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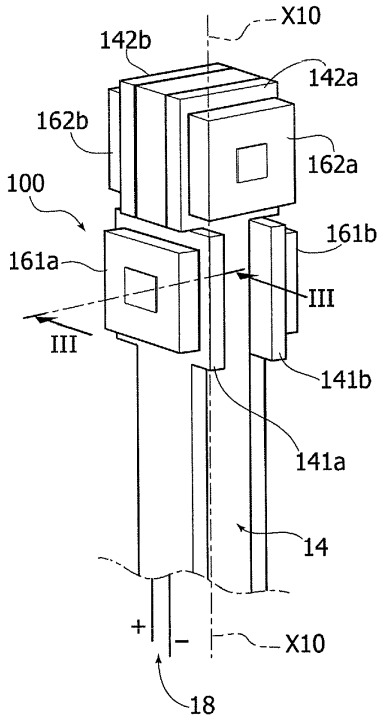
(54) A SUPPORT MEMBER FOR LIGHTING DEVICES, CORRESPONDING DEVICE AND METHOD

(57) A support member for lighting devices (10) comprising a thermally-conductive elongated body (100) extending in a longitudinal direction (X10) with several pairs (141a, 141b; 142a, 142b) of heat exchange surfaces for mounting light sources (161a, 161b; 162a, 162b) provided on the elongated body (100), with the surfaces of each pair (141a, 141b; 142a, 142b) being mutually opposed transversely with respect to the longitudinal direction (X10). The pairs of mounting surfaces (141a, 141b; 142a, 142b) are staggered from each other along the longitudinal direction (X10) of the body (10).

FIG. 2



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Description

Technical field

[0001] The description refers to lighting devices.

[0002] One or more embodiments may refer to lighting devices using electrically-powered light radiation sources, for example solid-state light radiation sources such as LED sources.

Technological background

[0003] In the production of lighting devices using electrically-powered light radiation sources, an important aspect is represented by the dissipation of the heat produced by the sources during operation.

[0004] This aspect assumes greater importance with the increasingly widespread use of lighting devices using solid-state radiation sources (e.g. LEDs) with a high emission level.

[0005] A solution currently in use envisages mounting the light radiation source(s) on a support board substantially similar to a Printed Circuit Board (PCB), with the heat transmitted coming from said board towards a heat-sink.

[0006] A reduced contact area between the board and the heat-sink can, therefore, result in an unsatisfactory level of heat dissipation.

Object and summary

[0007] One or more embodiments aim to contribute to the production of lighting devices in which the dissipation of the heat produced by the light radiation sources during operation is facilitated.

[0008] According to one or more embodiments, this object can be achieved thanks to a support member for lighting devices having the characteristics referred to in the following claims.

[0009] One or more embodiments may concern a corresponding device as well as a corresponding method.

[0010] The claims form an integral part of the technical disclosure provided here in relation to one or more embodiments.

Brief description of the figures

[0011] One or more embodiments will be now described, purely by way of non-limiting example, with reference to the attached figures, wherein:

- Figure 1 is a partially cross-sectioned perspective view of a lighting device, observed from a first observation point,
- Figure 2 is a perspective view, reproduced on a magnified scale, of the portion of the device of Figure 1 indicated by the arrow II, observed from a second observation point, and
- Figure 3 is a cross-sectional view approximately corresponding to a cross-section along the line III-III of Figure 2, reproduced on a further magnified scale.

[0012] It will be appreciated that, for greater clarity of illustration, the views in the various figures may not be reproduced on the same scale.

Detailed description

[0013] The following description illustrates various specific details in order to provide a thorough understanding of various examples of embodiments according to the description. The embodiments can be obtained 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 illustrated or described in detail so that the various aspects of the embodiments are not rendered unclear. The reference to "an embodiment" in the context of the present description indicates that a particular configuration, structure or characteristic described in relation to the embodiment is included in at least one embodiment. Thus, sentences such as "in an embodiment", which may be present at various points in the present description, do not necessarily refer to exactly the same embodiment. Moreover, particular configurations, structures or characteristics can be combined in any convenient way in one or more embodiments.

[0014] The references used here are provided simply for convenience and therefore do not define the field of protection or scope of the embodiments.

[0015] In Figure 1, the reference 10 indicates - as a whole - a lighting device that can use electrically-powered light radiation sources.

[0016] In one or more embodiments, it is possible to use solid state light radiation sources, such as, for example, LED sources.

[0017] The lighting device 10 exemplified in Figure 1 is substantially similar to an HB4-type "bulb" usable, for example, in the automotive sector.

[0018] This reference is purely exemplary and should not in any way be understood, even indirectly, in a limiting sense of the embodiments. One or more embodiments can, in fact, also be used in lighting devices of a different type.

[0019] Again by way of exemplary reference, within the device 10, a casing 12 can be identified, shaped (according to the application and use requirements, for example, according to the assembly requirements) and capable of comprising heat conductive material, such as a thermally-conductive plastic material or a light metal material.

[0020] The casing 12 can be made in such a way as to have heat-sink characteristics. For example, the casing 12 can be provided with a tabbed portion, indicated by 120, which can be exposed to an aeriform ventilation flow, which is spontaneous or possibly forced (for example, due to the presence of a fan).

[0021] Figure 1 presents the casing 12 of the device 10 cross-sectioned in an approximately median plane so as to highlight the presence of a support member body 100 that extends along a longitudinal axis X10 on which electrically-powered light radiation sources are mounted.

[0022] In the embodiment example (and according to an optional, non-imperative solution), the body 100 comprises an end portion (distal), protruding from the casing 12, of an elongated structure 14, at least roughly similar to a sort of bar or rod inserted into the casing 12.

[0023] In one or more embodiments, the light radiation sources that can be mounted on the body 100 may comprise solid-state light radiation sources, such as, for example, LED sources. These light radiation sources (hereinafter, for brevity, referred to as LED sources) are indicated with pairs of numerical references 161a, 161b; 162a, 162b, etc. so as to highlight the possible arrangement in pairs of mutually opposed sources in a transverse direction with respect to the axis X10, with the pairs arranged in a staggered manner, along the direction identified by the axis X10, both in the longitudinal direction and in the angular direction, according to a solution roughly comparable to that of road signs mounted on a pole.

[0024] As seen in the magnified scale view of Figure 2, the body 100 (here exemplified as constituting the distal end portion of the structure 14) may have respective mounting surfaces for the light radiation sources 161a, 161b; 162a, 162b, etc. with these surfaces defined by pairs of enlarged portions e.g. 141, 141b; 142a, 142b, etc. also being mutually opposed in a direction transverse to the axis X10, with the pairs arranged in a staggered manner along the direction identified by the axis X10.

[0025] In one or more embodiments, the enlarged portions corresponding to the surfaces 141, 141b; 142a, 142b, etc. may comprise support boards or plates comparable to printed circuit boards (PCB) which, in addition to allowing the assembly and electrical connection of the light radiation sources 161a, 161b; 162a, 162b, are capable of defining heat exchange surfaces between the light radiation sources mounted thereon and the support member body 100 (and, therefore, the structure 14 of which, in the example considered here, has the body 100 as the distal end).

[0026] In one or more embodiments, one of the boards, for example, that indicated by 141a, can act as a "master" board, which is connected to the electric power supply lines (possibly control lines) of the sources 161a, 161b, 162a, 162b, indicated as a whole by 18 in Figure 2. All this while the other boards, for example, those indicated with 141b, 142a and 142b are capable of acting as "slave" boards, able to receive the electric power supply signals (and possibly control signals) by means of additional electrically-conductive formations, not visible in the figures.

[0027] As can be appreciated in Figure 2, boards such as 141a and 14ab may comprise, in addition to the portion (e.g., enlarged) for mounting a respective light radiation source, a portion that extends on the body 100 (structure 14) so as to be able to increase the heat exchange surface.

[0028] One or more embodiments allow the overall dimensions of the lighting device 10 to be maintained (capable of being subject to regulations, such as, for example, ECE/SAE standards), improving the characteristics of heat exchange and, therefore, dissipation of the heat generated by the light radiation sources during operation.

[0029] For example, maintaining the overall dimensions of a lighting device such as an HB4 bulb, it is possible to produce (at the boards 141a, 141b, 142a, 142b) heat exchange surfaces in the order of 50 mm^2.

[0030] In one or more embodiments, the heat dissipation characteristics can be improved by using the solution exemplified in Figure 3.

[0031] Figure 3 illustrates one of the light radiation sources (by way of example, the one indicated by 161a, mounted on the board 141a), which can be provided, in a manner known per se, with a thermal areola or pad 1610.

[0032] In one or more embodiments, the pad 1610 can be placed in a heat exchange relationship with the body 100 (structure 14) using a so-called thermally-conductive "path" 1410 (in practice a bar of electrically conductive material) provided (also here in a manner known per se) in such a way as to extend across the board 141a.

[0033] In one or more embodiments, the heat exchange path between the pad 1610 and the body 100 (structure 14) may comprise, in addition to the path 1410, thermally-conductive masses 1410a, 1410b interposed respectively:

- between the pad 1610 and the path 1410, on the side of the board 141a facing the light radiation source 161a, and
- between the path 1410 and the body 100 (structure 14), on the side of the board 141a opposite the light radiation source 161a.

[0034] In one or more embodiments the thermally-conductive masses 1410a, 1410b may comprise e.g. layers (in practice "drops") of welding material, for example, thermally-conductive welding paste.

[0035] One or more embodiments as exemplified herein envisage the presence of two pairs of heat exchange surfaces, namely the boards 141a, 141b and the boards 142a, 142b, on which two respective pairs of light radiation sources are mounted, i.e. LEDs 161a, 161b and LEDs 162a, 162b.

[0036] All with:

- the boards 141a, 141b and the opposite sources 161a, 161b in a first direction transverse (perpendicular) to the X10 direction,
- the boards 142a, 142b and the opposite sources 162a, 162b in a second direction transverse (perpendicular) to the X10 direction, and

- the aforesaid first and second transverse directions are, in turn, perpendicular to each other, i.e. angularly offset from each other by 90°.

[0037] One or more embodiments may envisage a greater number of pairs of heat exchange surfaces/light radiation sources, for example, three or more pairs of heat exchange surfaces and a corresponding number of light radiation sources.

[0038] In this regard, it should be noted that one or more embodiments as exemplified herein enable (without negatively affecting the overall dimensions of the lighting device 10) the provision of a lighting device with good optical characteristics, e.g. at the intensity/uniformity level of the distribution of the light radiation emitted by the sources 161a, 161b; 162a, 162b in a radial direction starting from the axis X10.

[0039] This effect can be further developed, preserving the assembly modes exemplified here and the heat dissipation characteristics associated therewith, by increasing the number of light radiation source pairs.

[0040] To cite two possible examples, instead of using (as in the examples illustrated here) two pairs of sources/opposite surfaces according to a first and a second direction transverse to the axis X10 and perpendicular (thus mutually crossing, offset from each other by 90°), it is possible to use three pairs of sources/opposite surfaces according to three directions transverse to the axis X10 and mutually crossing, offset from each other by 60°, or four pairs of sources/opposite surfaces according to four directions transverse to the axis X10 and mutually crossing, offset from each other by 45°, e.g. with the light radiation sources 161a, 161b; 162a, 162b, etc. arranged along ideal helical trajectories in line with the axis X10.

[0041] It will be appreciated that the term "crossing" here refers to the directions and takes into account the fact that the various pairs of surfaces (141a, 141b; 142a, 142b, etc.) and sources (161a, 161b; 162a, 162b, etc.) can be distributed along the body 100 so as to be offset from each other both longitudinally and angularly with respect to the axis X10.

[0042] In one or more embodiments, a support member for lighting devices (e.g., 10) may comprise an elongated thermally-conductive body (e.g., 100) extending in a longitudinal direction (e.g., X10) with a plurality of pairs (e.g., 141a, 141b; 142a, 142b) of heat exchange surfaces for mounting light radiation sources (e.g., 161a, 161b; 162a, 162b), sources that may not be part of the embodiment per se), with the surfaces of each pair being mutually opposed transversely with respect to the longitudinal direction of the elongated body and the pairs of the plurality of pairs being offset from each other in the longitudinal direction of the elongated body.

[0043] One or more embodiments may comprise (at least two) pairs of heat exchange surfaces mutually opposed along a first direction and a second direction, respectively, the first direction and the second direction mutually crossing and transverse to the longitudinal direction of the elongated body. In other words, in one or more embodiments, the pairs of the plurality of pairs (for example, 141a, 141b; 142a, 142b) can be angularly offset from each other (for example by 90°, so as to be perpendicular to each other).

[0044] In one or more embodiments, the heat exchange surfaces may comprise enlarged portions of the elongated body (e.g., in the form of boards applied thereto).

[0045] One or more embodiments may comprise respective mounting boards of light radiation sources at the heat exchange surfaces.

[0046] One or more embodiments may comprise a bar-like formation (e.g., 14) of thermally-conductive material having the elongated body as an end portion.

[0047] One or more embodiments may comprise a heat-dissipative casing (e.g., 12) (see for example the tabbing 120) with the bar-like formation inserted into the casing with the elongated body carrying the plurality of pairs of heat exchange surfaces protruding from the casing.

[0048] In one or more embodiments, a lighting device (10) may comprise:

- a support member according to one or more embodiments, and
- a plurality of pairs of electrically-powered light radiation sources (e.g. 161a, 161b; 162a, 162b) arranged at the plurality of pairs of heat exchange surfaces.

[0049] In one or more embodiments, the light radiation sources can be configured to project light radiation radially away from the longitudinal direction of the elongated body.

[0050] In one or more embodiments:

- the light radiation sources may include thermal pads (e.g. 1610) facing towards the respective mounting boards (141a, 141b; 142a, 142b), and
- the mounting boards may include electrically-conductive formations (e.g. 1410) extending therethrough, the thermally-conductive formations being thermally coupled (e.g. 1410a, 1410b) with the thermal pads and the elongated body.

[0051] In one or more embodiments, the light radiation sources may comprise LED sources.

[0052] In one or more embodiments, a method for producing lighting devices may comprise:

- providing a support member according to one or more embodiments, and
- mounting electrically-powered light radiation sources, optionally of the LED-type, at the heat exchange surfaces of the support member.

[0053] Without prejudice to the underlying principles

of the invention, the details of construction and the embodiments may vary, even significantly, with respect to those illustrated here, purely by way of non-limiting example, without departing from the scope of the invention.

[0054] This extent of protection is determined by the attached claims.

LIST OF REFERENCE SIGNS

Lighting device	10
Casing	12
Bar-like formation	14
Heat exchange surfaces	141a, 141b; 142a, 142b
Thermal coupling	1410a, 1410b
Light radiation sources	161a, 161b; 162a, 162b
Thermal pads	1610
Power supply lines	18
Elongated body	100
Heat-sink	120
Longitudinal direction	X10

Claims

1. A support member for lighting devices (10) including a thermally-conductive elongated body (100) extending along a longitudinal direction (X10) with a plurality of pairs (141a, 141b; 142a, 142b) of heat exchange surfaces for mounting light radiation sources (161a, 161b; 162a, 162b), the surfaces in each pair (141a, 141b; 142a, 142b) being mutually opposed transversally relative to the longitudinal direction (X10) of the elongated body (100), with the pairs in the plurality of pairs (141a, 141b; 142a, 142b) staggered in the longitudinal direction (X10) of the elongated body (100).

2. The support member of claim 1, including pairs (141a, 141b; 142a, 142b) of heat exchange surfaces mutually opposed along a first direction and a second direction, respectively, the first direction and the second direction mutually crossing and transverse to the longitudinal direction (X10) of the elongated body (100) .

3. The support member of claim 1 or claim 2, wherein the heat exchange surfaces (141a, 141b; 142a, 142b) include enlarged portions of the elongated body (100) .

4. The support member of any of the previous claims, including respective light radiation source mounting boards (141a, 141b; 142a, 142b) at the heat exchange surfaces.

5. The support member of any of the previous claims, including a bar-like formation (14) of thermally-conductive material having the elongated body (100) as an end portion.

6. The support member of claim 5, including a heat-dissipative (120) casing (12) with the bar-like formation (14) inserted into the casing (12) with the elongated body (100) carrying the plurality of pairs (141a, 141b; 142a, 142b) of heat exchange surfaces protruding from the casing (12).

7. A lighting device, including:

   - a support member according to any one of claims 1 to 6, and
   - a plurality of pairs of electrically-powered light radiation sources (161a, 161b; 162a, 162b) arranged at the plurality of pairs (141a, 141b; 142a, 142b) of heat exchange surfaces.

8. The lighting device (10) of claim 7, wherein the light radiation sources (161a, 161b; 162a, 162b) are configured for projecting light radiation radially away from the longitudinal direction (X10) of the elongated body (100).

9. The lighting device (10) of claim 7 or claim 8, including a support member according to claim 4, wherein:

   - the light radiation sources (161a, 161b; 162a, 162b) include thermal pads (1610) facing towards the respective mounting boards (141a, 141b; 142a, 142b), and
   - the mounting boards (141a, 141b; 142a, 142b) include electrically-conductive formations (1410) extending therethrough, the thermally-conductive formations (1410) being thermally coupled (1410a, 1410b) with the thermal pads (1610) and the elongated body (100).

10. The lighting device (10) of any of claims 7 to 9, wherein the light radiation sources include LED sources (161a, 161b; 162a, 162b).

11. A method of providing lighting devices (10) including:

    - providing a support member according to any of claims 1 to 6, and
    - mounting electrically-powered light radiation sources (161a, 161b; 162a, 162b), preferably of the LED-type, at the heat exchange surfaces (141a, 141b; 142a, 142b) of the support member.

FIG. 1

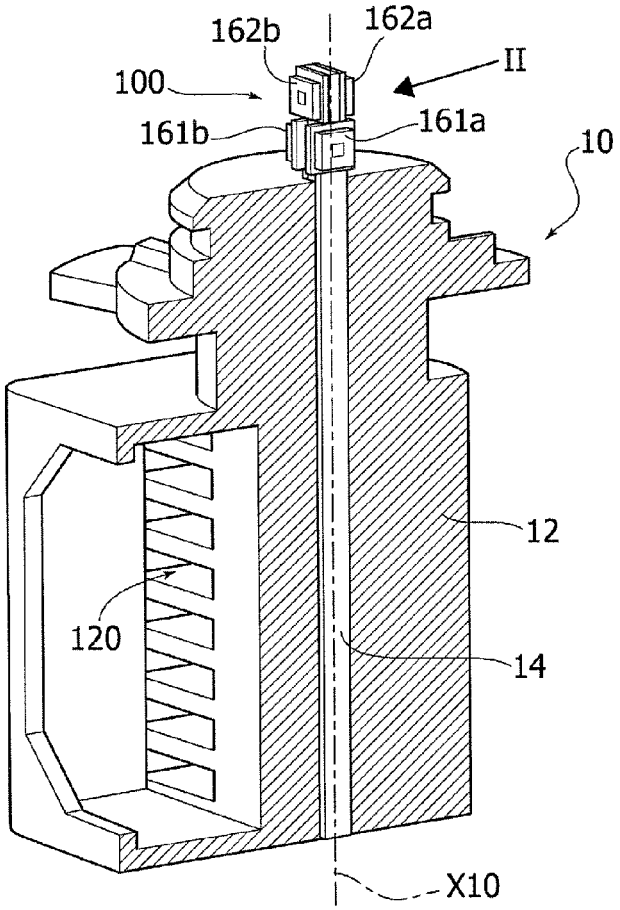
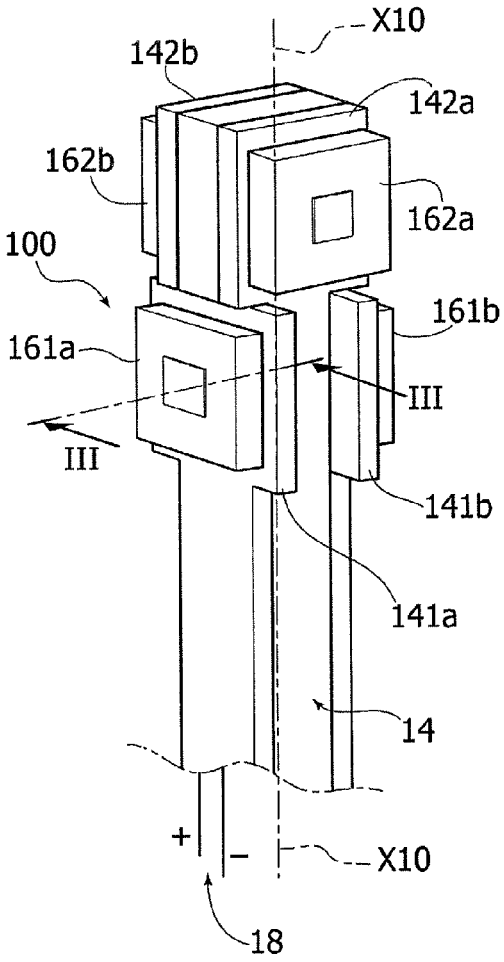


FIG. 2



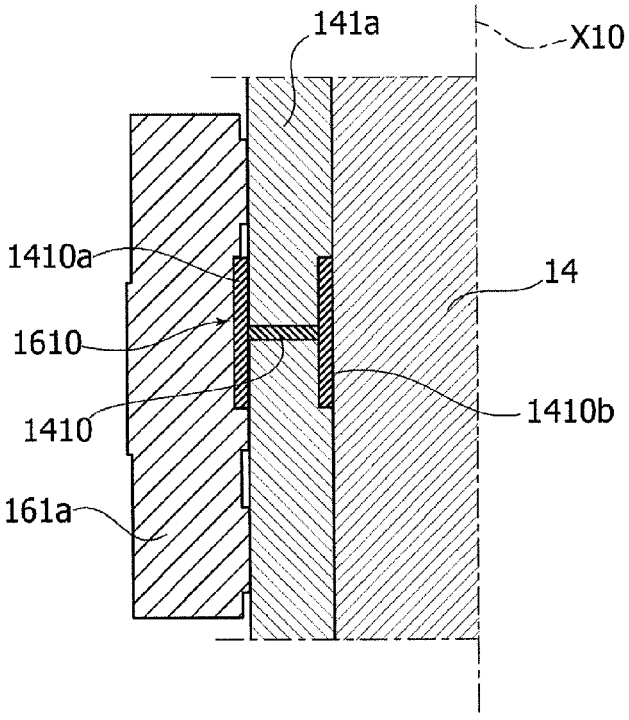


FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
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F21V
F21K
F21Y
F21S

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 September 2018	Vida, Gyorgy

CATEGORY OF CITED DOCUMENTS

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