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(54) Title: LUMINAIRE HOUSING

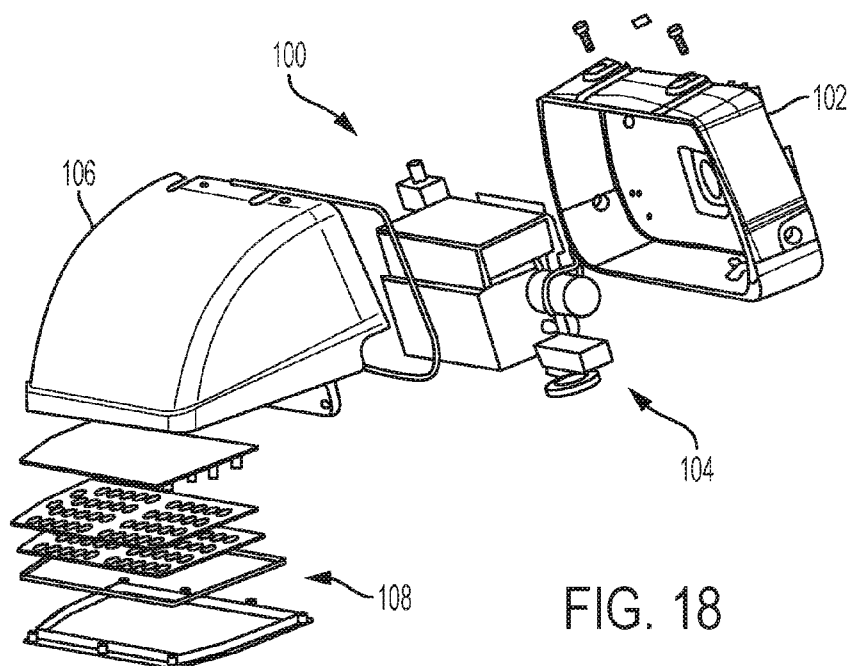


FIG. 18

(57) Abstract: A luminaire having a housing, a control assembly positioned in the housing, a cover connected to the housing, and a light emitter. Different covers, control components, and light emitters can be used with the luminaire to create a desired appearance and light output.



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PATENT APPLICATION
OF
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AND
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FOR
LUMINAIRE HOUSING

RELATED APPLICATION(S)

[0001] This application is based on U.S. provisional application Serial No. 62/148,118, filed April 15, 2015, the disclosure of which is incorporated herein by reference in its entirety and to which priority is claimed.

FIELD

[0002] Various exemplary embodiments relate to luminaires and components for luminaires.

BACKGROUND

[0003] Light fixtures, or luminaires, are used with electric light sources to provide an aesthetic and functional housing in both interior and exterior applications. One type of light fixture is an area light, generally used for exterior lighting of buildings, walkways, parks, and parking lots, and interior applications such as hallways, warehouses, entryways, or other areas. Area lights typically include a light fixture attached to a pole, wall, or other elevated structure to provide an elevated lighting position. In recent years, lighting applications, including area lights have trended towards the use of light emitting diodes (LEDs) as a light source in place of conventional incandescent and fluorescent lamps.

SUMMARY

[0004] According to an exemplary embodiment, a luminaire includes a base, a light support, a first set of fins, and a second set of fins. The light support extends from the base and includes a mounting section. The first set of fins is in thermal communication with the mounting section. The second set of fins intersects the first set of fins and is in thermal communication with the mounting section.

[0005] According to another exemplary embodiment, a luminaire includes a control assembly positioned in a housing. A cover is connected to the housing having a mounting section and a chamber including a heat fin in thermal communication with the mounting section. A light assembly is connected to the mounting section and operatively connected to the control assembly.

[0006] According to another exemplary embodiment, a luminaire includes a control assembly positioned in a housing. A cover is connected to the housing. A light assembly is operatively connected to the control assembly. A mounting assembly includes a mounting plate connectable to a surface and a mounting bracket connected to the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The aspects and features of various exemplary embodiments will be more apparent from the description of those exemplary embodiments taken with reference to the accompanying drawings, in which:

[0008] FIG. 1 is a bottom perspective view of an exemplary luminaire chassis;

[0009] FIG. 2 is a rear perspective view of FIG. 1;

[0010] FIG. 3 is a top perspective view of FIG. 1;

[0011] FIG. 4 is a top view of FIG. 1;

[0012] FIG. 5 is a bottom view of FIG. 1;

[0013] FIG. 6 is a top perspective view of the exemplary luminaire chassis including an exemplary cover;

[0014] FIG. 7 is a bottom perspective view of FIG. 6;

- [0015] FIG. 8 is a top perspective view of the exemplary luminaire chassis including another exemplary cover;
- [0016] FIG. 9 is a bottom perspective view of FIG. 8;
- [0017] FIG. 10 is a top perspective view of the exemplary luminaire chassis including another exemplary cover;
- [0018] FIG. 11 is bottom perspective view of FIG. 10;
- [0019] FIG. 12 is a top perspective view of the exemplary luminaire chassis including a first exemplary cover;
- [0020] FIG. 13 is a bottom perspective view of FIG. 12;
- [0021] FIG. 14 is a top perspective view of another exemplary luminaire;
- [0022] FIG. 15 is a bottom perspective view of FIG. 14;
- [0023] FIG. 16 is a front view of FIG. 14;
- [0024] FIG. 17 is a rear perspective view of FIG. 14;
- [0025] FIG. 18 is an exploded view of FIG. 14;
- [0026] FIG. 19 is a front perspective view of an exemplary housing;
- [0027] FIG. 20 is a rear perspective view of FIG. 19;
- [0028] FIG. 21 is a rear perspective view of the exemplary housing of FIG. 19 and an exemplary mounting assembly;
- [0029] FIG. 22 is an exploded view of FIG. 22;
- [0030] FIG. 23 is a front perspective view of a first exemplary control assembly positioned in the housing;
- [0031] FIG. 24 is a front perspective view of a second exemplary control assembly positioned in the housing;
- [0032] FIG. 25 is a front perspective view of the second exemplary control assembly with a bracket faded to show the attached driver;
- [0033] FIG. 26 is a front perspective view of a third exemplary control assembly positioned in the housing;
- [0034] FIG. 27 is a front perspective view of a fourth exemplary control assembly positioned in the housing;

- [0035] FIG. 28 is a bottom perspective view of an exemplary cover;
- [0036] FIG. 29 is a rear perspective view of FIG. 28;
- [0037] FIG. 30 is a bottom view of FIG. 28;
- [0038] FIG. 31 is a bottom perspective view of the exemplary cover and an exemplary light assembly;
- [0039] FIG. 32 is a side perspective, cross-sectional view of FIG. 31;
- [0040] FIG. 33 is a rear perspective, cross-sectional view of FIG. 31;
- [0041] FIG. 34 is a top perspective, exploded view of an exemplary light assembly; and
- [0042] FIG. 35 is a bottom perspective view of FIG. 34.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0043] Various exemplary embodiments of this application are directed to luminaires, for example indoor and outdoor area lighting luminaires. The luminaires allow for mounting and housing of different components as required for different applications using similar elements. For example, common housings or mounting features can accommodate different configurations of luminaires that include one or more different types of light emitters, drivers, surge protectors, fuses, photocells, occupancy sensors, wireless communication devices, covers, and lenses. The luminaires also provide efficient thermal management across the range of configurations. This allows customers to customize the luminaire to a desired architectural design within the same product line.

[0044] An exemplary embodiment of a luminaire is shown in FIGS. 1-13 having a chassis 40 which includes a base 42 and a light support 44 extending from the base 42. The chassis 40 can be a monolithic or unitarily formed structure or it can be formed of separate pieces that are attached together. Different materials can be used to form the chassis 40 including metals, for example aluminum, polymers, and/or composite materials. The chassis 40 can be molded, cast, machined, or formed by any other suitable process.

[0045] As best shown in FIGS. 3-5, the light support 44 extends outwardly from the base 42. The light support 44 can be substantially perpendicular to the base 42 or at an oblique angle depending on the overall configuration and the direction of the desired light output. The light support 44 includes a mounting section 46. In an exemplary embodiment, the mounting section 46 is configured to receive and LED board 48 which includes a printed circuit board (PCB) and one or more light emitters, for example light emitting diodes (LEDs). The light support 44 can also be configured to support other types of LED modules or other light sources.

[0046] The top surface of the light support includes a plurality of fins. In an exemplary embodiment, a plurality of first fins 50 extends outwardly from the base and a plurality of second fins 52 extend orthogonal to the first fins 50, although other angles and configurations of the first and second fins 50, 52 may be used.

[0047] The first fins 50 include a first section 54, a second section 56, and a third section 58. The first section 54 extends outwardly from the base 42, either in contact with the base 42 or spaced therefrom. The first section 54 includes a curved edge that transitions to the second section 56. The second section 56 extends between, and is spaced below, the first and the third sections 54, 58. The third section 58 extends from the second section 56 and has a pair of rounded edges. In an exemplary embodiment, at least a portion of the third section 58 extends beyond the mounting section 46. In certain exemplary embodiments, the LED board 48 is configured so that one or more LEDs are positioned substantially directly beneath one of the first fins 50. For example, rows of LEDs can be aligned with the first set of fins 50 and/or the second set of fins 52. The size, shape, length, and spacing of the first fins 50 can vary depending on the characteristics of the base and the components of the luminaire.

[0048] The second fins 52 extend across the first fins 50. The second fins 52 can include rounded corners, for example at a first end and a second end. In an exemplary embodiment, at least one of the second fins 52 extends beyond the mounting section 46 on a first and second side. The size, shape, length, and spacing of the second fins 52 can vary depending on the characteristics of the base and the components of the luminaire.

[0049] In an exemplary embodiment, one or more gaps 60 are formed between the base 42 and the mounting section 46. The first fins 50 extending from the base 42 can separate individual gaps 60. The gaps 60 allow for better air circulation and, in combination with the fins 50, 52, provide increased heat transfer to draw heat from the light emitters to the surrounding environment.

[0050] As best shown in FIG. 2, the base 42 can act as a housing or enclosure for various control components 62. For example, different drivers, surge protectors, photocells, occupancy sensors, and/or wireless communication devices can be housed in the base 42. The base 42 includes a top wall 64, a bottom wall 66, a front wall 68, and one or more side walls 70 to define a chamber or enclosed area. Although the base 42 is shown as open, another wall can partially or entirely enclose the chamber. The front and side walls 68, 70 include a top section and a bottom section. The bottom section is narrower than the top section. A curved transition 72 is provided between the top and bottom sections, although other configurations can be used. A third set of fins 74 extend from the front wall 68, for example extending downwardly from the top section and outwardly from the bottom section. The size, shape, length, and spacing of the third fins 74 can vary depending on the characteristics of the base 42 and the components of the luminaire.

[0051] In various exemplary embodiments, different covers can be connected to the chassis 40 to be positioned over and/or to at least partially enclose the light support 44. FIGS. 6 and 7 show an exemplary radius cover 76 that includes a semi-circular cover with a rounded front edge and a flat top. FIGS. 8 and 9 show an exemplary LNC cover 78 that includes a curved top edge, rounded corners, and angled sides. Fins 80 can extend from the inside of the cover 78 to align with the fins 50, 52 of the light support. FIGS. 10 and 11 show an exemplary trapezoid cover 82 that includes angled side walls and a front wall that angles down and away from the light support 44. FIGS. 12 and 13 show an exemplary quarter sphere cover 84 that includes a partial dome. Lenses or other optics can be connected to the covers or the chassis to direct or diffuse light.

[0052] FIGS. 14-35 show another exemplary embodiment of a luminaire 100 having a housing 102, a control assembly 104, a cover 106, and a light assembly 108. The housing 102 and cover 106 can have a variety of shapes, sizes, and configurations and be made from a variety of materials including metals, polymers, composites, and other suitable materials. The housing 102 and the cover 106 are each shown as single-piece, unitary structures, although they can also be composed of multiple pieces that are connected together. The control assembly 104 can include a variety of different components, including any combination of drivers, surge protectors, fuses, photocells, occupancy sensors, and wireless communication devices. The light assembly 108 includes one or more light emitting devices.

[0053] FIGS. 19 and 20 show an exemplary embodiment of a housing 102. The housing 102 has a back wall 110, a top wall 112, a bottom wall 114, and a pair of side walls 116 that surround a cavity. A number of openings are provided in the housing 102 to receive fasteners, seals, and components of the control assembly 104. A conductor opening 118 is provided in the back wall 110 and a recessed area is formed around the conductor opening 118. More than one conductor opening 118 can be provided in various locations on the housing 102. Knock-outs may be used to provide selective openings for conductors and other components. One or more fins 120 extend from the back wall 110 to increase the heat transfer from the housing 102.

[0054] FIGS. 21 and 22 show an exemplary mounting assembly 122 associated with the housing 102 used to attach the luminaire 100 to a structure, for example a wall, post, or other type of support. The mounting assembly 122 includes a gasket 124, a mounting plate 126, and a mounting bracket 128. The mounting plate 126 and the gasket 124 include different openings to allow for different connections. The gasket 124 is placed against the structure and the mounting plate 126 is attached to the structure, for example through straps, bolts, screws, or other fasteners. The mounting bracket 128 is secured to the housing 102. The mounting plate 126 includes a base 130 and one or more angled walls 132 extending from the base 130. The mounting bracket 128 includes an angled tab 134 that engages the angled walls 132 of the mounting plate 126. After the

mounting plate 126 is connected to a structure, the housing 102 can be positioned adjacent the mounting plate 126 and the angled tab 134 of the mounting bracket 128 can engage the angled wall 132 of the mounting plate 126. The angled surfaces allow the housing 102 to slide down onto the mounting plate 126, providing easier mounting and forming a close engagement with the structure. One or more set screws can be used to secure the mounting plate 126 to the mounting bracket 128.

[0055] As best shown in FIGS. 21 and 22, a conductor gasket 136 can be connected to the housing 102. The conductor gasket 136 is positioned in the recess in the housing 102 around the conductor opening 118. The conductor opening 118 aligns with openings on the mounting plate 126 and the gasket 124 so that conductors can be feed into the housing 102. The conductor gasket 136 protects the conductors from wear and can also prevent water from entering the housing 102.

[0056] A variety of components and configurations can be used in connection with the luminaire 100 as desired by a user. FIGS. 23-27 show exemplary embodiments of different control assemblies 104A-D that can be incorporated in the housing 102. Each of the exemplary control assemblies 104A-D can utilize a photo-detector 138 and a motion or occupancy sensor 140 positioned in and extending through the housing 102. Additional and alternative sensors can be used as would be understood by one of ordinary skill in the art.

[0057] FIGS. 23-25 show exemplary control assemblies 104A-B that utilize a single first driver 142. In an exemplary embodiment, the first driver 142 runs at approximately 1050 mA. In the first control assembly 104A, the first driver 142 is positioned so that a major surface is substantially parallel to the back wall of the housing 102. FIGS. 24 and 25 show a control assembly 104B that includes the first driver 142, a backup battery unit 144, and a surge protector 146. The backup battery unit 144 can include a housing, a rechargeable battery, and circuitry to control the charging and discharging of the battery. The first driver 142 is connected to a bracket 148 and is oriented so that a major surface is substantially perpendicular to the back wall of the housing 102. The surge protector 146 can be connected to the back battery unit 144 and/or the driver 142. The

backup battery unit 144 and the surge protector 146 can also be incorporated into any of the other control assemblies 104C-D.

[0058] FIGS. 26 and 27 show exemplary control assemblies 104C-D that utilize dual drivers. FIG. 26 shows a pair of second drivers 150 that run at approximately 700 mA each. FIG. 27 shows a pair of third drivers 152 that runs at approximately 525 mA each. The second and third drivers 150, 152 are positioned so that a major surface is substantially parallel to the back wall of the housing 102. Different components and combinations of components can be used in different control assemblies, including different drivers, surge protectors, sensors, and/or wireless communication devices as required for different applications.

[0059] FIGS. 28-30 show an exemplary cover 106. The cover 106 includes a curved top edge, rounded corners, and angled sides that enclose a chamber. The cover 106 also includes a mounting section 154 for receiving at least a portion of the light assembly 108. One or more openings can extend through the mounting section 154 to receive fasteners. Openings can also be provided to increase heat transfer from the light assembly 108. In an exemplary embodiment, the mounting section 154 is recessed to receive the light assembly 108. The cover 106 can also include a mounting flange 156 to assist in connecting the cover 106 to the housing 102. The chamber includes a plurality of fins 158 to transfer heat from the light assembly 108. In an exemplary embodiment, the fins 158 are aligned with rows of light emitters. FIGS. 31-33 show an exemplary embodiment of a light assembly 108 connected to the cover 106.

[0060] FIGS. 34 and 35 show an exemplary embodiment of a light assembly 108 that includes an LED board 160, an LED board gasket 162, a bezel 164, a lens 166, and a lens gasket 168. The LED board 160 includes a printed circuit board (PCB) 170 and one or more light emitting devices, for example LEDs, connected to the PCB. One or more optics 172 can be connected to the PCB 170 over the LEDs to direct or diffuse the emitted light. The LED board gasket 162 is positioned between the LED board 160 and the bezel 164 to seal and protect the LED board 160. The LED board gasket 162 can be made from a polymer or elastomer material, for example silicone, although other

materials may be used. The bezel 164 can be made from a metal, although other materials may also be used. The lens 166 and lens gasket 168 can be connected to the LED board 160 or the bezel 164. The lens 166 is an optional component that can be connected depending on the desired use. The lens 166 can be colored and/or include light directing or diffusing elements such as prisms.

[0061] The foregoing detailed description of the certain exemplary embodiments has been provided for the purpose of explaining the general principles and practical application, thereby enabling others skilled in the art to understand the disclosure for various embodiments and with various modifications as are suited to the particular use contemplated. This description is not necessarily intended to be exhaustive or to limit the disclosure to the exemplary embodiments disclosed. Any of the embodiments and/or elements disclosed herein may be combined with one another to form various additional embodiments not specifically disclosed. Accordingly, additional embodiments are possible and are intended to be encompassed within this specification and the scope of the appended claims. The specification describes specific examples to accomplish a more general goal that may be accomplished in another way.

[0062] As used in this application, the terms “front,” “rear,” “upper,” “lower,” “upwardly,” “downwardly,” and other orientational descriptors are intended to facilitate the description of the exemplary embodiments of the present application, and are not intended to limit the structure of the exemplary embodiments of the present application to any particular position or orientation. Terms of degree, such as “substantially” or “approximately” are understood by those of ordinary skill to refer to reasonable ranges outside of the given value, for example, general tolerances associated with manufacturing, assembly, and use of the described embodiments.

What is Claimed:

1. A luminaire comprising:
 - a base;
 - a light support extending from the base having a mounting section;
 - a first set of fins in thermal communication with the mounting section; and
 - a second set of fins intersecting the first set of fins and in thermal communication with the mounting section.
2. The luminaire of claim 1, wherein the first and second set of fins are in contact with the mounting section and dissipate heat from the LED board.
3. The luminaire of claim 1, wherein the second set of fins is substantially orthogonal to the first set of fins.
4. The luminaire of claim 1, wherein the first set of fins includes a first section, a second section, and a third section, and an upper edge of the second section is spaced below an upper edge of the first and third sections.
5. The luminaire of claim 1, wherein at least one of the first set of fins extends beyond the mounting section.
6. The luminaire of claim 1, wherein at least one of the second set of fins extends beyond the mounting section.
7. The luminaire of claim 1, wherein a plurality of gaps are positioned between the base and the light support.
8. The luminaire of claim 1, wherein a control assembly is positioned in the base.
9. The luminaire of claim 1, wherein a cover is connected to the base.

10. A luminaire comprising:
 - a housing;
 - a control assembly positioned in the housing;
 - a cover connected to the housing having a mounting section and a chamber including a heat fin in thermal communication with the mounting section; and
 - a light assembly connected to the mounting section and operatively connected to the control assembly.
11. The luminaire of claim 10, wherein the housing includes a conductor opening.
12. The luminaire of claim 11, wherein a recessed is formed around the conductor opening and a conductor gasket is positioned in recess.
13. The luminaire of claim 10, wherein the control assembly includes a photo sensor and an occupancy sensor.
14. The luminaire of claim 10, wherein the control assembly includes a driver.
15. The luminaire of claim 10, wherein the control assembly includes a first driver and a second driver.
16. The luminaire of claim 10, wherein the cover includes a mounting flange.
17. A luminaire comprising:
 - a housing;
 - a control assembly positioned in the housing;
 - a cover connected to the housing;
 - a light assembly operatively connected to the control assembly; and
 - a mounting assembly including a mounting plate connectable to a surface and a mounting bracket connected to the housing.

18. The luminaire of claim 17, wherein the mounting plate includes an angled wall and the mounting bracket includes an angled tab for engaging the angled wall.
19. The luminaire of claim 17, wherein a gasket is positioned between the mounting plate and the surface.
20. The luminaire of claim 17, wherein the housing includes a conductor opening and the conductor opening is aligned with an opening in the mounting plate.

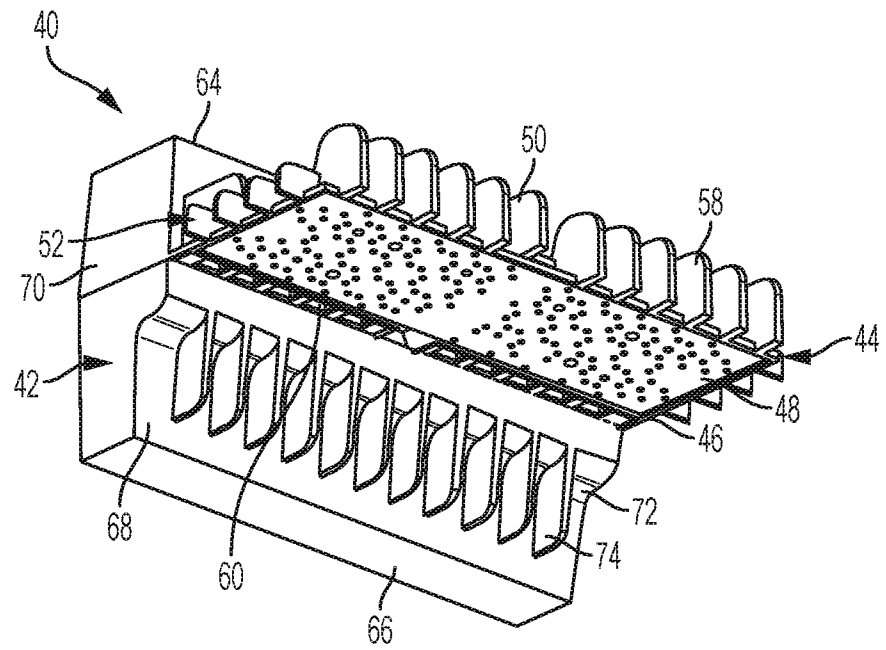


FIG. 1

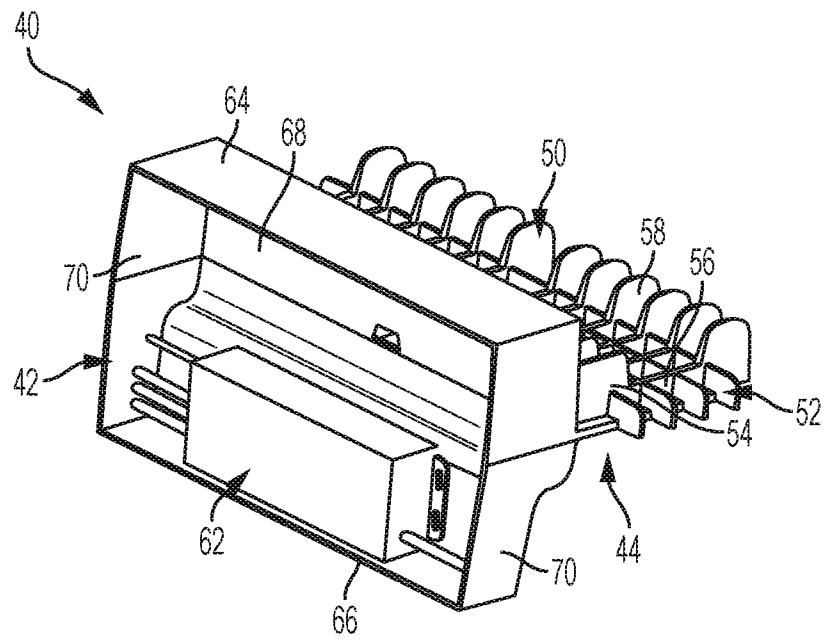


FIG. 2

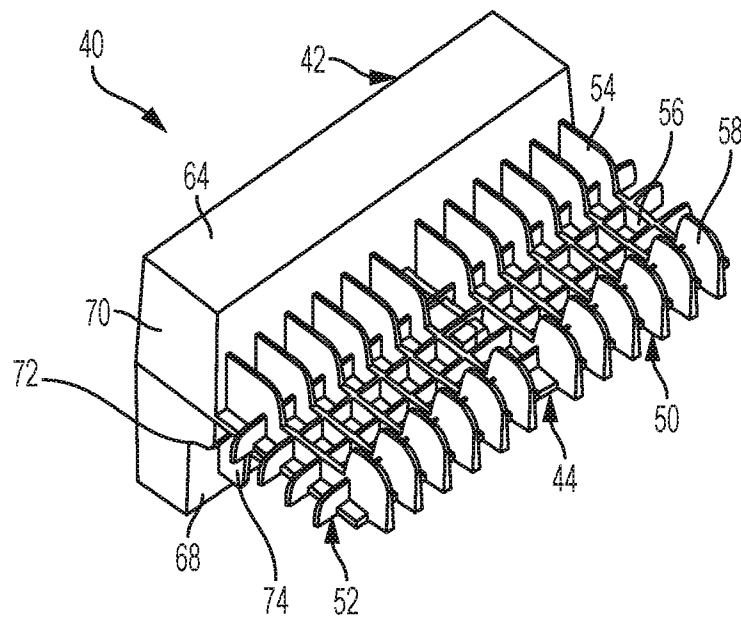


FIG. 3

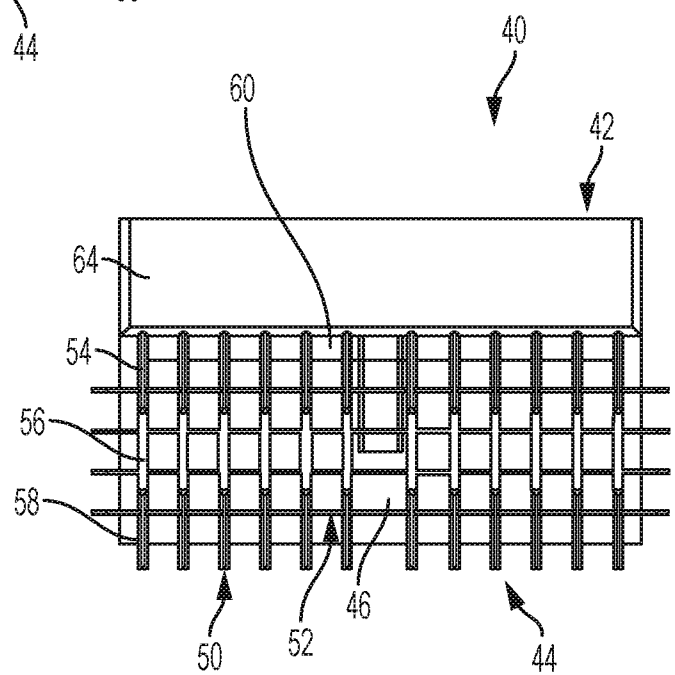


FIG. 4

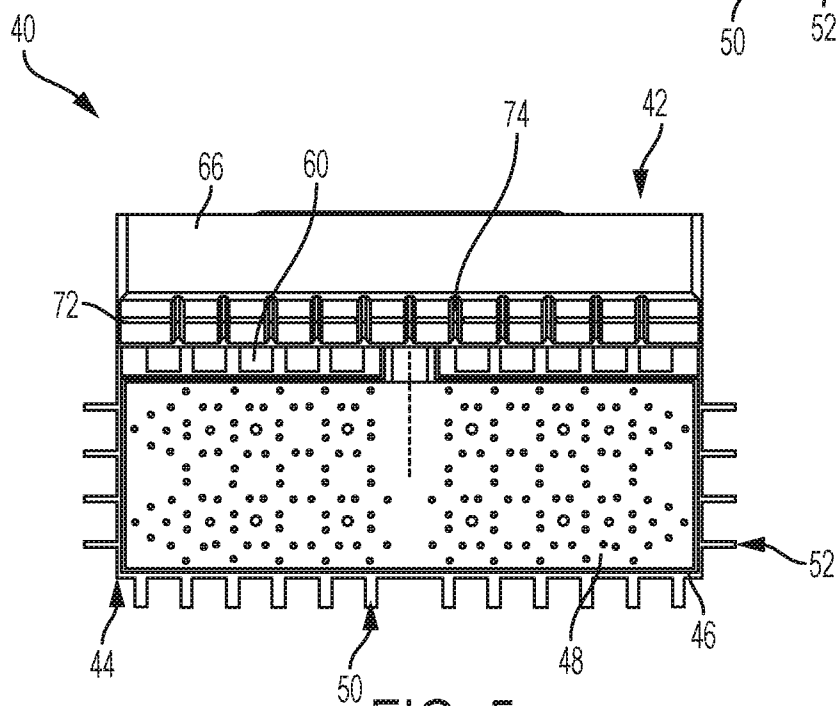


FIG. 5

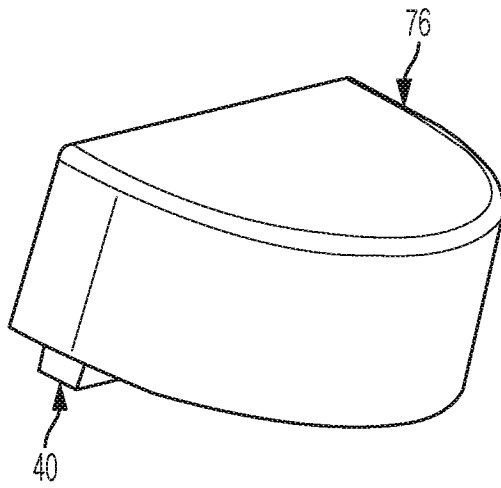


FIG. 6

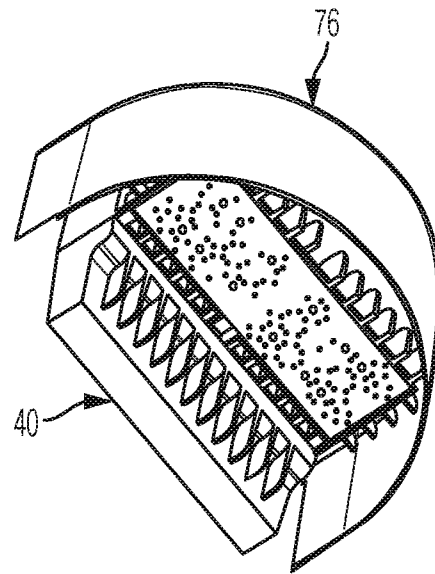


FIG. 7

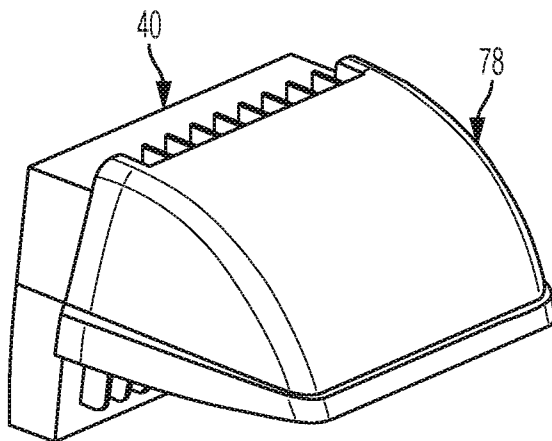


FIG. 8

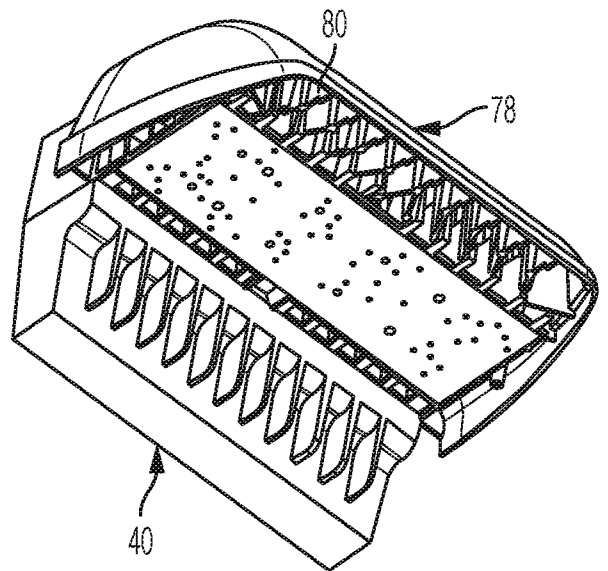


FIG. 9

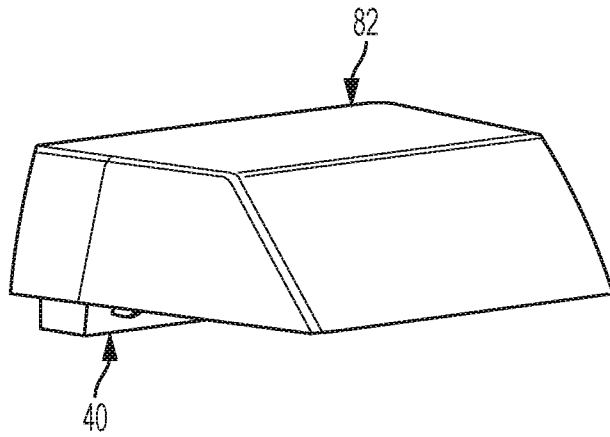


FIG. 10

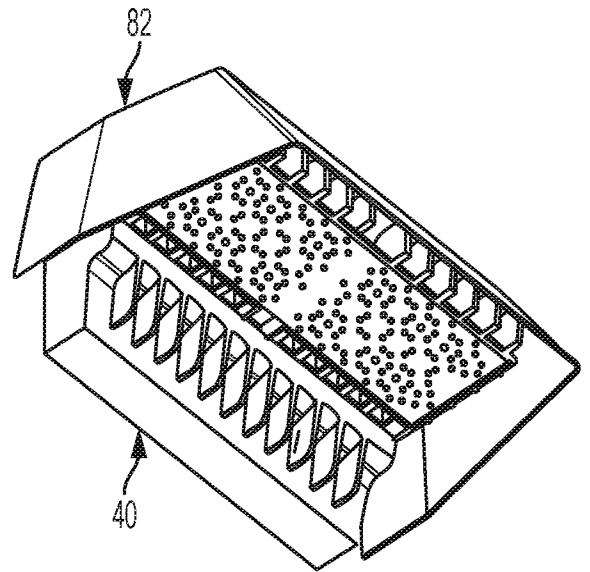


FIG. 11

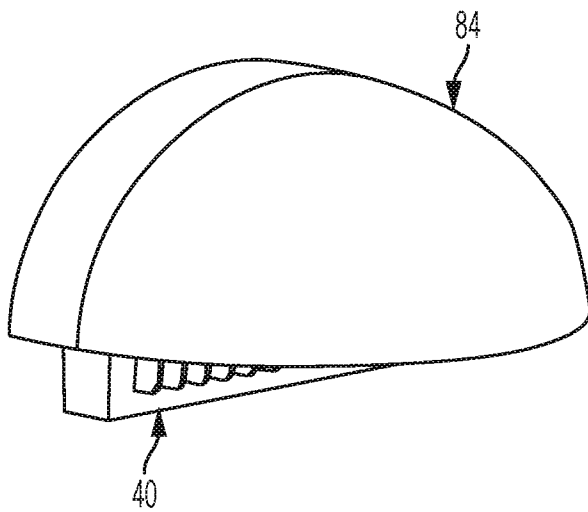


FIG. 12

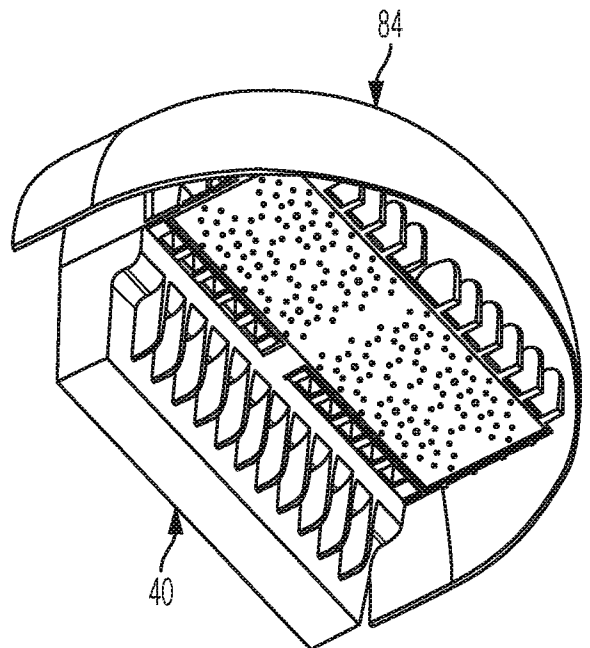


FIG. 13

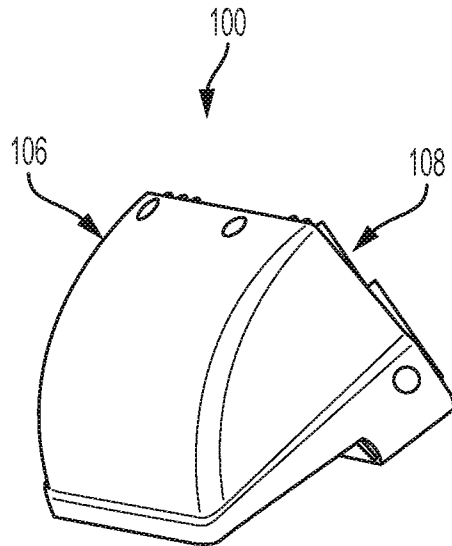


FIG. 14

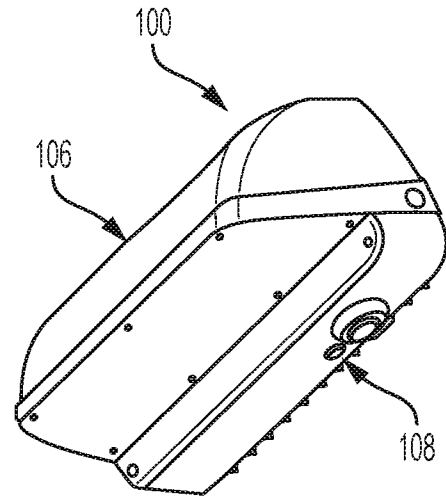


FIG. 15

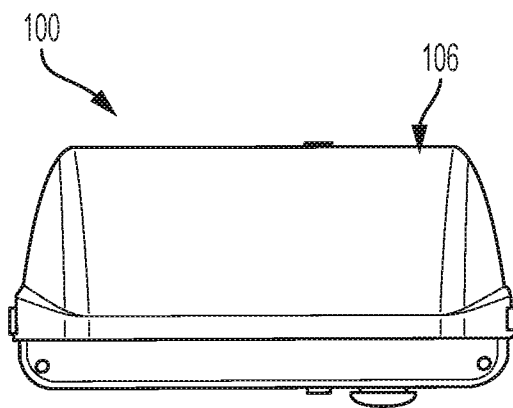


FIG. 16

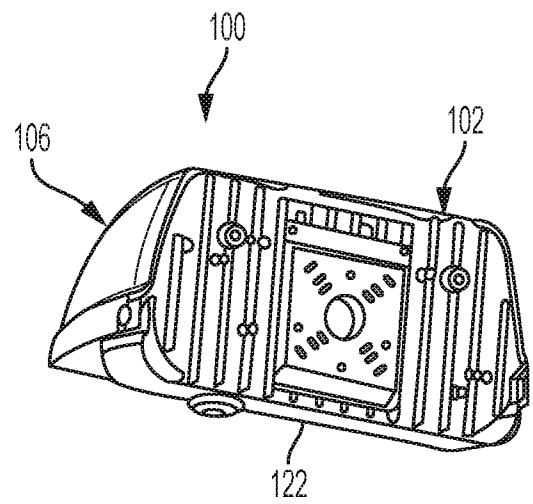


FIG. 17

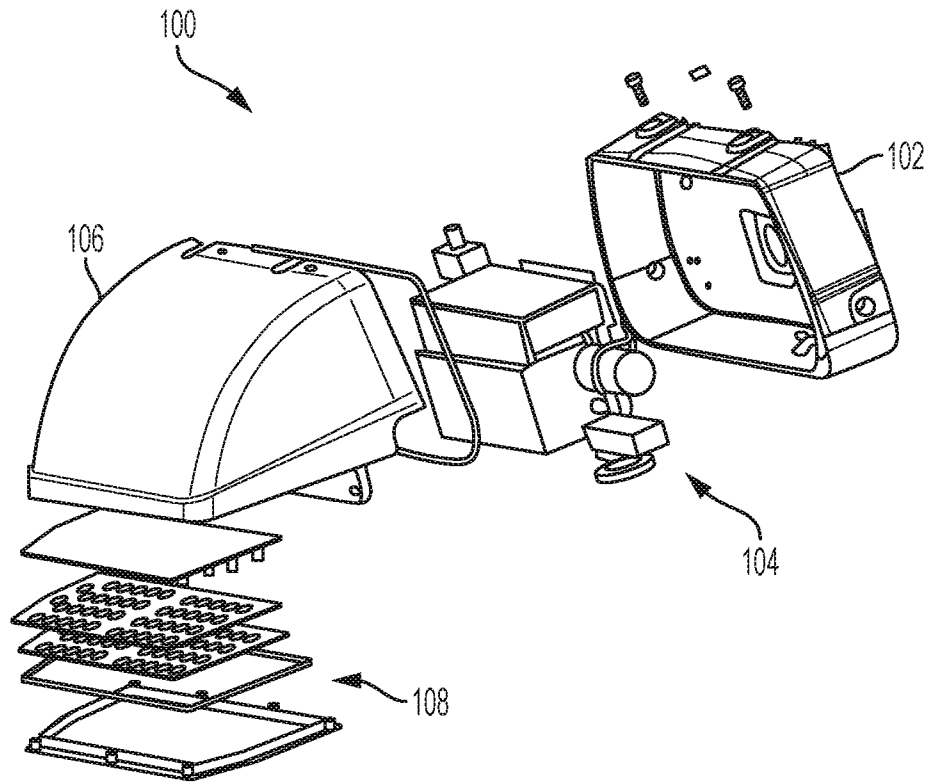


FIG. 18

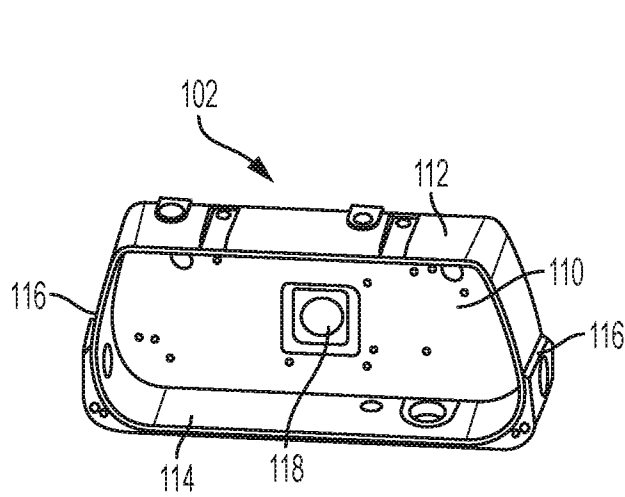


FIG. 19

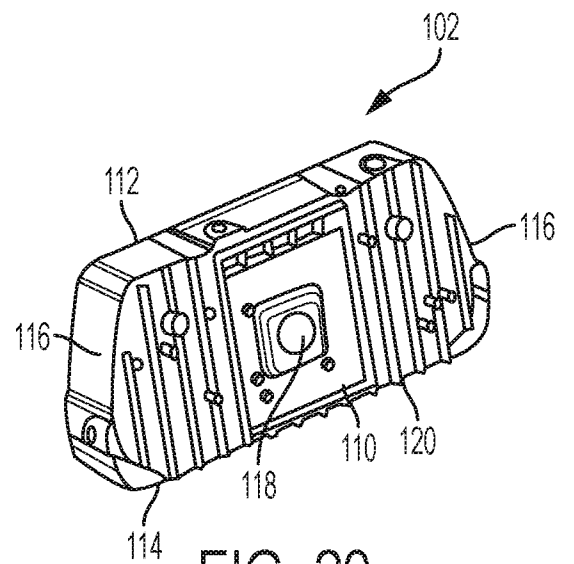


FIG. 20

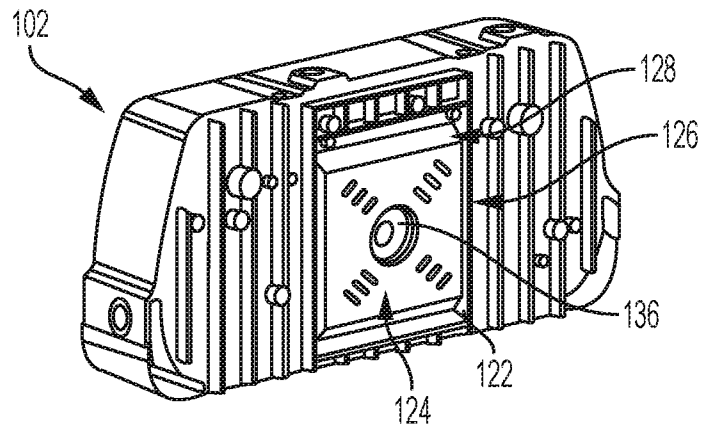


FIG. 21

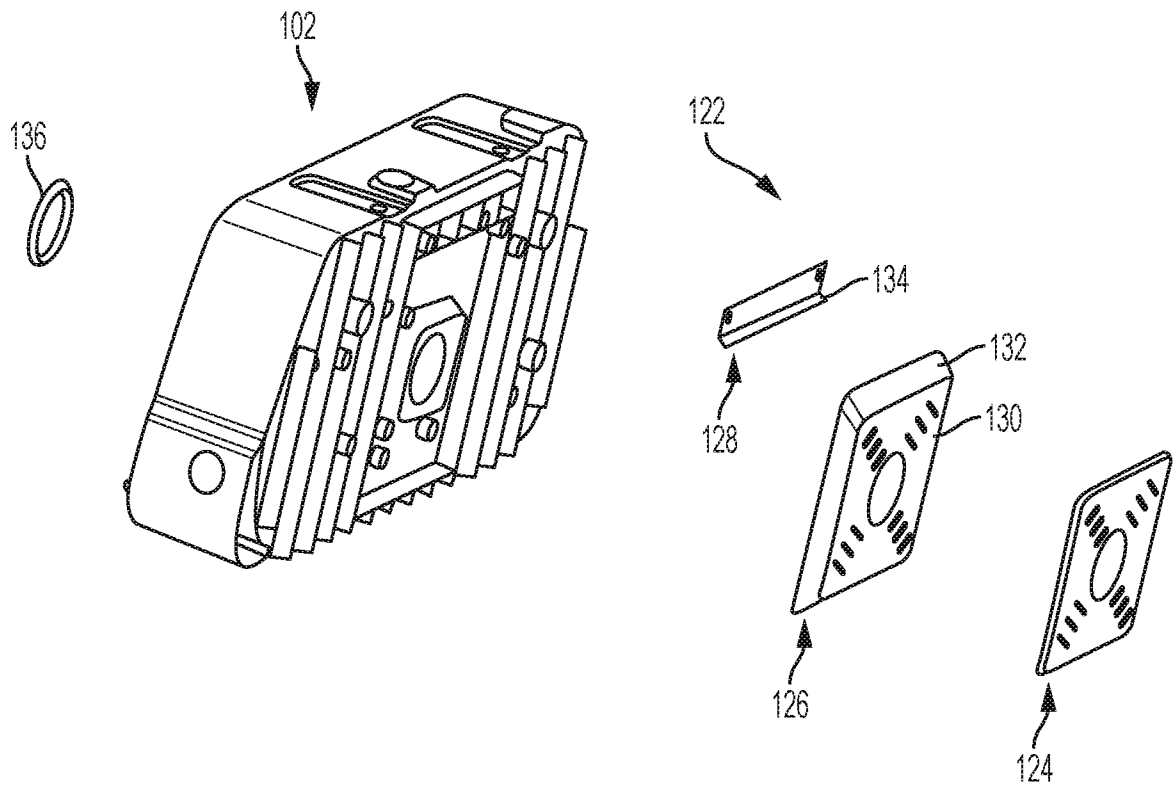


FIG. 22

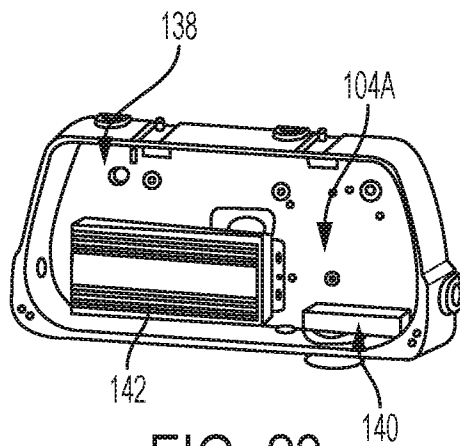


FIG. 23

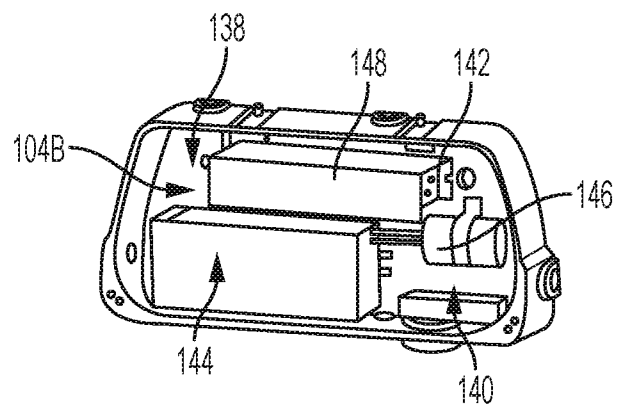


FIG. 24

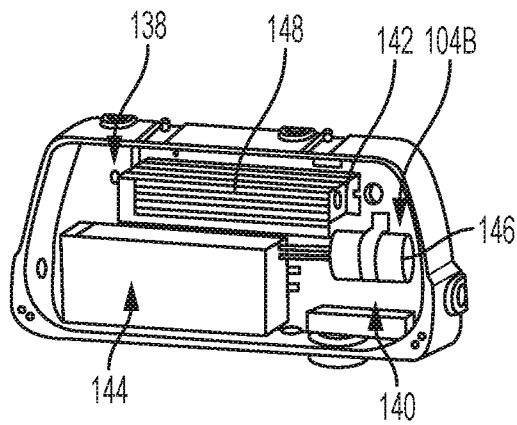


FIG. 25

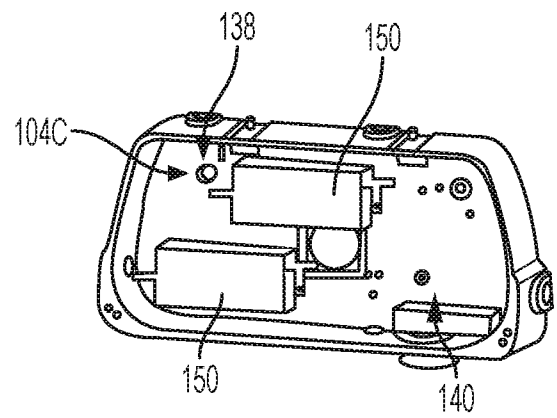


FIG. 26

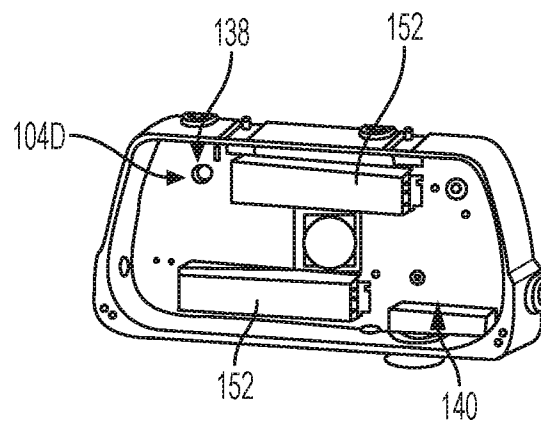


FIG. 27

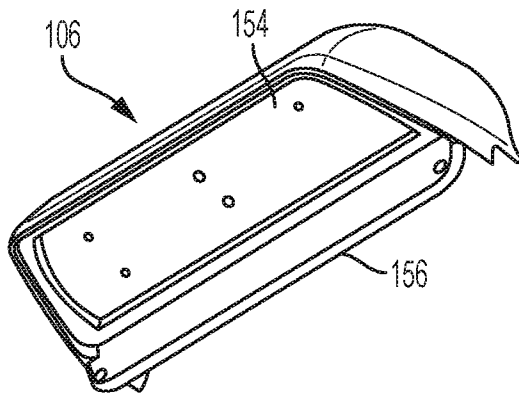


FIG. 28

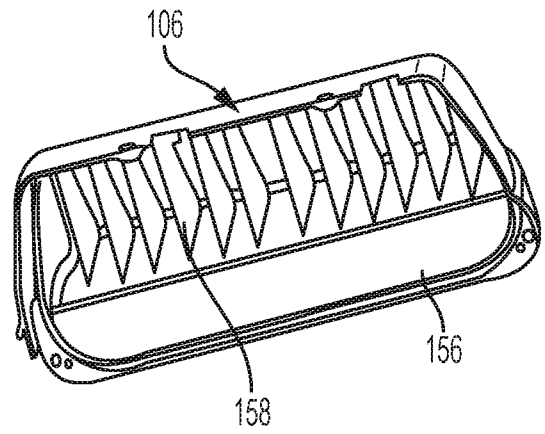


FIG. 29

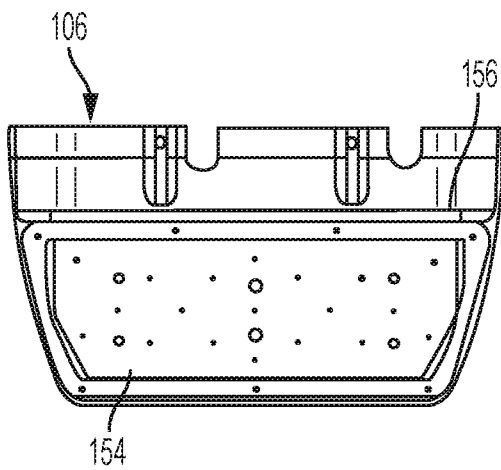


FIG. 30

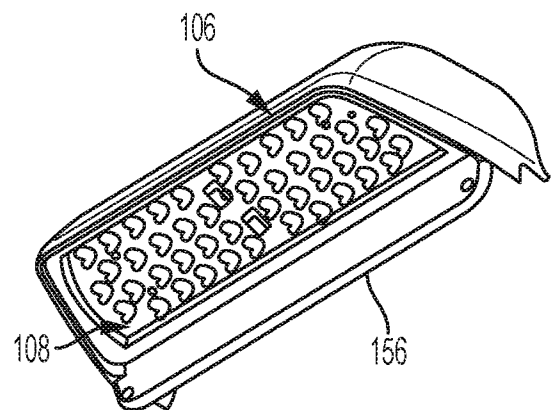


FIG. 31

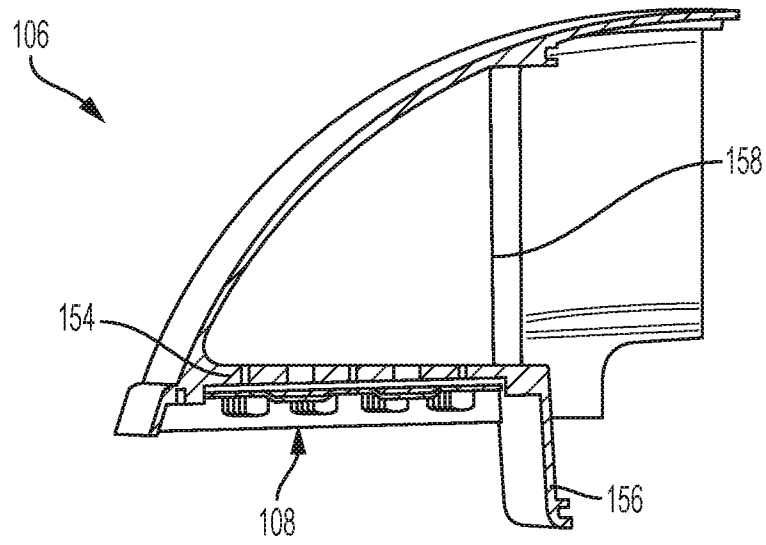


FIG. 32

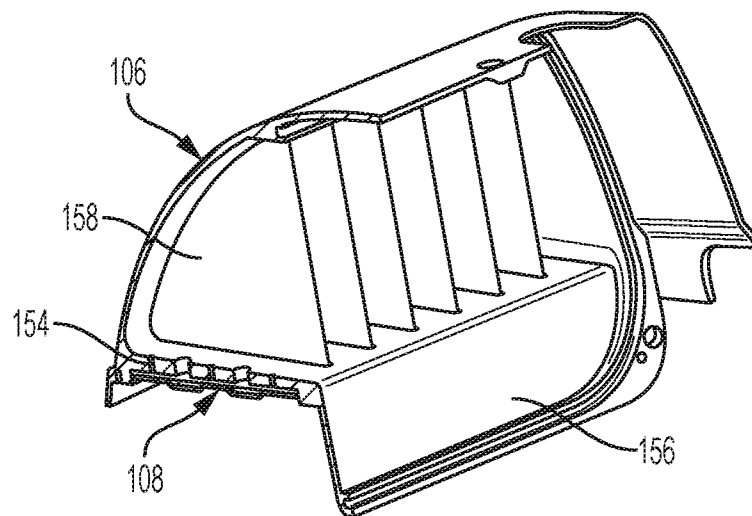


FIG. 33

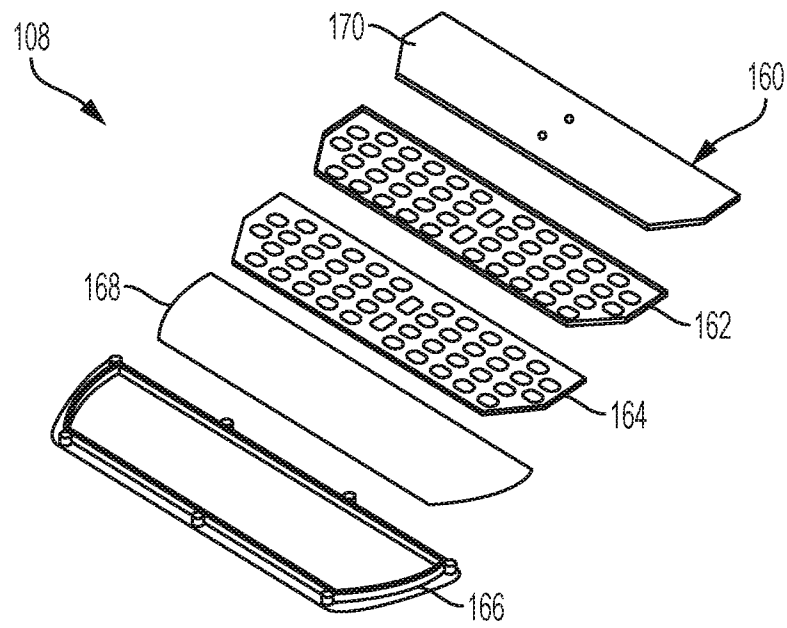


FIG. 34

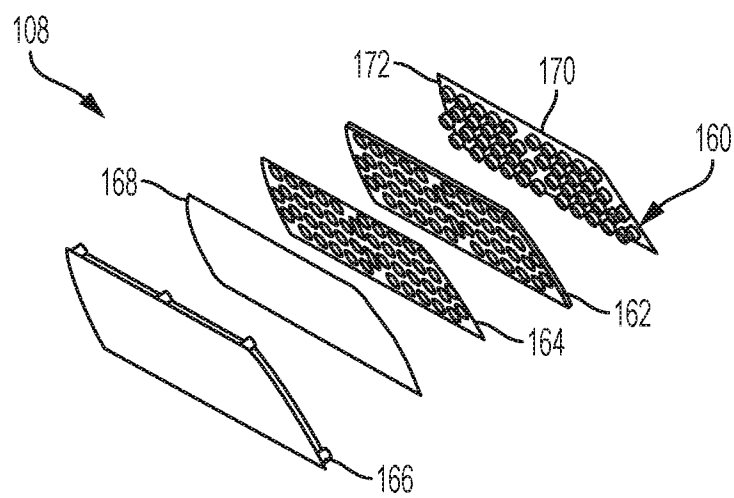


FIG. 35

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/27067

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F21V 29/00, F21V 29/50, F21V 29/70, F21V 29/74, F21V 29/76 (2016.01)

CPC - F21V 29/50, F21V 29/70, F21V 29/74, F21V 29/745, F21V 29/76, F21V 29/763, F21V 29/767

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)

IPC(8): F21V 29/* (2016.01)

CPC: F21V 29/*

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

IPC(8): F21V* (2016.01)

CPC: F21V*

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

PatBase, Google Patents, Google Web

Keywords: luminaire, LED, fins, second, cover, control, orthogonal, intersecting

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/0085902 A1 (HIGUCHI et al.) 27 March 2014 (27.03.2014), entire document	1-9
A	US 8,419,217 B2 (LU et al.) 16 April 2013 (16.04.2013), entire document	1-9
A	US 2012/0087118 A1 (BAILEY et al.) 12 April 2012 (12.04.2012), entire document	1-9
A	US 8,814,398 B2 (KANG et al.) 26 August 2014 (26.08.2014), entire document	1-9
A	EP 2187121 B1 (VALEO VISION) 03 December 2014 (03.12.2014), entire document	1-9
A,P	US 2015/0345772 A1 (DUCKWORTH et al.) 03 December 2015 (03.12.2015), entire document	1-9

☐ Further documents are listed in the continuation of Box C.


* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

01 August 2016

Date of mailing of the international search report

06 SEP 2016

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

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Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/27067

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-9 directed to a luminaire comprising a first set of fins and a second set of fins.

Group II: Claims 10-20 directed to a luminaire comprising a control assembly and a cover.

---See Supplemental Box---

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
Claims 1-9

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/27067

---Continued from Box III---

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because under PCT Rule 13.2 they lack the same or corresponding technical features for the following reasons:

Group I does not include the technical features of a control assembly or a cover, as required by Group II.

Group II does not include the technical feature of a second set of fins, as required by Group I.

The common features between Group I and Group II of:

a luminaire comprising: a housing, a light assembly connected to the housing, and a heat fin in thermal communication with the housing are taught by US 2014/0085902 A1 to HIGUCHI et al. (hereinafter 'Higuchi').

Higuchi teaches a luminaire (luminaire 1) comprising: a housing (main body 10), a light assembly (light source 40) connected to the housing (para [0023]: light source 40 provided on the inside of the main body 10), and a heat fin in thermal communication (para [0109]: convection of air along the Z direction of the first fins 16) with the housing (para [0028]: heat fins 16 are provided on the upper surface of the light-source housing section 11).

Therefore, the common features are not an improvement over the prior art.

Unity of invention is lacking under PCT Rule 13.2, because Groups I and II do not share a same or corresponding special technical feature providing a contribution over prior art.