, 110) include at least one tooth (110) and at least one spring (114) loaded hook (108) rotatable between a closed position wherein said hook (108) engages said tooth (110) and said lamp (104) is secured against said base plate (102) and an open position wherein said hook (108) disengages said tooth (110) and said lamp (104) is released from said base plate (102).

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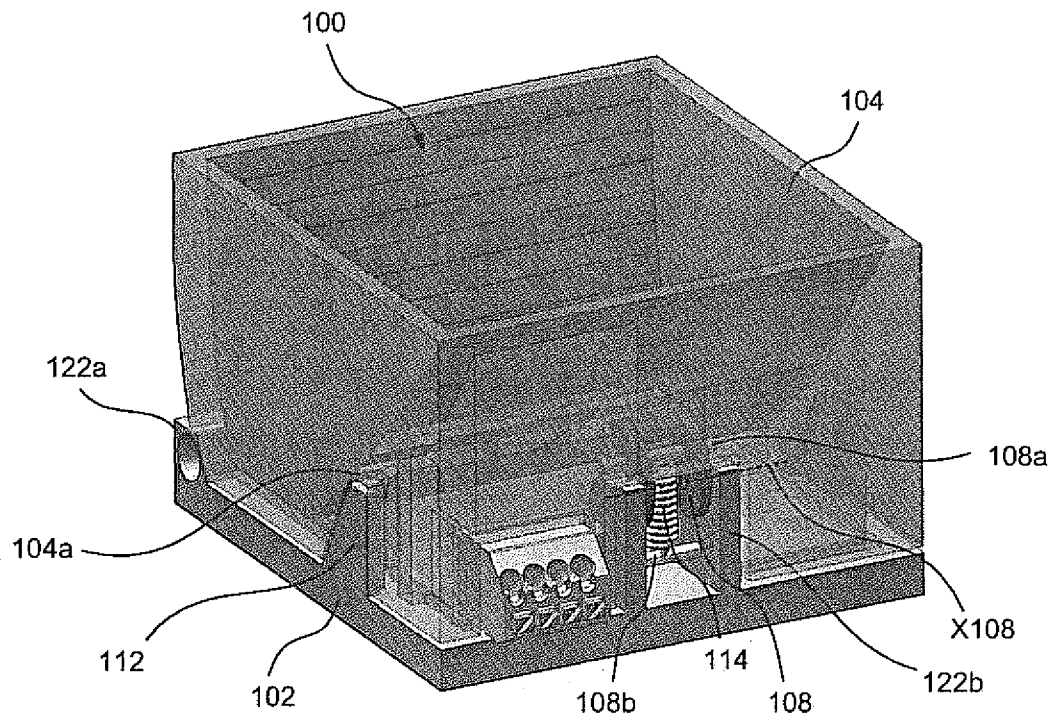


Fig. 1

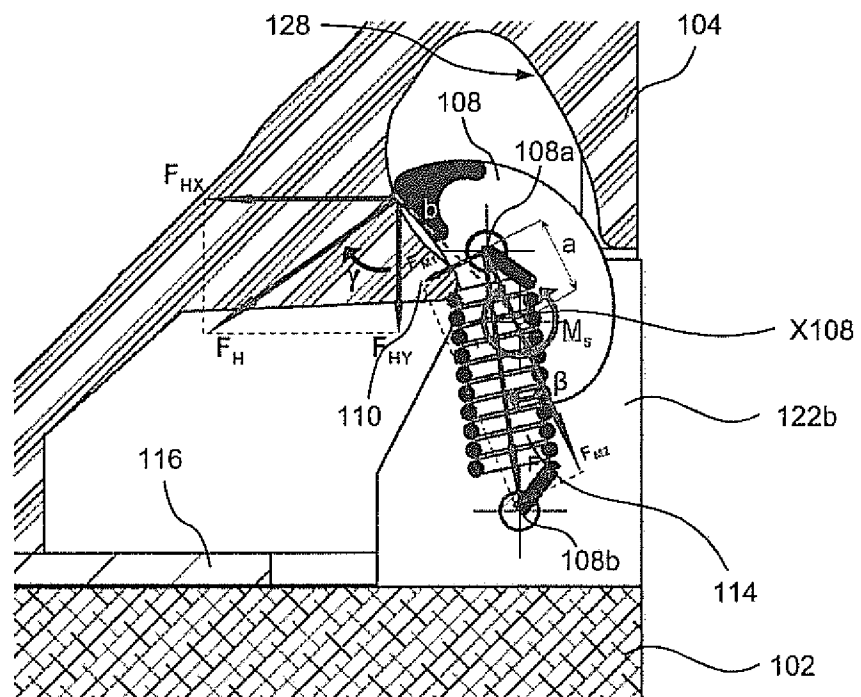


Fig. 7

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Fig. 2

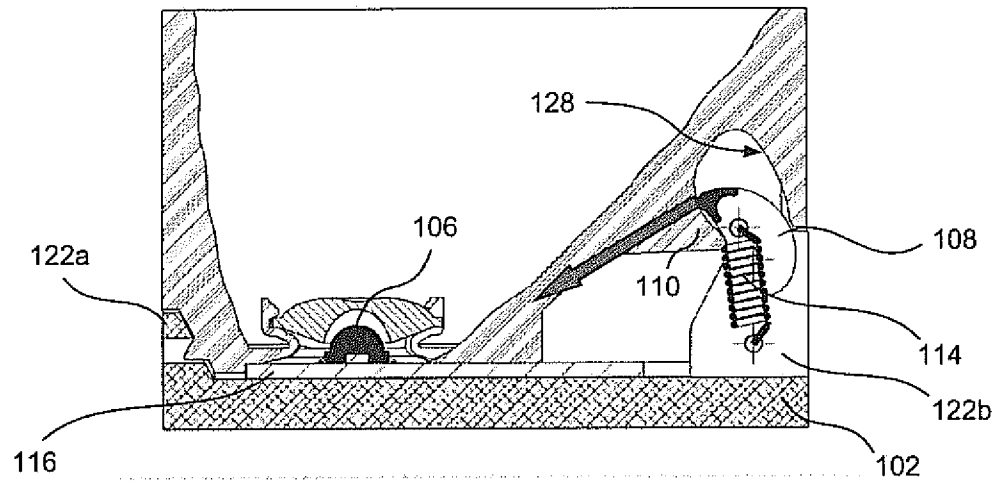


Fig. 3

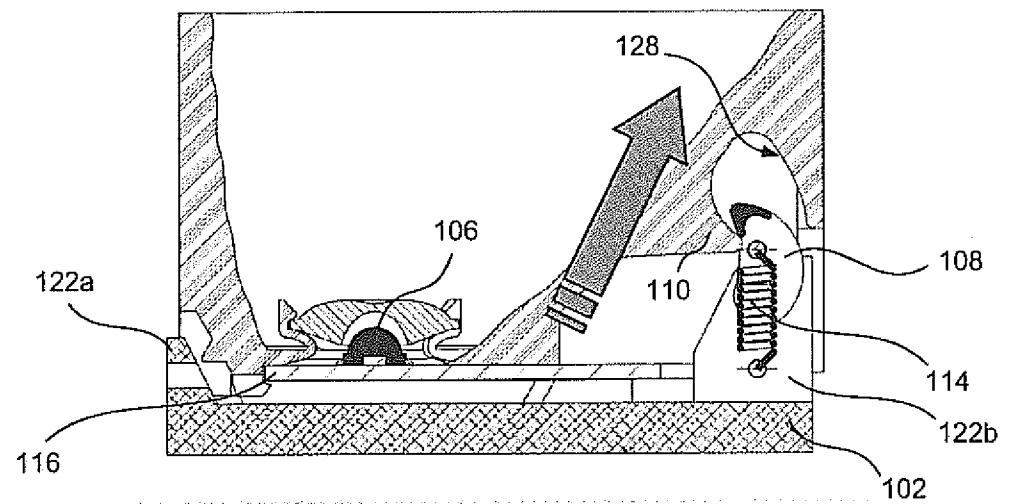


Fig. 4

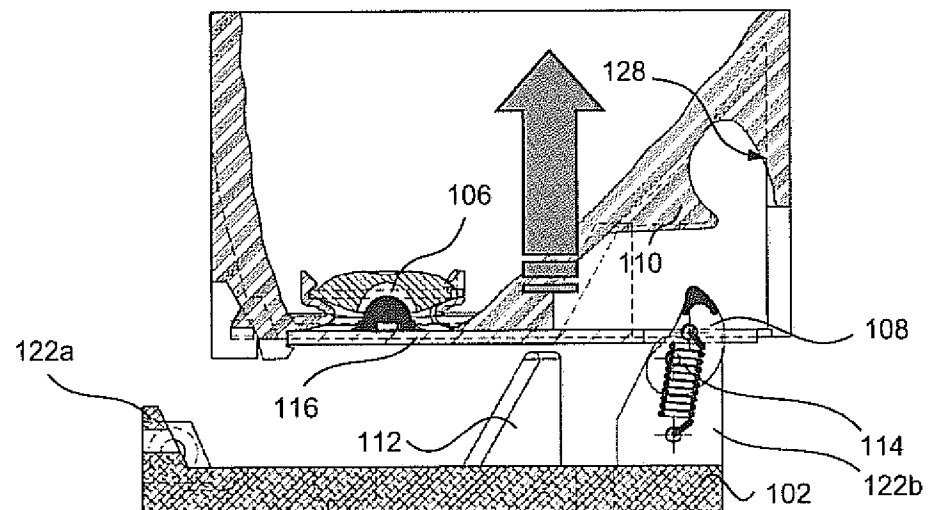


Fig. 5

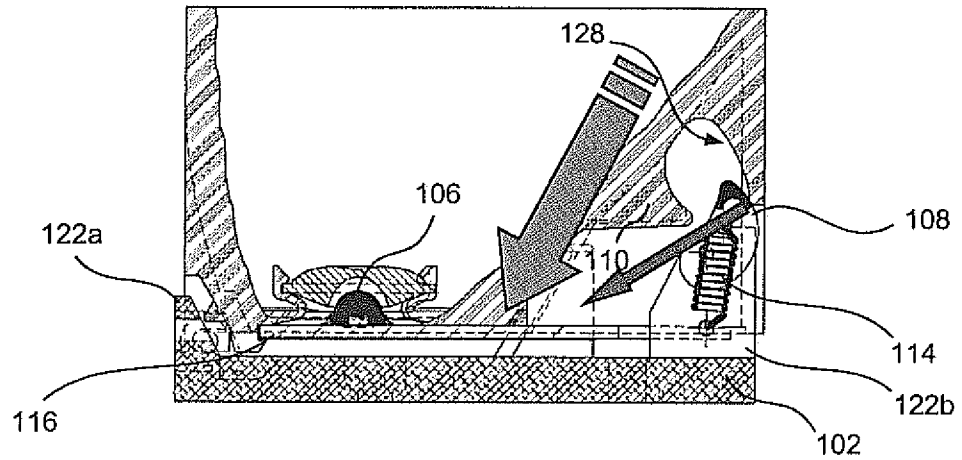
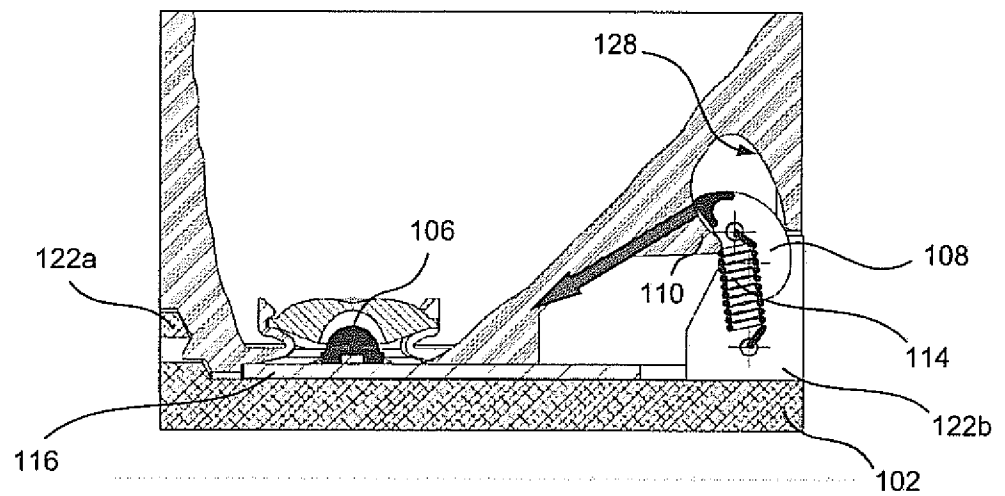


Fig. 6



INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2009/064397

A. CLASSIFICATION OF SUBJECT MATTER

INV. F21V19/00 F21V21/08

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F21V

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 1 272 633 A (M. ROBERT, YVES, GABRIEL BONNET) 29 September 1961 (1961-09-29)	1-4,6, 10-11
Y	page 1, paragraphs 8,9,11	9
X	EP 0 754 906 A2 (ENGEL HARTMUT S [DE]) 22 January 1997 (1997-01-22) column 3, line 38 - line 58 column 4, line 7 - line 11 figure 1	1-4,7, 10-11
Y	EP 1 724 516 A1 (IVELA S P A [IT]) 22 November 2006 (2006-11-22)	9
A	paragraph [0016] figure 2	1
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "O" document referring to an oral disclosure, use, exhibition or other means
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Date of the actual completion of the international search

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01/03/2010

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2009/064397

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 16 75 722 U (WILHELM LENZE K G [DE]) 29 April 1954 (1954-04-29) page 1, paragraph 2 page 3, paragraph 1 figures 1-4 -----	1-4,8, 10-11
A	DE 14 89 419 A1 (NIKOLL RUPERT) 14 May 1969 (1969-05-14) page 4, paragraph 2 - page 5, paragraph 1 page 6, paragraph 1 figures 1-7 -----	1-4,6,8, 10-11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2009/064397

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