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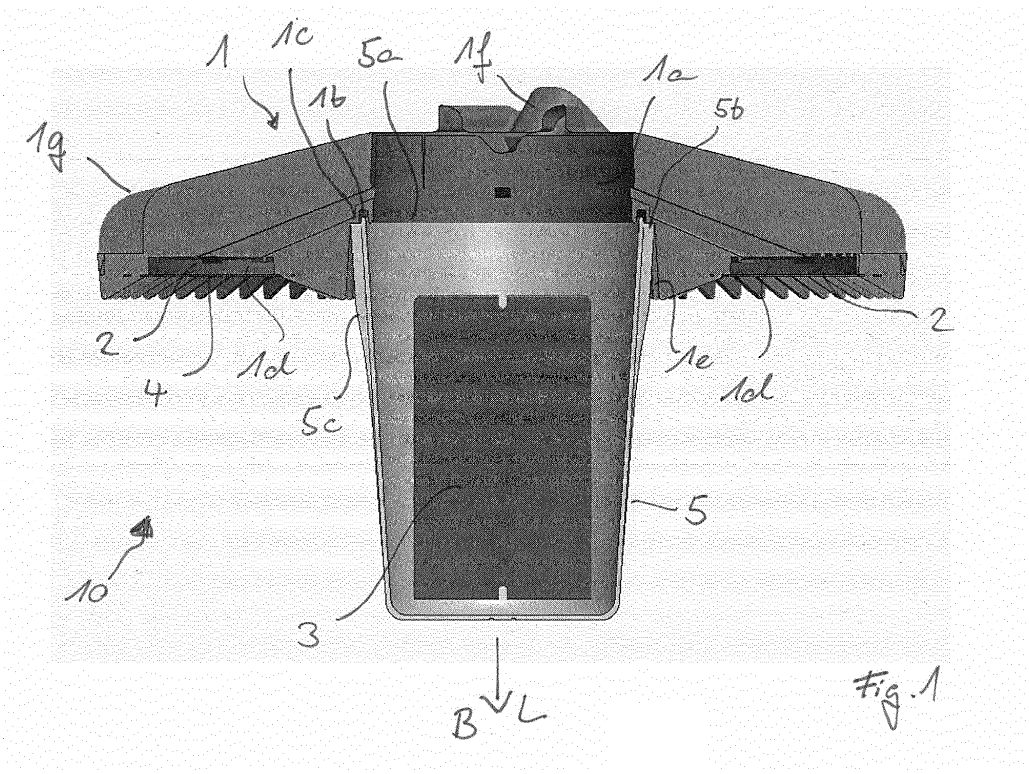
(54) HEATSINK

(57) A heatsink (1) for a luminaire (10) comprises a first portion being adapted for arranging a light source driver (3), an emergency lighting unit or a housing (5) for accommodating a light source driver (3) or an emergency lighting unit, and a second portion being integrally formed with the first portion and adapted for arranging a light source (2), wherein at least some cooling fins (15) extending from the first portion to the second portion are interrupted by a gap (16).



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Description

1. Field of the invention

[0001] The present invention relates to luminaires having a high lumen output resulting in an excessive heat generation. In particular, the present invention relates to a heatsink which is used in such a luminaire.

2. Technical background

[0002] In the prior art, luminaires having a high lumen output are well known. Those luminaires usually comprise a driver and a light source having a light emitting direction of the light source for constituting a main beam direction of the luminaire. The driver is usually provided somewhere at the rear side a housing of a central supporting element of the luminaire with respect to the light emitting direction of the light source.

[0003] During operation of the luminaire, heat is generated by the driver but in particular by the light source. Today, mostly light sources on the basis of LEDs are used which require a reliable cooling during operation to avoid local high temperatures which could result in damages not only of the LEDs but also of other components of the luminaire.

[0004] In the prior art, heatsinks are known being in thermal contact with heat generating components of the luminaire and having an enlarged surface configuration for transferring the heat to the surrounding air. These heatsinks have been optimized in the past and indeed help to keep the temperatures in luminaires at an acceptable level. On the other hand, in case such heatsinks are in thermal contact with the light source and other electric components such as drivers, there is a risk that the heatsink even supports a transfer of heat from the light source to the driver or in the other direction.

[0005] Therefore, it is an object of the present invention to provide a luminaire that is compact and that allows that the driver is not being affected by the heat of the luminaire.

[0006] These and other objects, which become apparent upon reading the following description, are solved by the subject-matter of the independent claim. The dependent claims refer to preferred embodiments of the invention.

3. Summary of the invention

[0007] According to the present invention, a heatsink for a luminaire is provided wherein the heatsink comprises a first portion being adapted for arranging a light source driver, an emergency lighting unit or a housing for accommodating a light source driver or an emergency lighting unit; and a second portion being integrally formed with the first portion and adapted for arranging a light source. In order to prevent a transfer of heat from the light source to the driver or the emergency lighting unit, at least some cooling fins extending from the first portion of the heatsink to the second portion of the heatsink are interrupted by a gap.

[0008] Accordingly, an integrally formed heatsink is provided which is used to cool simultaneously the light source and other electrical components wherein nevertheless a (cross) transfer of heat is prevented by using cooling fins having a gap. Each gap divides the corresponding cooling fin then in a first cooling fin portion and a second cooling fin portion wherein both portions are aligned with each other. The gap preferably separates both cooling fin portions by distance of around 3 to 7 mm, preferably by around 5mm.

[0009] Depending on the amount of heat generated by the different components of the luminaire, the length ratio between the cooling fin portions can be adapted. However, preferably the length ration between the first cooling fin portion and the second cooling fin portion is around 1:4 considering the fact that usually the light source generates more heat than the light source driver.

[0010] Nevertheless, to improve the handling of the heat source, preferably the heatsink further comprises a few support elements extending from the first portion of the heatsink to the second portion of the heatsink. These support elements preferably comprise a cut which splits each support elements in two portions. This cut in particular can extend diagonally through the support element again preventing a transfer of heat from the light source to the electrical components or in the other direction.

[0011] In a preferred embodiment of the present invention, the heatsink has a circular configuration with the first portion forming a center portion of the heatsink and the second portion forming an outer portion. The cooling fins then preferably radially extend outwardly from the first portion of the heatsink to the second portion wherein in particular cooling fins are evenly distributed over the circumference of the heatsink. The heatsink further can comprise a central hole being adapted for being combined with a housing for accommodating a light source driver or an emergency lighting unit. To arrange the light source, the heatsink further comprises preferably a receiving groove, e.g. a circumferentially extending receiving groove.

[0012] As an alternative to the above-mentioned circular configuration, the heatsink can also have a longitudinal configuration with both portions extending parallel to each other. In particular, the heatsink can comprise a further second portion being adapted for arranging another light source wherein the first portion extends between both second portions.

[0013] According to the present invention, also a luminaire having a main beam direction is provided comprising a heatsink as defined above, al light source mounted to the heatsink and a driver configured to drive the light source. Preferably, the light source is an LED light source.

4. Description of a preferred embodiment

[0014] In the following, the invention is described exemplarily with reference to the enclosed figures in which

Figure 1 is a schematic cross-sectional view of a preferred embodiment of an inventive luminaire;

Figure 2 is a schematic cross-sectional view of a heatsink in a traditional configuration;

Figure 3 is a schematic cross-sectional view similar to figure 2 but showing an inventive heatsink;

Figure 4 is a schematic view showing the distribution of the temperatures during use of the luminaire;

Figure 5 is a to p view of the inventive heatsink; and

Figure 6 is another cross-sectional view of the inventive luminaire showing in particular the structure of the supporting elements.

[0015] Figure 1 is a cross-sectional view of a luminaire 10 comprising a heatsink 1 according to a preferred embodiment of the present invention. The luminaire 10 of the preferred embodiment is a luminaire for being operated with a high lumen output and/or in environments having a high ambient temperature. The luminaire 10 has a main beam direction B.

[0016] The luminaire 10 comprises as a main component a heatsink 1. In the preferred embodiment of Figure 1, the heatsink 1 has a substantially round and symmetrical shape. The heatsink 1 is, however, not restricted to a particular shape and could for example also be realized in a longitudinal shape. The heatsink 1 has such a shape that its surface is increased for facilitating heat flow. Increasing the surface of the heatsink 1 is achieved by (integrally) providing cooling fins 1g with the heatsink 1, which are preferably evenly distributed over the circumference of the heatsink 1. The cooling fins 1g may extend radially and may be arranged annularly with respect to the main beam direction B. Preferably, the cooling fins 1g constitute a lattice-like heatsink 1, thus providing an increased surface of the heatsink 1 for facilitating cooling of different components of the luminaire 10.

[0017] The luminaire 10 further comprises a light source 2 mounted to the heatsink 1. As can be seen from the cross sectional view of Figure 1, the light source 2 is preferably mounted to the heatsink 1 by means of a receiving groove 1d that slightly extends in the heatsink 1 preferably around the main beam direction B and receives the light source 2. Preferably, the receiving groove 1d extends in the plurality of cooling fins 1g and forms an annular space for arranging the light source 2. It should be noted that also other means for mounting the light source 2 are possible, such as by means of fixing elements or the like.

[0018] The light source 2 may have a substantially two-dimensional extension and has in the present embodiment an annular shape. The light source 2 may comprise one or more LED modules. The LED-module(s) may be in plane contact with the heatsink 1. The LED module(s) may comprise at least one LED and/or printed circuit board (PCB). Preferably, the at least on LED is bonded to the printed circuit board.

[0019] Furthermore, the luminaire 10 comprises a driver 3 configured to drive the light source 2. As can be seen from Figure 1, the luminaire 10 may comprise a housing 5 for enclosing and preferably holding the driver 3. Holding the driver 3 may be carried out by holding elements (not shown) provided in the housing 5. Preferably, the housing 5 is designed for further enclosing and optionally holding also further components, e.g. a battery, and/or the further electronic and/or electric components. The housing 5 may be mounted to the heatsink 1 my means of a corresponding connection between a central opening 1a of the heatsink 1 and the housing 5, such as an engagement of corresponding connection means, a transition fit, a snap fit or the like. In addition or alternatively, the housing may be mounted to the heatsink 1 by means of fixing elements, such as bolts, nuts or the like. Preferably, the housing 5 comprises an opening 5a facing towards the heatsink 1. The opening 5a may face the opening 1a of the heatsink 1. Furthermore, the driver 3 may extent through the opening 5a into the opening 1a.

[0020] In the preferred embodiment according to Figure 1, the housing 5 has a substantially cylindrical shape that tapers in a direction away from the heatsink 1, i.e. a substantially cone-shaped form. However, the housing may also have a different shape, such as a rectangular shape or the like. The end of the housing 5 facing towards the heatsink 1 may be held by the opening 1a of the heatsink 1. Said end may comprise a rim 5b that is preferably received by a connection groove 1b extending in a step of the opening 1a. The connection groove 1b may further comprise engaging elements for engagement of the housing 5.

[0021] The housing 5 for accommodating the driveer3 may comprise a plurality of cooling fins 5c. The cooling fins 5c may be evenly distributed over the circumference of the housing 5. These cooling fins 5c may extend from the opening 5b of the housing 5 in the extending direction of the housing 5, preferably away from the heatsink 1, substantially in the direction of the main beam direction B. As viewed perpendicular to the extending direction of the housing 5, the longitudinal axis L, respectively, the cooling fins 5c may be wedge-shaped. However, the cooling-fins 5c may also have any different shape, such as a rectangular shape or the like, that increases the total surface of the housing 5 for facilitating cooling of the components enclosed in the housing 5.

[0022] The plurality of cooling fins 5c may engage with the opening 1a of the heatsink 1 for mounting the housing 5 on the heatsink 1. This arrangement also provides a heat flow from the housing 5 by way of the cooling fins 5c to the heatsink 1 where the heat is finally transferred to the surrounding air.

[0023] Preferably, the opening 1a of the heatsink 1 comprises recesses 1e, in particular slots, corresponding to the shape and preferably to the number of the plurality of cooling fins 5c for engagement of the cooling fins 5c with the opening 1a. Furthermore, as can be seen in Figure 1, the cooling fins 5b may abut the step 1c of the opening 1a on the face side of the cooling fins 5b. The cooling fins 1g of the heatsink 1 and the cooling fins 5c of the housing 5 may thermally cooperate with each other, e.g. by extending longitudinally from one another, to form a combined cooling body. As such, the housing 5 may also be integrally formed with the heatsink 1.

[0024] The material of the housing 5 and the cooling fins 5c, respectively, has a high thermal conductivity for facilitating cooling. Preferably, the material of the housing 5 is metal. The material of the heatsink 1 may also have a high thermal conductivity for facilitating cooling, such as metal or the like.

[0025] The luminaire 10 may further comprise an optical system 4 provided on the side of the light source 2 being opposite to the heatsink 1 for influencing the light emitted by the light source 2. For instance, the optical system 4 may influence the emitted light to constitute the main beam direction B. For facilitating heat flow from the optical system 2 to the heatsink 1, the optical system 4 may be connected to, preferably mounted on, the heatsink 1. The optical system 4 may cover the receiving groove 1d, and thus preferably also covers the light source 2. As an alternative, the optical system 4 may also be provided/placed within the receiving groove id, i.e. the optical system 4 may be received by the receiving groove 1d and may cover the light source 2.

[0026] The heatsink 1 may further comprise attaching elements 1f for attaching the luminaire, e.g. to a housing, a ceiling, a wall etc. The attaching elements 1f are preferably provided on a side of the heatsink 1 being opposite to the side of the heatsink 1, where the light source 2 is mounted.

[0027] During operation of the luminaire 10, heat is generated by the light source 2 and the driver 3. Both components are, as explained above, thermally coupled to the heatsink 1 and thus heat is transferred to the heatsink 1 from the light source 2 but also from the driver 3.

[0028] A heatsink 1 in traditional configuration is shown in Figure 2. For practical reasons, it is of course preferred that the heatsink 1 is integrally formed and thus both parts of the heatsink 1 to which the light source 2 and the driver housing 5 are attached are connected with each other. In the exampled shown in Figure 2, this connection is realized by the radially extending cooling fins 15 which extend from the central opening 1a of the heatsink 1 to its circumference. These cooling fins 15, on the other, not only mechanically couple both regions of the heatsink 1 with each other but also result in a thermal coupling between both regions. Heat generated by the light source 2 can thus be transferred in the center region surrounding the driver 3 and vice versa.

[0029] It now has been found that the transfer of heat in particular from the LED light sources 2 to the driver 3 via cooling fins 15 can have a negative influence on the performance of the driver 3. In particular in situations where the luminaire 10 is operated at relatively high ambient temperatures, this transfer of heat from the light sources 2 to the driver 3 can reduce the output of the driver 3 and/or its lifetime. Also additional elements for emergency lighting like batteries which are arranged in housing 5 should be protected against this heat transfer.

[0030] To avoid these problems explained above, it is suggested to adapt the heatsink 1 of Figure 2 in the inventive manner shown in Figure 3.

[0031] The inventive heatsink 1 of Figure 3 is similar to the one shown in Figure 2 but has been adapted to prevent the cooling fins 15 from transferring heat from the light source 2 to the center region where the driver housing 5 is arranged. The inventive further development can be seen when comparing both figures. While the heatsink 1 of Figure 2 comprises several cooling fins 15 extending from the center region to the circumference of the heatsink 1, most of this fins 15 are in the inventive embodiment of Figure 3 interrupted by a gap 16. This gap 16 divides the cooling fins 15 in a first portion 15a extending from the center region outwardly and a second portion 15b extending from the circumference of the heatsink 1 inwardly. Both cooling fin portions 15a and 15b are aligned with each other but prevented from exchanging heat by the gap 16.

[0032] The effect of the inventive measure can be seen in Figure 4. Most heat during operation of the luminaire 10 is generated by the LED light source 2 and thus the temperature in the outer region of the heatsink 1 is relatively high. This temperature gradually decreases in inward direction but drops by a significant step in the gap region. In particular, the temperature of the inner cooling fin portions 15a is around 5 C° lower than the temperature of the outer cooling fin portions 15b in the area of the gap 16. This shows that the gaps 16 indeed significantly reduce a transfer of the heat from the LED light source 2 to the region of the driver and thus the problems mentioned above can be avoided.

[0033] The size and location of the gaps 16 can be adapted according to the actual design of the heatsink 1. However, since the gap 16 reduces the surface of the corresponding cooling fin 15, it is preferred that the gap width of the gap 16 is small. On the other hand, a minimum width of the gap 16 is required to block a heat transfer from one portion of the fin 15 to the other. Accordingly, the width of the gap 16 is preferably in the rage between 3mm and 7mm, in particular around 5mm.

[0034] Further, the gap 16 is preferably located closer to the center region, i.e., the outer portion 15b of the cooling fin 15 being responsible for cooling the LED light sources 2 is larger than the inner portion 15a which is responsible for removing heat from the driver 3. In particular, the length ratio of both cooling fin portions 15a, 15b is around 1:4 but can be adapted in case the design of the heatsink 1 and/or the amount of heat generated by the LED light source 2 is changed.

[0035] As can also be seen in Figures 3 to 6, very few fin-like support elements 20 integrally extend from the center region to the outer region of the heatsink 1 where the LED light sources 2 are arranged. These support elements 20 are required to integrally connect the outer part with the inner part of the heatsink 1 which otherwise would be split in two separate components. A design of the heatsink 1 in one piece is, however, preferred with respect to the mounting of the complete luminaire 10. On the other hand, the total number of such support elements 20 should be kept low since these elements 20 again increase the thermal coupling between both regions of the heatsink 1. In the embodiment shown in the Figures, 4 support elements 20 are used.

[0036] Regarding these support elements 20, a preferred design of them is shown in the cross sectional view of Figure 6. As it can be seen, a diagonal cut 21 splits each support element 20 in an upper portion 20a and a lower portion 20b. While the upper portion 20a extends from an upper area of the central portion to the outer region of the heatsink 1, the lower portion 20b merely projects outwardly with a triangular shape from the circumference of the central opening 1a but is not in contact with LED light sources 2. The upper portion 20a further comprises the shown stepped configuration resulting in a minimum amount of material which thermally connects the outer portion of the heatsink 1 with the inner portion. This design of the support elements 20 ensures a reliable support for the outer portion of the heatsink 1 while at the same time an undesired heat transfer is avoided or at least reduced to a minimum.

[0037] Accordingly, the inventive structure of the heatsink 1 helps to avoid the heat transfer problems mentioned above. In particular, overheating of an LED driver or other components required for an emergency lighting can be avoided even in situations where the luminaire is operated at high ambient temperatures.

[0038] Obviously, the shown heatsink can be adapted in several aspects without departing from the inventive concept. In particular, the idea of using an integral heatsink for cooling both a light source and a driver but avoiding or at least suppressing a transfer of heat between both regions of the heatsink could also be realized in longitudinal heatsink designs or other structures.

Claims

1. Heatsink (1) for a luminaire (10), said heatsink (1) comprising

- a first portion being adapted for arranging a light source driver (3), an emergency lighting unit or a housing (5) for accommodating a light source driver (3) or an emergency lighting unit, and
- a second portion being integrally formed with the first portion and adapted for arranging a light source (2),

wherein at least some cooling fins (15) extending from the first portion to the second portion are interrupted by a gap (16).

2. Heatsink according to claim 1,
wherein each gap (16) divides a corresponding cooling fin (15) in a first cooling fin portion (15a) and a second cooling fin portion (15b), both portions being aligned with each other.

3. Heatsink according to claim 2,
wherein the gap (16) separates both cooling fin portions (15a, 15b) by a distance of around 3 to 7 mm, preferably by around 5 mm.

4. Heatsink according to claim 2 or 3,
wherein the length ratio between the first cooling fin portion (15a) and the second cooling fin portion (15b) is around 1:4.

5. Heatsink according to one of claims 1 to 4,
wherein the heatsink (1) further comprises support elements (20) extending from the first portion of the heatsink (1) to the second portion.

6. Heatsink according to claim 5,
wherein the support elements (20) comprise a cut which splits each support element (20) in two portions (20a, 20b).

7. Heatsink according to claim 6,
wherein the cut (21) diagonally extends through the support element (20).

8. Heatsink according to one of the preceding claims, said heatsink (1) having a circular configuration with the first portion forming a center portion of the heatsink (1) and the second portion forming an outer portion.

9. Heatsink according to claim 8,
wherein the cooling fins (15) radially extend outwardly from the first portion of the heatsink (1) to the second portion, said cooling fins (15) being preferably evenly distributed over the circumference of the heatsink (1).

10. Heatsink according to claim 8 or 9,
wherein the heatsink (1) comprises a central hole (1a) adapted for a being combined with a housing

(5) for accommodating a light source driver (3) or an emergency lighting unit.

11. Heatsink according to one of claim 8 to 10, wherein the heatsink (1) comprises a receiving groove (1d), e.g. a circumferentially extending receiving groove, for receiving the light source (2).

12. Heatsink according to one of claims 1 to 7, said heatsink (1) having a longitudinal configuration with both portions extending parallel to each other.

13. Heatsink according to claim 12, said heatsink (1) comprising a further second portion being adapted for arranging a light source, wherein the first portion extends between both second portions.

14. A luminaire (10) having a main beam direction (B) comprising:

a heatsink (1) according to one of the preceding claims,
a light source (2) mounted to the heatsink (1), and
a driver (3) configured to drive the light source (2).

15. A luminaire according to claim 14, wherein the light source (2) is a LED light source.

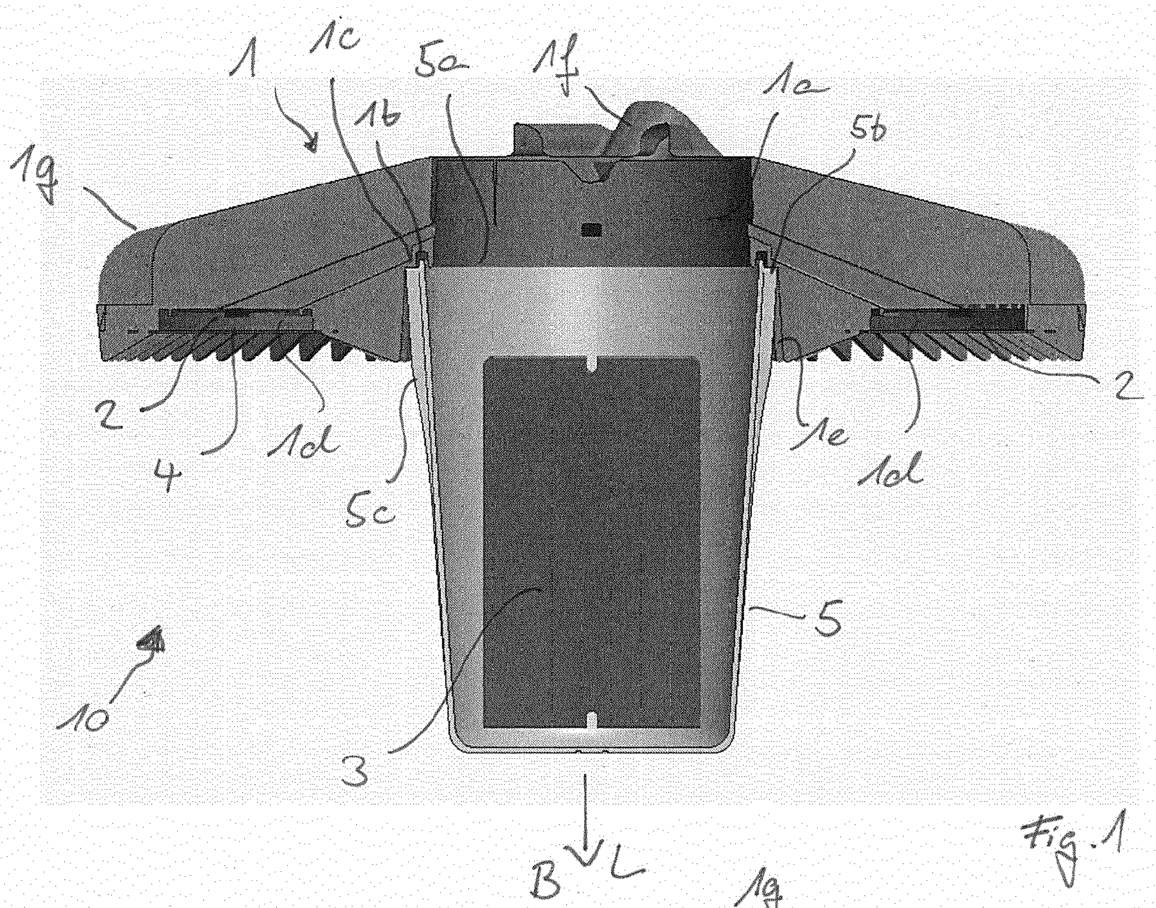


Fig.1

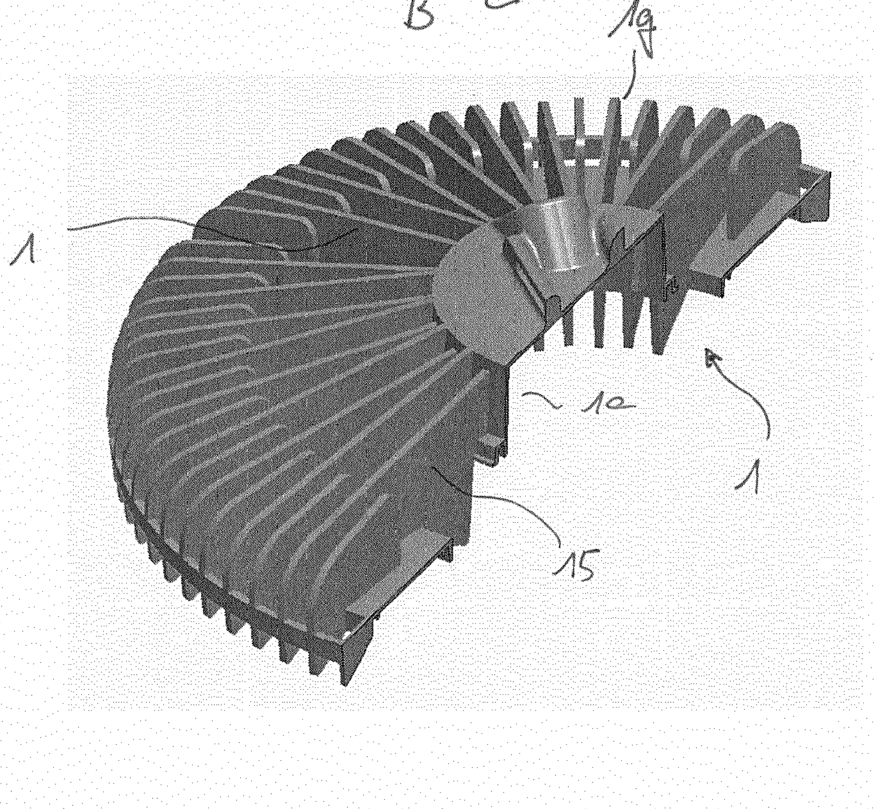


Fig.2

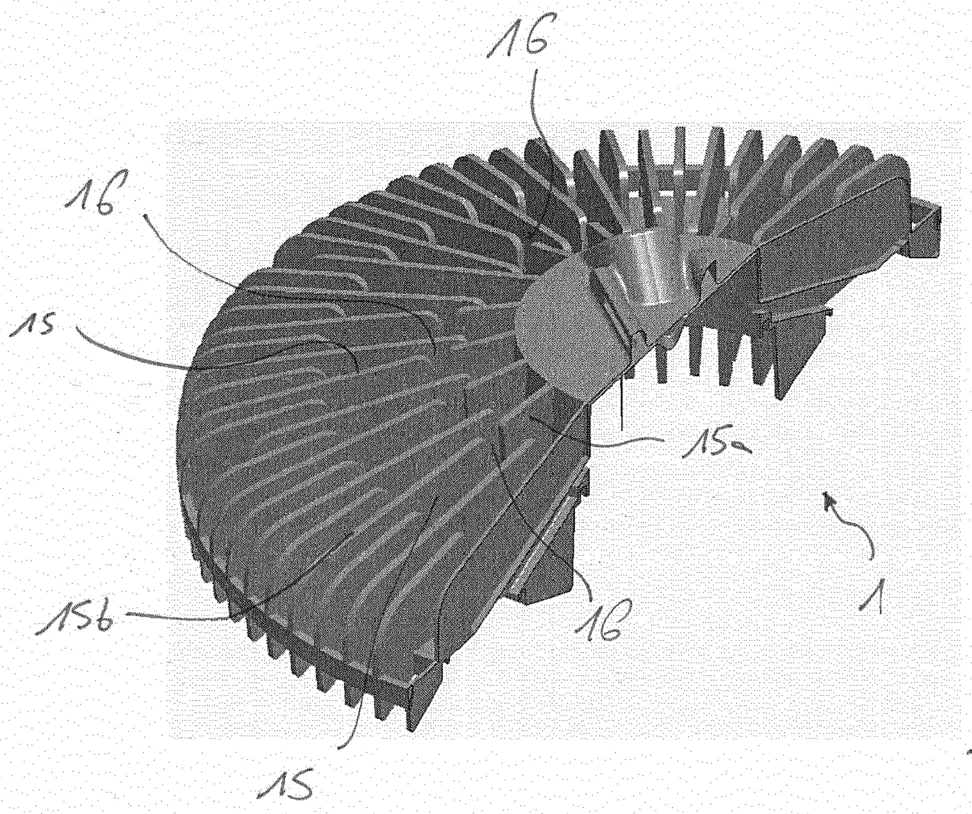
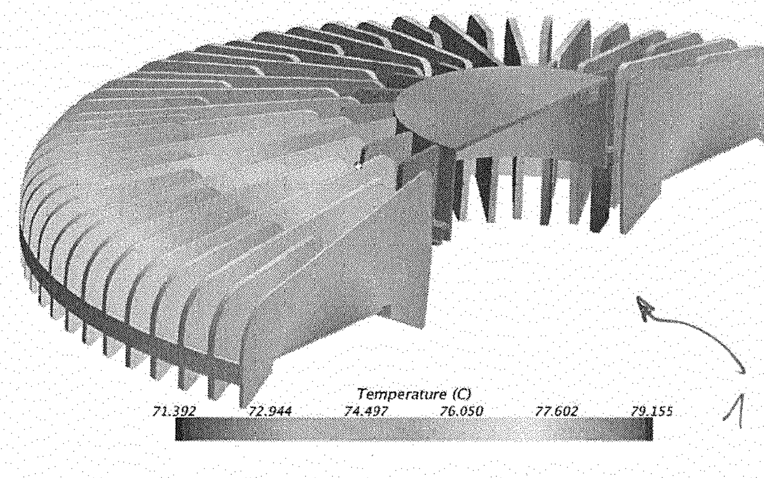

16
16
15
15a
1
15b
16
15

Fig.3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79.155
1

Fig.4

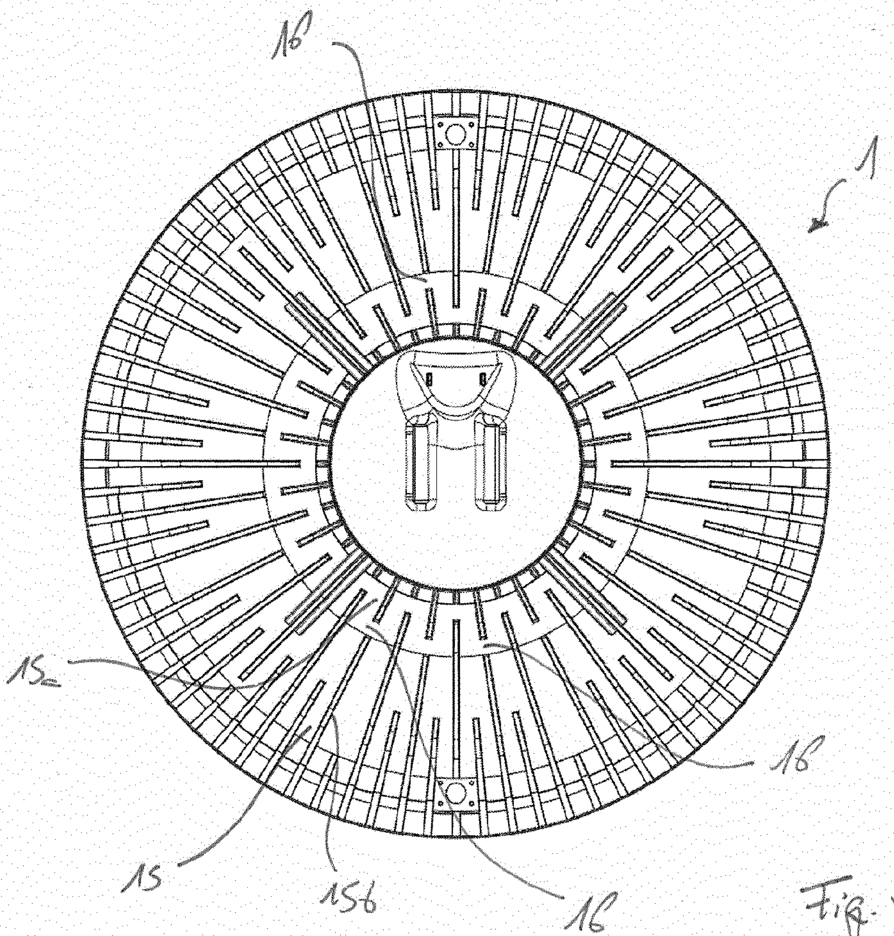

Fig. 5

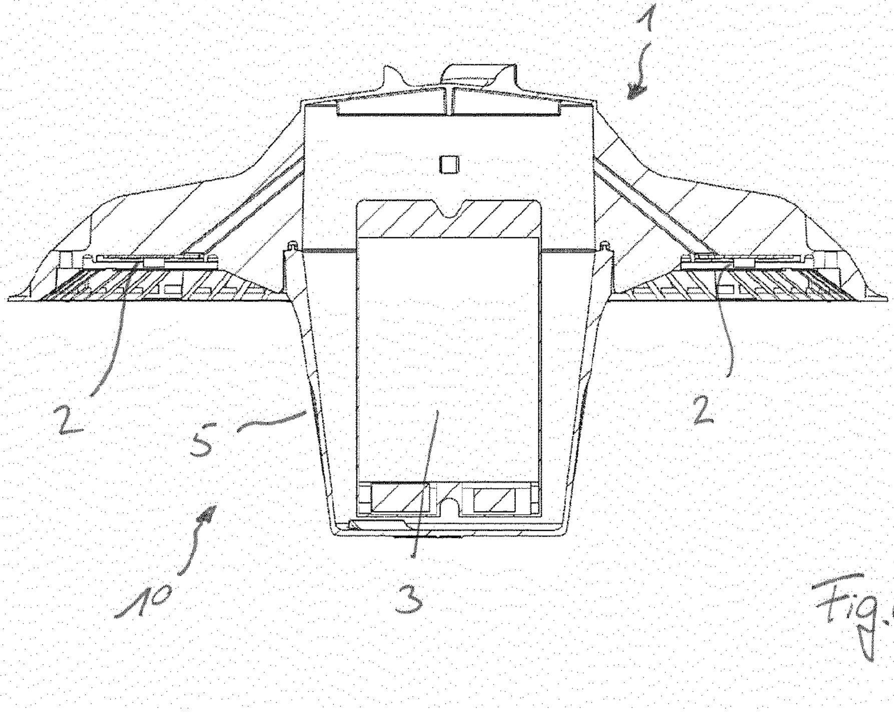

Fig. 6

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Application Number
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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	19 October 2016	Soto Salvador, Jesús

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 18 6226

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