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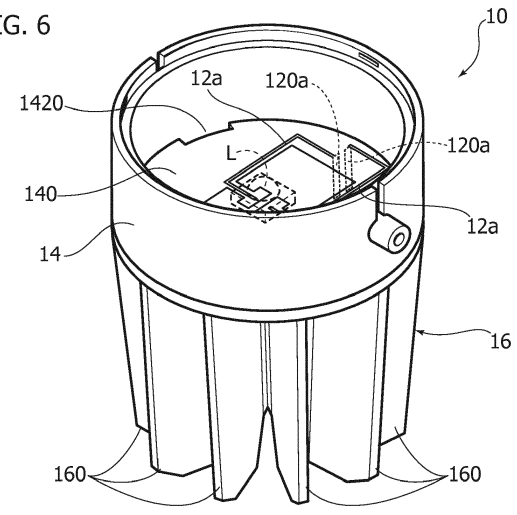
(54) A METHOD OF PROVIDING A HOUSING FOR LIGHTING DEVICES AND CORRESPONDING HOUSING

(57) A housing (10) for lighting devices (L), e.g. LED lighting devices, includes:
- a planar element (12) of thermally and electrically conductive material, the planar element (12) including a first portion (12a) with electrically conductive lines for an electrically-powered light radiation source (L) and a second portion (12b) with a thermally conductive pattern,
- a vat-like body (14) of thermally conductive and electrically insulating material, the vat-like body (14) having a bottom wall (14) with one or more window portions therein, the planar element (12) being coupled with the bottom wall (140) of the vat-like body (14) with the electrically conductive lines (12a) extending over bottom wall (140) and the thermally conductive pattern (12b) extending at the window portion(s),
- a further body (16) of thermally and electrically conductive material, coupled with bottom wall (140) of vat-like body (14), with the thermally conductive pattern (12b) of the planar element (12) which extends at window portion(s) of the bottom wall (140) of the vat-like body (14) in thermal contact with further body (16).

FIG. 6



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Description

Technical Field

[0001] The description relates to lighting devices.

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

Technological Background

[0003] A branch of lighting technology which is experiencing an intensive research concerns the implementation of housings or casings for lighting devices.

[0004] Despite the extensive activity, e.g. proven by documents such as US 2007/0121326 A1, US 2009/0135997 A1, US 2009/0277684 A1, US 2011/095690 A1, EP 1 469 707 A2, EP 2 312 204 A1, EP 2 432 038 A1, EP 2 827 687 A1, CN 201210013309.5, the need is still felt for solutions which may improve traditional arrangements, wherein the various parts of the housing are coupled by screws or various hook elements (e.g. clips).

[0005] Specifically, the need is felt for solutions adapted to meet various possible requirements which may also be in contrast with each other, such as:

- an ideal thermal contact among the various parts of the housing, so as to increase system efficiency;
- an integrated electrical connection, by combining thermal dissipation and electrical insulation,
- a reduction in the number of the housing components,
- an improved appearance of the housing.

Object and Summary

[0006] One or more embodiments aim at satisfying such need.

[0007] According to one or more embodiments, said object may be achieved thanks to a method having the features specifically set forth in the claims that follow.

[0008] One or more embodiments may also concern a corresponding housing.

[0009] The claims are an integral part of the technical teaching provided herein with reference to the embodiments.

[0010] One or more embodiments lead to the achievement of one or more of the following advantages:

- an improved thermal contact, with a correspondingly increased thermal efficiency of the system,
- possibility of implementing an integrated electrical connection, e.g. by resorting to lead-frame technologies and/or thermally conductive plastic materials having electrically insulating properties,
- reduction of the number of the parts which form the housing, with a consequent simplification of the manufacturing method, which is also made more economical, and
- possibility of improving the appearance of the housing, e.g. by reducing and virtually eliminating visible coupling components.

Brief Description of the Figures

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

- Figure 1 shows a component which may be used in one or more embodiments,
- Figures 2 to 5 show various method steps according to one or more embodiments, Figure 4 grossly corresponding to a section along line IV-IV of Figure 3, shown in magnified scale, and
- Figure 6 schematically shows a housing for lighting devices which may be obtained according to one or more embodiments.

Detailed Description

[0012] In the following description, numerous specific details are given in order to provide a thorough understanding of various exemplary embodiments. The embodiments may be practiced without one or several 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 the various aspects of the embodiments.

[0013] 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 possible appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring exactly to the same embodiment. Furthermore, particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

[0014] The headings provided herein are given for convenience only, and therefore do not interpret the extent of protection or the scope of the embodiments.

[0015] It will be appreciated that, for clarity of illustration, the Figures may not be drawn all to the same scale.

[0016] One or more embodiments as exemplified herein refer to the manufacturing of a housing for lighting devices, generally denoted as 10 in Figure 6.

[0017] In one or more embodiments housing 10 may be adapted to accommodate therein an electrically-powered light radiation source L, shown in dashed lines in Figure 6 only.

[0018] One or more embodiments may envisage a sol-

id-state light radiation source, such as a LED source.

[0019] Source L (which in itself may be a part of one or more embodiments) may be of any known kind and may include, for example, a single source (one LED) or multiple sources, such as a LED array.

[0020] The sequence of Figures 1 to 5 may be seen as ideally representative of subsequent steps of a method according to one or more embodiments, in order to manufacture a housing such as housing 10 visible in Figure 6.

[0021] Figure 1 refers to the manufacturing of a planar element 12 of a material (e.g. a metal material such as copper) having both thermal and electrical conduction features.

[0022] In one or more embodiments, planar element 12 may be manufactured, for example, from a metal sheet.

[0023] In one or more embodiments, planar element 12 may be manufactured via known technologies used for socalled lead frames of integrated electrical circuits.

[0024] This choice, however, is by no way mandatory: one or more embodiments may envisage the use of different manufacturing technologies, e.g. 3D printing.

[0025] Whatever the choice adopted for manufacturing, in one or more embodiments planar element 12 may include a first and a second portion, respectively denoted as 12a and 12b.

[0026] The first portion 12a may comprise a pattern of electrically conductive lines, adapted to enable e.g. the power supply (and optionally the performance of control functions) of the light radiation source L.

[0027] On the other hand, the second portion 12b may include the presence of one or more planar portions ("lands") adapted to perform a thermal dissipation action of the heat produced by source L in operation.

[0028] For this purpose, source S may be provided (as known in itself, so as not to require a specific description herein) both with electrical contact pads, adapted to establish the electrical contact with electrically conductive lines 12a, and with one or more thermal dissipation pads, adapted to be brought into contact with the thermally dissipative formations (planar portions 12b) so as to achieve a heat transfer function towards said portions.

[0029] Figure 2 shows the possibility, in one or more embodiments, of coupling planar element 12 with a (first) body 14 having a general vat-like configuration, e.g. the shape of a cup, with a core or bottom wall 140 and a peripheral or shell wall 142.

[0030] In one or more embodiments, the coupling of element 12 with vat-like body 14 may be achieved by comoulding vat-like body 14 with element 12, according to a procedure to be described in the following.

[0031] In one or more embodiments, vat-like body 14 may be formed of a material (e.g. a plastic material) having thermally conductive (and therefore dissipative) properties, combined with electrically insulating properties.

[0032] For example, in one or more embodiments, the material of body 14 may be selected out of polycarbonate - PC, acrylonitrile-butadiene-styrene - ABS, polyamide - PA, polybutylenterephtalate - PBT, poly-paraphenylene sulfide - PPS, optionally with a filler such as glass material.

[0033] As visible in Figure 4, in one or more embodiments the coupling between element 12 and vat-like body 14 may be implemented so that the lines 12a of element 12 extend on the bottom wall 140 of body 14 (optionally with bent end portions 120a, as will be better detailed in the following), while portions 12b of the thermally conductive pattern extend in a position corresponding to one or more windows 1400 provided in bottom wall 140 of body 14 (see Figure 4).

[0034] By stating that the portions of the thermally conductive pattern 12b extend in a position corresponding to window(s) 1400 of bottom wall 140, it is meant that such portions 12b face window(s) 1400, so that they are accessible from the bottom wall 140 of body 14 from the outside of body 14 itself.

[0035] For this purpose, as shown e.g. in Figure 4, portions 12b may be provided with rims, such as e.g. the rim denoted as 120b, which are connected (e.g. as a consequence of co-molding) with the material of bottom wall 140 of body 14.

[0036] As previously stated, electrically conductive lines 12a may have end portions 120a which, e.g. during the coupling operation of element 12 to body 14, are bent (e.g. outwardly of body 14 itself) so as to form, as visible in Figure 4, a connector 144 which protrudes from bottom wall 140 outwardly of body 14.

[0037] For clarity of illustration, in Figure 2 (which is a schematic representation of the general procedure of coupling element 12 to body 14) reference A denotes the area wherein, during the coupling step (e.g. while body 14 is being co-molded onto element 12) ends 120a of electrically conductive lines 12a are bent inwardly of connector 144.

[0038] The same schematic representation of Figure 2 shows that, in this or in a subsequent step, electrically conductive lines 12a and thermally conductive patterns 12b may be separated from each other (e.g. via a cutting operation) e.g. in the locations denoted as B in Figure 2. In this way, conductive lines 12a may be electrically insulated from thermally conductive portions 12b, optionally with a mutual electrical separation of the various lines 12a (ground line, "hot" line, etc.) which must be connected to source L.

[0039] It must be appreciated, moreover, that the material of element 12 may be one material (e.g. a metal) which may be both electrically and thermally conductive.

[0040] Figure 5 (which again must be considered as a schematic representation having an essentially illustrative purpose) exemplifies possible connections of vat-like body 14 with a further body 16 adapted to complete housing 10.

[0041] In one or more embodiments, body 16 may be provided with fins 160, so that it is adapted to act as a heatsink.

[0042] In one or more embodiments, body 16 may include a thermally conductive (e.g. plastic) material, e.g. having a higher thermal conductivity than the material of body 14), in combination with electrical conductivity features.

[0043] The use of an electrically conductive material for body 16 does not originate undesired short-circuits of the electrically conductive lines 12a: as a matter of fact, as shown (in an intentionally schematic representation) in Figure 5, the electrically conductive lines 12a may be separated, and therefore insulated, from body 16 by the bottom wall 140 of body 14 (of which Figure 5 only shows the outer dimensions in dashed lines), which includes an electrically insulating material and therefore is adapted to perform a function of electrical insulation.

[0044] The coupling of body 16 to body 14 (which in turn is coupled with element 12) may again be achieved via overmolding, so as to originate a fixation of the (e.g. plastic) material which may correspond to a sort of chemical gluing.

[0045] In one or more embodiments, the material of body 16 may be selected out of aluminium and alloys thereof, magnesium and alloys thereof, copper, brass, thermo-conductive polymers of various nature.

[0046] As can be appreciated in Figure 5, thanks to the coupling of body 14 and body 16, the material of body 16 extends into the window(s) (see e.g. window 1400 visible in Figure 4) provided in the bottom 140 of body 14.

[0047] In this way, the thermally conductive portions 12b are in contact (practically along the whole extension thereof, with the possible exception of the rims, such as rim 120b visible in Figure 4) with body 16.

[0048] This enables the achievement of an effective transfer of the heat generated by source L towards body 16, the latter being adapted to act as a heatsink.

[0049] In one or more embodiments, the coupling between bodies 14 and 16 may be made firmer by providing e.g. hook formations such as complementary hook formations, e.g. form-fitting teeth/cavities generally denoted as 1420 in various annexed Figures.

[0050] In one or more embodiments, as schematically shown in Figure 5, body 16 may include e.g. a cavity 144a, adapted to accommodate connector 144 therein, which in turn may be provided e.g. with hook formations such as one or more teeth 144a.

[0051] Without prejudice to the basic principles, the implementation details and the embodiments may vary, even appreciably, with respect to what has been described herein by way of non-limiting example only, without departing from the extent of protection.

[0052] The extent of protection is defined by the annexed claims.

Claims

1. A method of providing a housing (10) for lighting devices, the method including:

   - providing a planar element (12) of thermally and electrically conductive material, the planar element (12) including a first portion (12a) with electrically conductive lines for an electrically-powered light radiation source (L) and a second portion (12b) with a thermally conductive pattern,
   - coupling the planar element (12) with a vat-like body (14) of thermally conductive and electrically insulating material, the vat-like body (14) having a bottom wall (14) with at least one window portion (1400) therein, the planar element (12) coupled with the bottom wall (140) of the vat-like body (14) with the electrically conductive lines (12a) extending over said bottom wall (140) and the thermally conductive pattern (12b) extending at said at least one window portion (1400), and
   - coupling with the bottom wall (140) of the vat-like body (14) having the planar element (12) coupled therewith a further body (16) of thermally and electrically conductive material, whereby the thermally conductive pattern (12b) of the planar element (12) extends at said at least one window portion (1400) of the bottom wall (140) of the vat-like body (14) in thermal contact with said further body (16).

2. The method of claim 1, including providing the planar element (12) as a single body and separating (B) the first portion (12a) from the second portion (12b) to provide electrical insulation between the electrically conductive lines (12a) and the thermally conductive pattern (12b).

3. The method of claim 1 or claim 2, including coupling the planar element (12) with the vat-like body (14) by bending end portions (120a) of the electrically conductive lines (12a) to form an electrical connector (144) of the vat-like body (14).

4. The method of any of the previous claims, including:

   - coupling the planar element (12) with the vat-like body (14) by overmolding with said thermally conductive and electrically insulating material, and/or
   - coupling said further body (16) of thermally and electrically conductive material to the bottom wall (140) of the vat-like body (14) by overmolding .

5. The method of any of the previous claims, including providing the planar element (12) by lead-frame technology.

6. A housing for lighting devices (L), including:

- a planar element (12) of thermally and electrically conductive material, the planar element (12) including a first portion (12a) with electrically conductive lines for an electrically-powered light radiation source (L) and a second portion (12b) with a thermally conductive pattern,
- a vat-like body (14) of thermally conductive and electrically insulating material, the vat-like body (14) having a bottom wall (140) with at least one window portion (1400) therein, the planar element (12) coupled with the bottom wall (140) of the vat-like body (14) with the electrically conductive lines (12a) extending over said bottom wall (140) and the thermally conductive pattern (12b) extending at said at least one window portion (1400), and
- a further body (16) of thermally and electrically conductive material coupled with the bottom wall (140) of the vat-like body (14) having the planar element (12) coupled therewith, with the thermally conductive pattern (12b) of the planar element (12) extending at said at least one window portion (1400) of the bottom wall (140) of the vat-like body (14) in thermal contact with said further body (16).

7. The housing of claim 6, wherein:

- the thermally and electrically conductive material of the planar element (12) includes a metal material, preferably copper; and/or
- the thermally conductive and electrically insulating material of the vat-like body (14) is selected out of polycarbonate - PC, acrylonitrile-butadiene-styrene - ABS, polyamide - PA, polybutylenterephtalate - PBT, poly(p-phenylene sulphide - PPS, preferably with a filler such as glass material; and/or
- the thermally conductive and electrically conductive material of the further body (16) is selected out of aluminium and its alloys, magnesium and its alloys, copper, brass, thermo-conductive polymers.

8. The housing of claim 6 or claim 7, wherein the further body (16) is a finned body (160).

FIG. 1

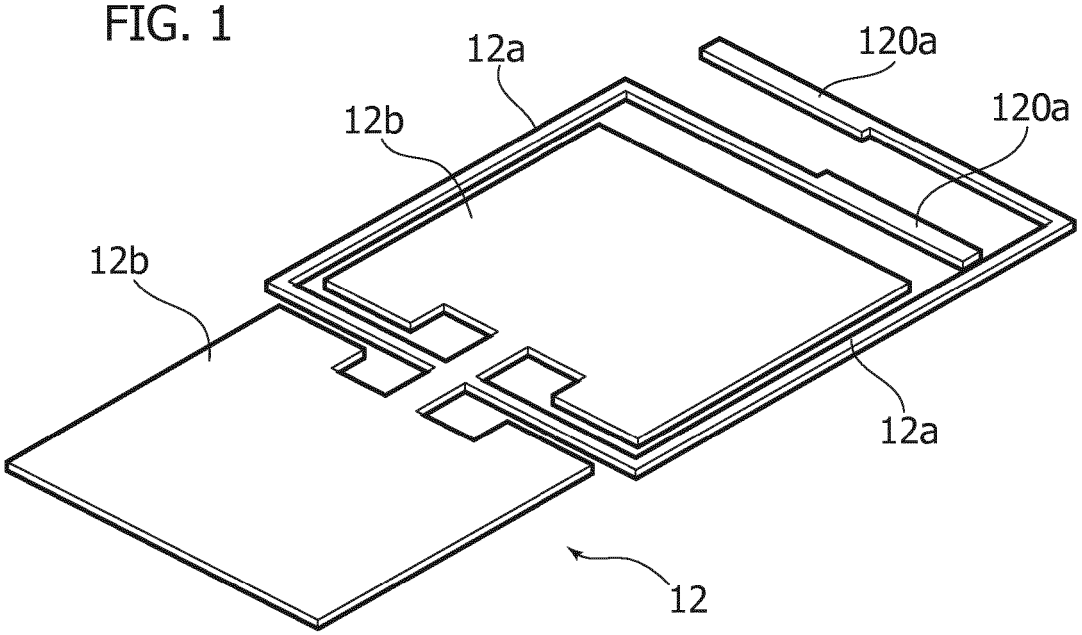

12a
120a
12b
120a
12b
12a
12

FIG. 2

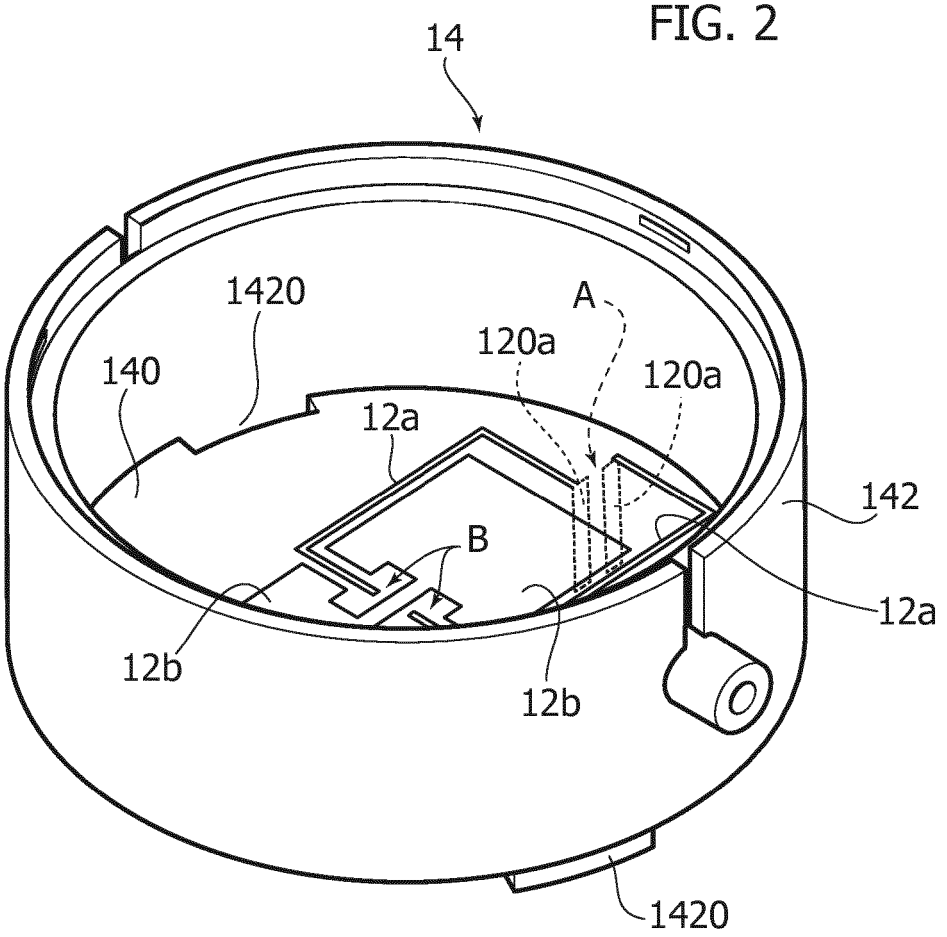

14
1420
A
120a
120a
140
12a
142
B
12a
12b
12b
1420

FIG. 3

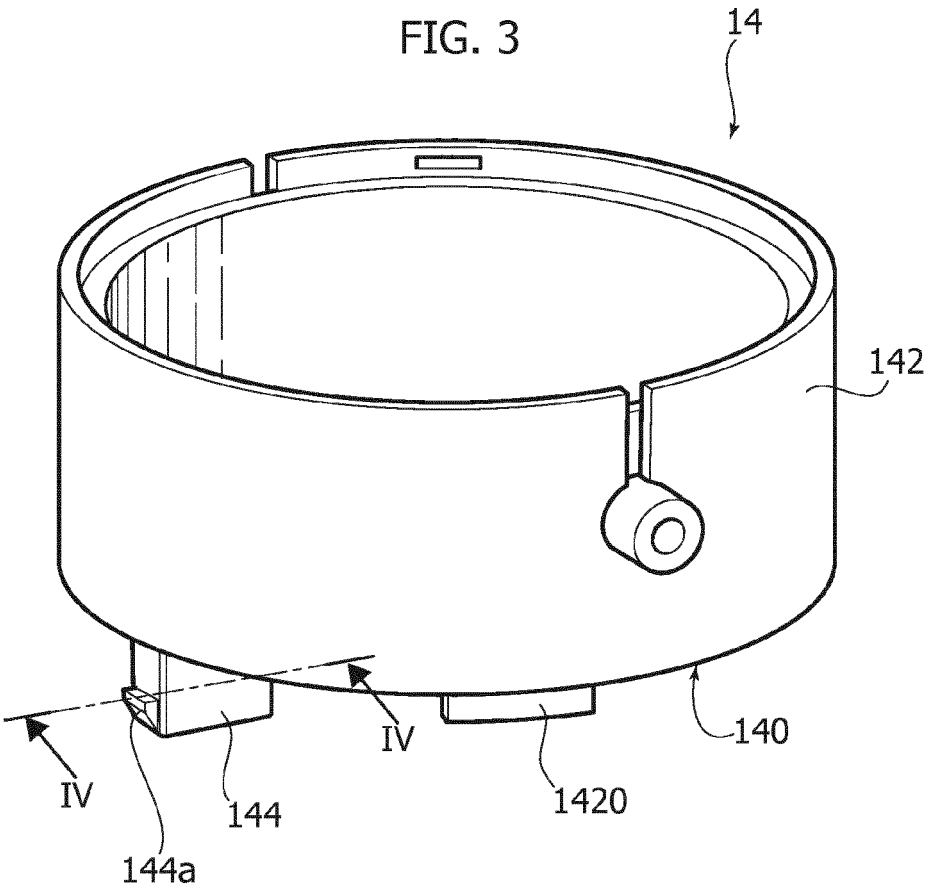

14
142
140
IV
IV
144
144a
1420

FIG. 4

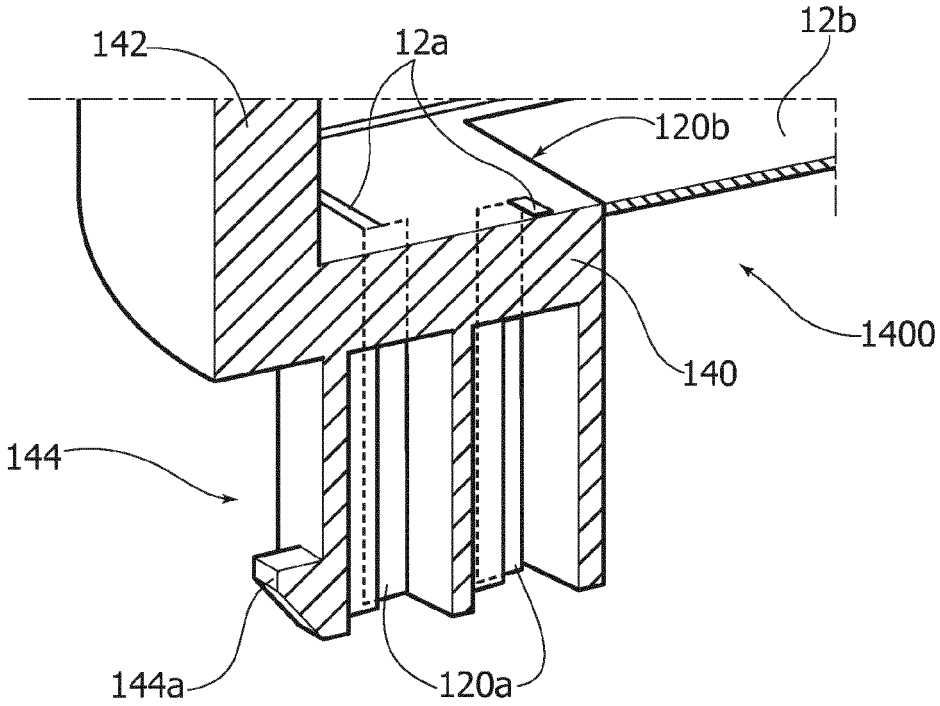

142
12a
12b
120b
1400
140
144
144a
120a

FIG. 5

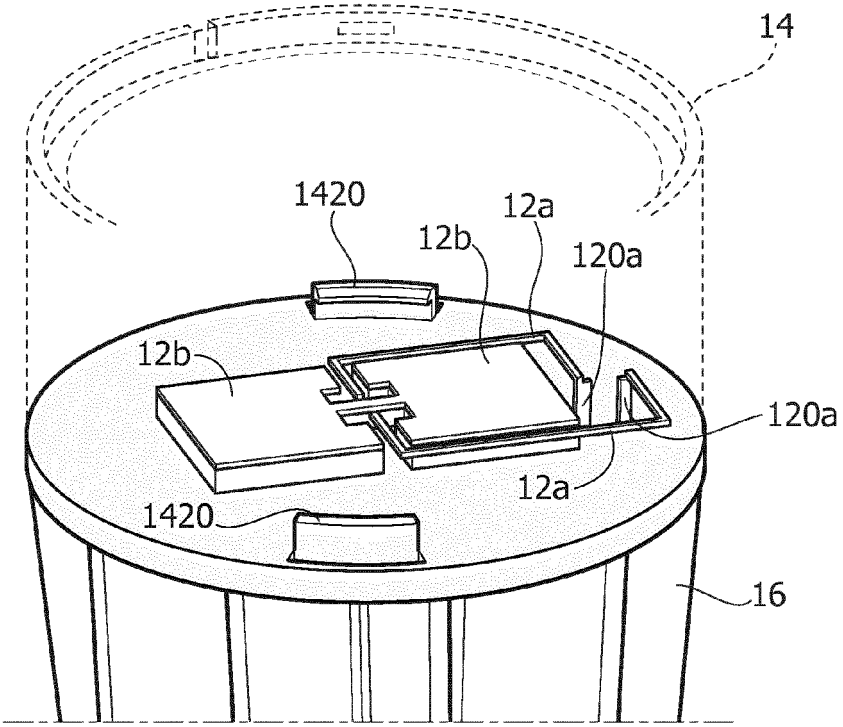
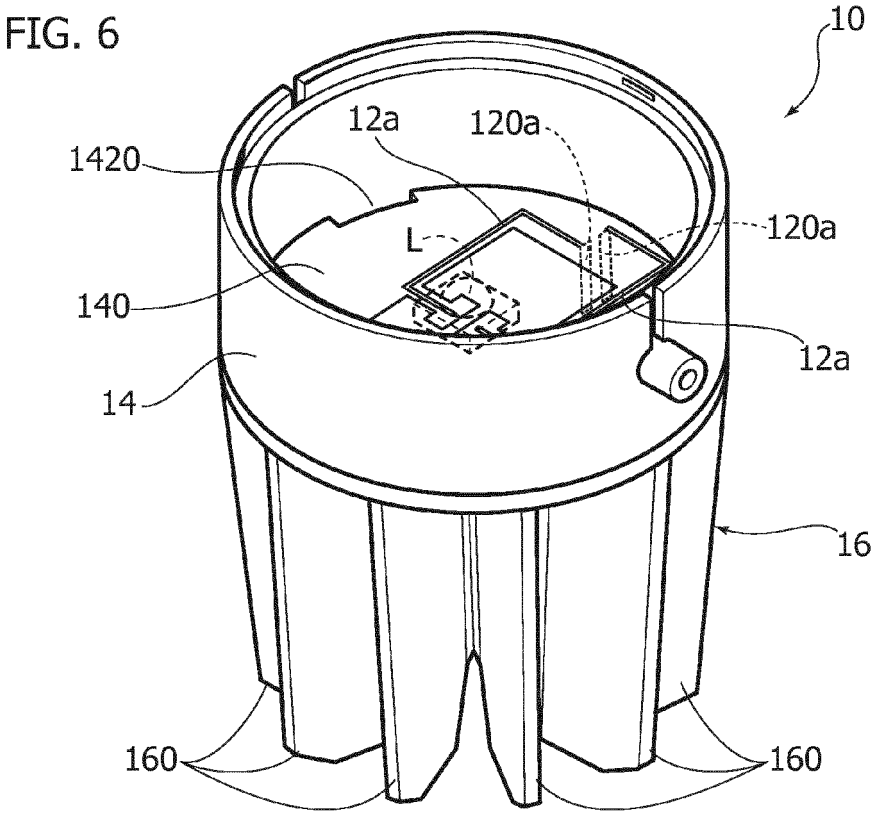

14
1420
12a
12b
120a
12b
120a
12a
1420
16

FIG. 6


10
12a
120a
1420
L
120a
140
12a
14
16
160
160

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EUROPEAN SEARCH REPORT

Application Number
EP 16 20 7382

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	DE 10 2006 017718 A1 (KROMBERG & SCHUBERT GMBH & CO [DE]) 16 May 2007 (2007-05-16) * paragraph [0018] - paragraph [0022] * * figure 9 * -----	1,4-8	INV. F21V15/01 ADD. F21Y115/10
Y	WO 2011/155851 A1 (VELU PANNIRSELVAM A L [NZ]) 15 December 2011 (2011-12-15) * page 9, line 7 - page 17, line 2 * * figure 9d * -----	1,4-8	

TECHNICAL FIELDS SEARCHED (IPC)

F21V
F21K
H05K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 March 2017	Blokland, Russell

CATEGORY OF CITED DOCUMENTS

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28-03-2017

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

REFERENCES CITED IN THE DESCRIPTION

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