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(54) Title: AREA LUMINAIRE WITH HEAT FINS

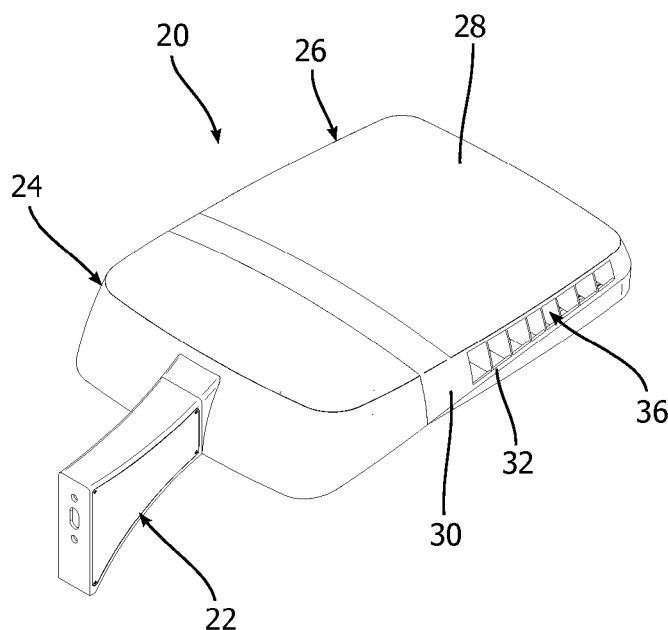


FIG. 2

(57) Abstract: A luminaire includes a housing, a plurality of fins, and an LED module. The housing includes a first compartment having a top wall, a side wall extending from the top wall, and a first opening in the side wall. The plurality of fins is positioned in the first compartment so that at least one fin is in communication with the first opening. The LED module is connected to at least one of the heat fins and includes a PCB, a bezel, and at least one LED.



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AREA LUMINAIRE WITH HEAT FINS

CLAIM TO PRIORITY

[0001] This application is based on U.S. Provisional Application Serial No. 62/005,665, filed May 30, 2014, 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 light fixtures or luminaires, for example external area light fixtures designed to illuminate streets, paths, parking lots, or other areas.

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 roads, walkways, parks, parking lots, or other large areas requiring a significant amount of lighting. 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 housing, a plurality of fins, and an LED module. The housing includes a first compartment having a top wall, a side wall extending from the top wall, and a first opening in the

side wall. The plurality of fins is positioned in the first compartment so that at least one fin is in communication with the first opening. The LED module is connected to at least one of the heat fins and includes a PCB, a bezel, and at least one LED.

[0005] According to another exemplary embodiment, a luminaire includes a housing, a plurality of fins, and an LED assembly. The housing includes a first compartment having an interior, a top wall, a side wall extending from the top wall, and an opening in the side wall. The plurality of fins is positioned in the interior of the housing. The plurality of fins has a plurality of bottom surfaces substantially planar with one another. The LED assembly is connected to at least one of the fins.

[0006] According to another exemplary embodiment, a luminaire includes a housing, a plurality of fins, and an LED module. The housing includes a first compartment having a top wall. A side wall extends from the top wall. The side wall has a first opening and the top wall has a second opening. A plurality of fins are positioned in the first compartment so that at least one fin is in communication with the first opening. An LED module is connected to at least one of the heat fins including a PCB, a bezel, and at least one LED.

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 top, front perspective view of a luminaire according to an exemplary embodiment;

[0009] FIG. 1A is an enlarged view of section A of FIG. 1;

[0010] FIG. 2 is a top, rear perspective view of the luminaire of FIG. 1;

[0011] FIG. 3 is a bottom, front perspective view of the luminaire of FIG. 1;

[0012] FIG. 4 is a side view of the luminaire of FIG. 1;

[0013] FIG. 5 is a top view of the luminaire of FIG. 1;

[0014] FIG. 6 is a bottom view of the luminaire of FIG. 1;

[0015] FIG. 7 is a front view of the luminaire of FIG. 1;

[0016] FIG. 8 is a rear view of the luminaire of FIG. 1;

- [0017] FIG. 9 is a bottom view of the luminaire of FIG. 1 with an LED module removed;
- [0018] FIG. 9A is an enlarged view of section A of FIG. 9;
- [0019] FIG. 10 is a bottom view of the luminaire of FIG. 9;
- [0020] FIG. 10A is an enlarged view of section A of FIG. 10;
- [0021] FIG. 11 is a bottom perspective view of the luminaire of FIG. 1 with all of the LED modules removed;
- [0022] FIG. 11A is an enlarged view of section A of FIG. 11; and
- [0023] FIG. 12 is a bottom view of the luminaire of FIG. 11.
- [0024] FIG. 13 is a top, front perspective view of another exemplary luminaire;
- [0025] FIG. 14 is a top, rear perspective view of FIG. 13;
- [0026] FIG. 15 is a bottom, front perspective view of FIG. 13;
- [0027] FIG. 16 is a left side view of FIG. 13;
- [0028] FIG. 17 is a top view of FIG. 13;
- [0029] FIG. 18 is a bottom view of FIG. 13;
- [0030] FIG. 19 is a bottom view of an exemplary arm and first compartment;
- [0031] FIG. 20 is an exploded view of FIG. 19;
- [0032] FIG. 21 is a top perspective view of the first compartment and an exemplary door;
- [0033] FIG. 22 is a bottom perspective view of FIG. 21 with the door in an open position;
- [0034] FIG. 23 is a bottom perspective view of the exemplary first and second compartments;
- [0035] FIG. 24 is an exploded view of FIG. 23;
- [0036] FIG. 25 is a top perspective view of FIG. 24;

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0037] According to various exemplary embodiments, a luminaire includes a housing 20 having an arm 22, a first compartment 24, and a second compartment 26. The arm 22 connects the housing 20 to a wall, post, or other support or structure so that the luminaire can direct light to a given area. In an exemplary embodiment,

the first compartment includes one or more electronic components and the second compartment includes one or more light sources. For example, the first compartment 24 houses one or more drivers (not shown) and other necessary equipment to supply power to light emitters contained in or otherwise connected to the second compartment 26. The second compartment 26 can be configured to contain a variety of light emitters in different patterns based on the desired use and light output. The positions of the first and second compartments 24, 26 may vary as needed.

[0038] In various exemplary embodiments the housing 20 is made from aluminum, although other metal, polymer, or composite materials may also be used. The housing 20 may be integrally formed or formed in separate sections and attached to one another. A lens, diffuser, or other cover (not shown) may be connected to the housing 20 positioned beneath the light emitters. The housing 20 can have various shapes, sizes, and configurations as needed.

[0039] According to various exemplary embodiments, the second compartment 26 includes a top wall 28, and a side wall 30 extending at least partially around the top wall 28 to define an interior. The top wall 28 is a substantially continuous structure, although different configurations may be used depending on the housing 20. In other exemplary embodiments different numbers of sidewalls can be used, including a continuous sidewall having a first side, a second side, and a front. The top wall 28 and the side wall 30 may be integrally formed or formed in separate sections and connected to one another. The side wall 30 includes a first opening 32 on a first side and a second opening 34 on a second side. In the illustrated exemplary embodiment, the first and second openings 32, 34 extend through the side wall 30 to the interior and have a substantially trapezoidal shape with sides that taper along the length of the second compartment 26. In alternative embodiments, the size, shape, and configuration of the first and second openings 32, 34 is varied depending on the housing, the light emitters, and the desired light output and performance of the luminaire.

[0040] As best shown in FIGS. 9-12, and in accordance with further exemplary embodiments, the interior of the second compartment 26 includes a plurality of fins 36 spaced from one another by gaps. One or more fins 36 extend down from a bottom surface of the top wall 28, extending from the first side to the second side of the side wall 30. In various exemplary embodiments, the fins 36 can extend from the front to back or diagonally across the housing 20. The fins 36 are at least partially exposed to the outside of the second compartment 26 on the bottom and one or more of the fins 36 can be in communication with the first and second openings 32, 34, for example in thermal and/or fluid communication. In an exemplary embodiment one or more of the fins 36 are exposed to the outside of the second compartment 26 on the sides through the openings 32, 34.

[0041] In various exemplary embodiments, the fins 36 are connected to the bottom surface of the top wall 28, spaced from the bottom surface of the top wall 28, or any combination thereof. The bottoms of the fins 36 are substantially planar to one another so that the overall height of each fin 36 may vary according to the curve or taper of the second compartment 26. One or more fins 36 include at least one substantially planar portion 38 and at least one embossed or enlarged portion 40. According to an exemplary embodiment, one or more interval fins 42 does not include any embossed portion 40 and does not extend across the entire second compartment 26. The interval fin 42 can be configured similar to the other fins 36 as required. As best shown in FIG. 12, the interval fin 42 has a first, second, and third portion spaced by a first and second gap. The fins 36 are made from metal, for example aluminum. The fins 36 and the may be formed integrally with the second compartment 26 or formed separately and attached to the second compartment 26, for example through welding or fasteners. In various alternative embodiments, the size shape and configuration of the fins 36 can be varied depending on the housing and the required heat dissipation. The fins 36 may also be adapted to be used with different housings and types of luminaires.

[0042] As best shown in FIGS. 3, 6, and 9-10, and in accordance with further exemplary embodiments, the second compartment 26 contains one or more light

emitters. In the exemplary embodiment shown, the light emitters are a plurality of light emitting diode (LED) modules 44. The luminaire may utilize other light sources, for example other solid state, electrical filament, fluorescent, plasma, or gas light sources. In an exemplary embodiment, the LED modules 44 include one or more LED light source connected to a printed circuit board (PCB) (not shown). The LED light sources can include a dome-shaped lens surrounding one or more light generating elements and necessary circuitry. Various types of LED modules may be used depending on the performance requirements and the desired output as would be understood by one of ordinary skill in the art.

[0043] According to an exemplary embodiment, an optic 46 is positioned over each LED light source to direct or diffuse the emitted light. The optic 46 may be moveable, for example rotatable and angled, with respect to the PCB. Groups of LED modules 44 can be used, for example the front and rear right modules and front and rear left modules – as shown in FIGS. 3 and 5. The LED modules 44 may be arranged in different groupings and patterns depending on the housing 20 and the desired light output.

[0044] The LED modules 44 are connected to a power source, such as a driver housed in the first compartment 24. The PCB includes traces or pathways to provide power to the LEDs. A backing member or bezel 50, for example a sheet metal backing layer or enclosure at least partially encloses and at least partially isolates the PCB in the second compartment 26. As best shown in FIGS. 9-10, and according to various exemplary embodiments, the bezel 50 covers the top, sides, and bottom of the PCB and has openings to allow the optics 46 to extend through the bezel 50. The bezel 50 may be configured to seal the perimeter of the PCB. The various sizes and shapes of the PCB, as well as the various light sources, materials, and other configurations used in connection with the PCB, would be understood by one of ordinary skill in the art.

[0045] According to various exemplary embodiments, the LED modules 44 are connected to the bottom surface of the fins 36, to the top or sides of the second compartment 26, or any combination thereof. The LED modules 44 are connect to

the fins 36 or second compartment 26 by mechanical fasteners, for example mounting screws or bolts, or other available mechanical or chemical connections. In an exemplary embodiment where the bottom surfaces of the fins 36 are substantially planar, the LED modules 44 extend substantially planar to one another, for example in a horizontal plane substantially parallel to the ground, although the LED modules 44 can also be obliquely angled to the ground. As best shown in FIGS. 9 and 9A, and according to various exemplary embodiments, the LED modules 44 are spaced so that at least a portion of the fins 36 are exposed on the bottom. The fins 36 are designed to dissipate heat from the LEDs and the configuration of the second compartment 26, fins 36, and LED modules 44 allows air to flow underneath of the housing 20, through the interior, and through the first and second openings 32, 34.

[0046] According to an exemplary embodiment, an embossed portion 40 of the fins 36 extends substantially over each LED package and the interval fin 42 is positioned along the intersection of the front and rear LED modules 44. The embossed portion 40 creates a larger surface area that allows heat to be more efficiently dissipated from the LEDs.

[0047] According to various exemplary embodiments, one or more drivers connect to the one or more LED modules 44. For example, a single driver may power the four LED modules 44 shown in FIGS. 3 and 5 or separate drivers may power each LED module 44. As best shown in FIGS. 11-12, and according to an exemplary embodiment, one or more of the fins 36 includes one or more channels, for example a first channel 52A and a second channel 52B to act as a conductor path. The first channel 52A provides a path to the left side LED modules 44 and second channel 52B provides a path to the right side LED modules 44. The interval fin 42 may also include one or more gaps or channels to allow conductors to pass to the front LED module 44. In alternative embodiments, spacing may be provided between the top of the PCB and the bezel 50 to allow conductors to pass from the conductor compartments to the LED modules 44 or openings may be included through the heat fins 36.

[0048] FIGS. XXX show another exemplary luminaire that includes a housing 110, an arm 112, and one or more light emitter assemblies connected to the housing. The housing includes a first compartment 116 and a second compartment 118. The arm 112 connects the housing 110 to a wall, post, or other support or structure so that the luminaire can direct light to a given area. In an exemplary embodiment, the first compartment 116 includes one or more electronic components and the second compartment includes one or more light sources. For example, the first compartment 116 houses one or more drivers (not shown) and other necessary equipment to supply power to light emitters 114 contained in or otherwise connected to the second compartment 118. The second compartment 118 can be configured to contain a variety of light emitters in different patterns based on the desired use and light output. The positions of the first and second compartments 116, 118 may vary as needed.

[0049] In various exemplary embodiments the housing 110 is made from aluminum, although other metal, polymer, or composite materials may also be used. The housing 10 may be integrally formed or formed in separate sections and attached to one another. A lens, diffuser, or other cover (not shown) may be connected to the housing positioned beneath the light emitters. The housing can have various shapes, sizes, and configurations as needed.

[0050] In an exemplary embodiment, the arm 112 is removably connected to the housing 110. The arm 112 includes a first mounting component 120 that engages with a second mounting component 122 on the housing. The arm 112 is initially connected to a structure, for example by one or more fasteners. The housing 110 is then connected to the arm 112, eliminating the need to hold and manipulate the entire luminaire housing during connection. In an exemplary embodiment, the arm 112 includes a projection that mates with a slot in the housing 10, so that the housing 110 can be slidably engaged with the arm 112. The housing 110 can then be further secured with fasteners. Other mounting connections can be used. The arm 112 can also include a removable panel that allows a user access to the interior of the arm, for example to access wiring.

[0051] The first compartment 116 includes a top wall 124, a side wall 126 extending at least partially around the top wall 124, and a door 128. One or more fins can extend from the top wall 124 to transfer heat from the electronic components. A sensor, for example a photo controller, extends through the top wall 124. The door 128 is removeably connected to the housing 110, for example with fasteners, to provide access to the first compartment 116. The door 128 can also be pivotally connected to the first compartment 116 through a hinge member 130. The door includes a recess that can optionally receive a sensor, for example an occupancy sensor or a camera. One or more gaskets can be used to seal a portion of the first compartment 116. A series of openings 130 can be provided, for example in the door 128, to allow fluid to pass through the housing 110.

[0052] The second compartment 118 includes a top wall 134, and a side wall 136 extending at least partially around the top wall 134 to define an interior. The top wall 134 is a substantially continuous structure, although different configurations may be used depending on the housing 110. In other exemplary embodiments different numbers of side walls 136 can be used, including a continuous side wall having a first side, a second side, and a front.

[0053] The first compartment 116 is connected to the second compartment 118, for example through corresponding first and second mounting features 138, 140. The first mounting feature 138 can extend from the first compartment 116 and the second mounting feature 140 can be positioned on the second compartment 118.

[0054] A top opening 142 extends through the top wall 124. The top opening 142 has a substantially rectangular shape. The side wall 136 includes a first opening 144 on a first side and a second opening 146 on a second side. In the exemplary embodiment, the first and second openings 44, 46 extend through the side wall 136 to the interior and have a substantially rectangular shape. In alternative embodiments, the size, shape, and configuration of the top, first, and second openings 142, 144, 146 is varied depending on the housing 110, the light emitters, and the desired light output and performance of the luminaire.

[0055] In accordance with further exemplary embodiments, the interior of the second compartment includes a plurality of fins 148 spaced from one another by gaps. One or more fins 148 extend down from a bottom surface of the top wall 134, extending from the first side to the second side of the side wall 136. In various exemplary embodiments, the fins 148 can extend from the front to back or diagonally across the housing 110. The fins 148 are at least partially exposed to the outside of the second compartment 118 on the bottom and one or more of the fins 148 can be in communication with the top, first and second openings 142, 144, 146, for example in thermal and/or fluid communication. In an exemplary embodiment one or more of the fins 148 are exposed to the outside of the second compartment 118 on the top and the sides through the openings.

[0056] In various exemplary embodiments, the fins 148 are connected to the bottom surface of the top wall 134, spaced from the bottom surface of the top wall 134, or any combination thereof. One or more fins 148 include an embossed or enlarged portion 150. The fins 148 may be formed integrally with the second compartment 118 or formed separately and attached to the second compartment 118, for example through welding or fasteners. In various alternative embodiments, the size shape and configuration of the fins 148 can be varied depending on the housing 110 and the required heat dissipation. The fins 148 may also be adapted to be used with different housings and types of luminaires.

[0057] The second compartment 118 contains one or more light emitters. In the exemplary embodiment shown, the light emitters are a plurality of light emitting diode (LED) modules 114. The luminaire may utilize other light sources, for example other solid state, electrical filament, fluorescent, plasma, or gas light sources. In an exemplary embodiment, the LED modules 114 include an LED board (not shown) having one or more LED light sources connected to a printed circuit board (PCB). The LED light sources can include a dome-shaped lens surrounding one or more light generating elements and necessary circuitry. Various types of LED modules 114 may be used depending on the performance requirements and the desired output as would be understood by one of ordinary skill in the art. According to an exemplary

embodiment, an optic is positioned over each LED light source to direct or diffuse the emitted light. The optic extends through a bezel, for example a sheet metal enclosure at least partially encloses the LED board. According to an exemplary embodiment, the bezel covers the bottom and sides of the LED board and has openings for the optics. The bezel can also cover the top of the LED board if required. The bezel also may be configured to seal the perimeter of the LED board. In certain exemplary embodiments, the bezel and the optics are sealed together, for example through adhesives or welding, such as ultrasonic welding, to form an integral unit. The various sizes and shapes of the PCB, as well as the various light sources, materials, and other configurations used in connection with the PCB, would be understood by one of ordinary skill in the art.

[0058] More than one LED modules 114 can be used, for example front and rear right modules and front and rear left modules. The LED modules 114 may be arranged in different groupings and patterns depending on the housing and the desired light output. The LED modules 114 can be designed to emit light in a certain direction. For example, the optics can include light directing features that focus light in a uniform direction, for example toward the front of the housing. To modify the light output, the light modules can be removed and rotated so that the optics direct the light in a new direction. The exemplary, substantially square LED modules 114 shown can be adjusted ninety degrees at a time. Different shapes and configurations of LED modules 114 can allow for different rotation angles, for example a hexagonal LED module could be rotated sixty degrees.

[0059] According to various exemplary embodiments, the LED modules 114 are connected to the bottom surface of the fins 148, to the top or sides of the second compartment 118, or any combination thereof. The LED modules 114 are connected to the fins 148 or second compartment by mechanical fasteners, for example mounting screws or bolts, or other available mechanical or chemical connections. In an exemplary embodiment, one or more bosses 152 extend from the top wall and receive fasteners to connect the LED modules 114. According to various exemplary embodiments, the LED modules 114 are spaced so that at least a portion of the fins

are exposed on the bottom. The fins are designed to dissipate heat from the LEDs and the configuration of the second compartment, fins, and LED modules 114 allows air to flow underneath of the housing 120, through the interior, and through the top, first, and second openings. In an exemplary embodiment, boundary walls 154 are positioned between the LED modules 114 and the top openings. The boundary wall 154 helps separate the LED modules 114 from the openings and provide protection from elements such as dirt or other debris and water. The boundary wall 154 can extend all the way to the top wall 134, or a top edge of the boundary wall 154 can be spaced from the top wall 134 to increased airflow around the LED modules 114. The exact height of the boundary wall 154 can be varied depending on the application.

[0060] 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.

[0061] 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 housing including a first compartment having a top wall, a side wall extending from the top wall, and a first opening in the side wall;
 - a plurality of fins positioned in the first compartment so that at least one fin is in communication with the first opening; and
 - an LED module connected to at least one of the heat fins including a PCB, a bezel, and at least one LED.
2. The luminaire of claim 1, wherein
 - the housing further comprises an arm and a driver compartment housing a driver.
3. The luminaire of claim 2, wherein
 - the housing is unitarily formed.
4. The luminaire of claim 1, wherein
 - the first compartment further comprises a second opening opposite the second opening.
5. The luminaire of claim 1, wherein
 - the plurality of fins are spaced from one another by gaps.
6. The luminaire of claim 1, wherein
 - the plurality of fins extend from the top wall.
7. The luminaire of claim 1, wherein
 - at least one heat fin is in fluid communication with the first opening.

8. The luminaire of claim 1, wherein
at least one heat fin is in thermal communication with the first opening.
9. A luminaire comprising:
a housing including a first compartment having an interior, a top wall, a side wall extending from the top wall, and an opening in the side wall;
a plurality of fins positioned in the interior, the plurality of fins having a plurality of bottom surfaces substantially planar with one another; and
an LED assembly connected to at least one of the fins.
10. The luminaire of claim 9, further comprising
at least two LED assemblies connected to the plurality of heat fins in a plan substantially parallel to a horizontal ground plane.
11. The luminaire of claim 9, wherein
the LED assembly comprises a PCB, a bezel, an optic, and an LED.
12. The luminaire of claim 9, wherein
the fins extend from a first side of the interior to a second side of the interior.
13. The luminaire of claim 9, wherein
at least one of the fins is exposed through the opening.
14. The luminaire of claim 9, wherein
at least one of the fins includes an enlarged portion aligned with a light emitting device.
15. The luminaire of claim 9, wherein
at least one of the plurality of fins includes a channel.

16. A luminaire comprising:
- a housing including a first compartment having a top wall, a side wall extending from the top wall, a first opening in the side wall, and a second opening in the top wall;
 - a plurality of fins positioned in the first compartment so that at least one fin is in communication with the first opening; and
 - an LED module connected to at least one of the heat fins including a PCB, a bezel, and at least one LED.
17. The luminaire of claim 1, wherein
- the housing further comprises a driver compartment housing a driver.
18. The luminaire of claim 17, wherein
- the first compartment is connected to the driver compartment with a mounting feature.
19. The luminaire of claim 16, wherein
- an arm slidably engages the housing.
20. The luminaire of claim 16, wherein
- a boundary wall is positioned adjacent the LED module.
21. The luminaire of claim 20, wherein
- the boundary wall is positioned between the LED module and the opening in the top wall.
22. The luminaire of claim 20, wherein
- the boundary wall extends from the LED module to the top wall.
23. The luminaire of claim 20, wherein
- a top edge of the boundary wall is spaced from the top wall.

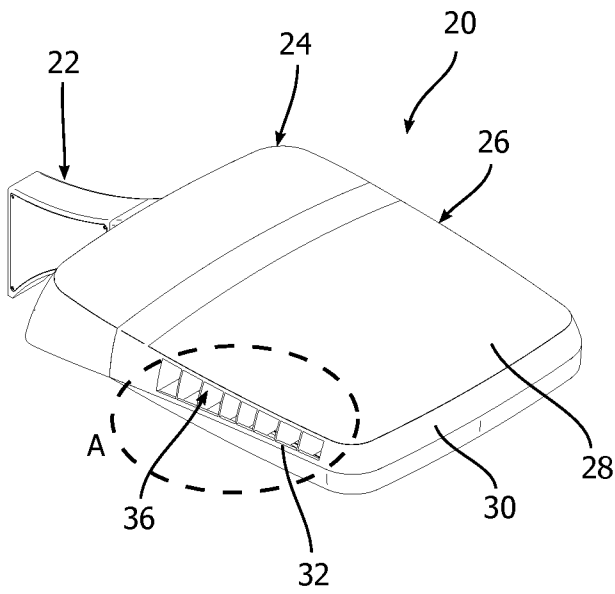


FIG. 1

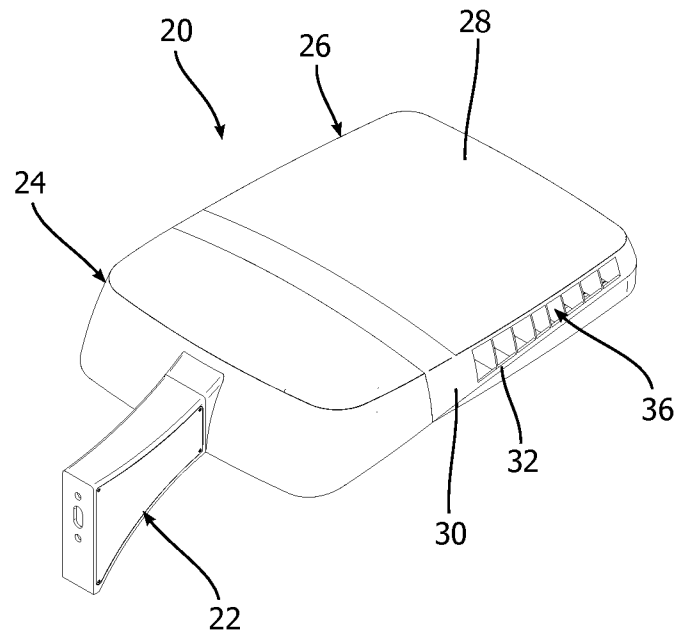


FIG. 2

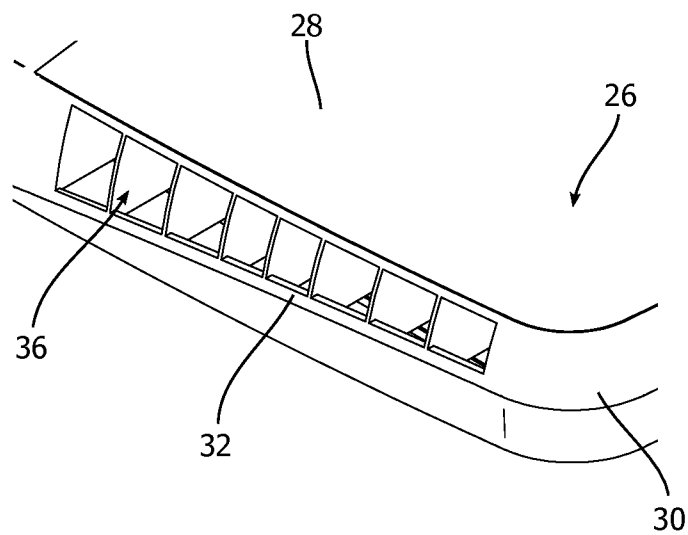


FIG. 1A

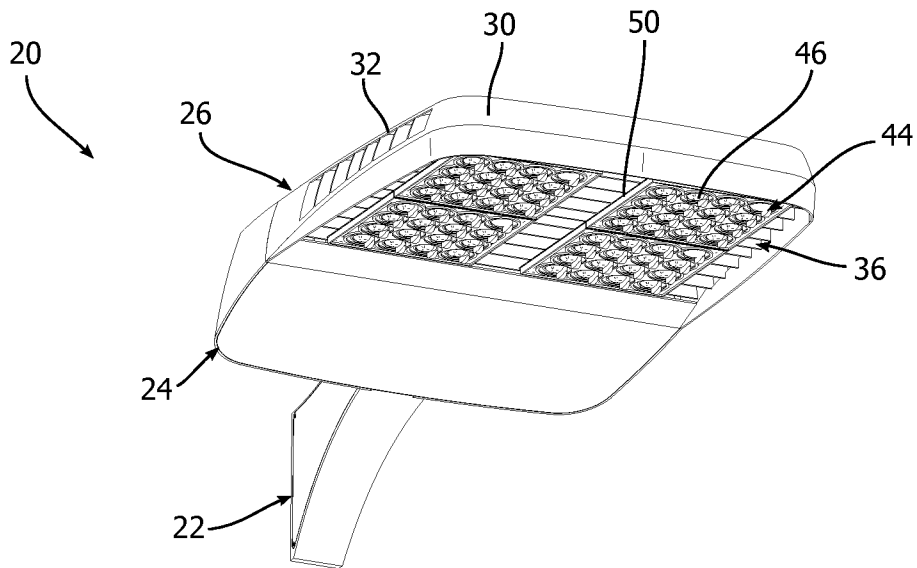


FIG. 3

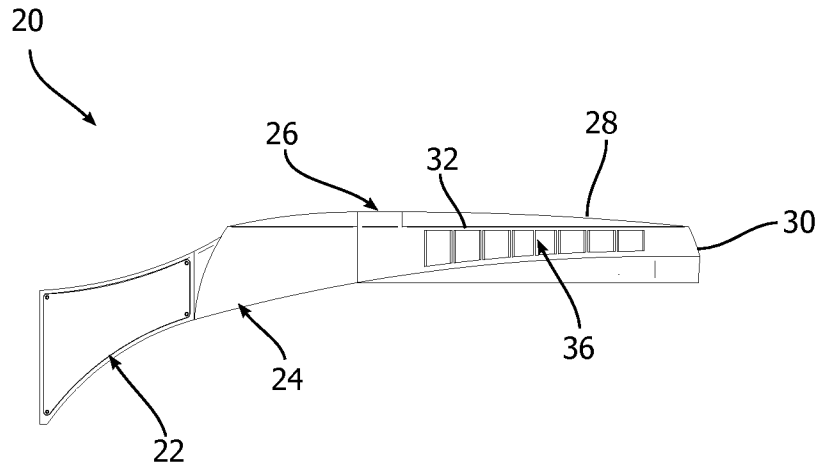


FIG. 4

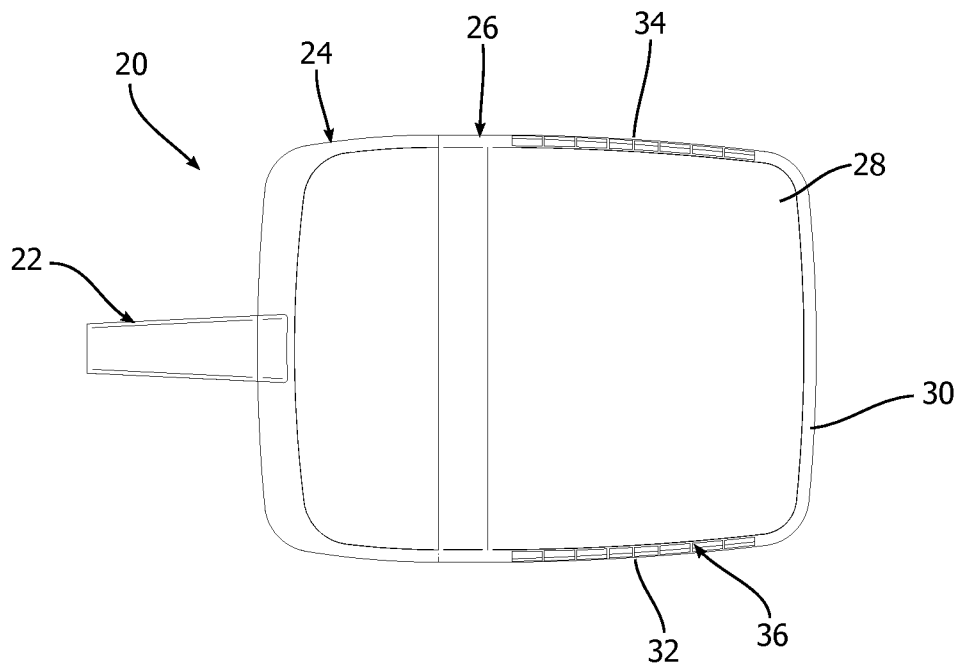


FIG. 5

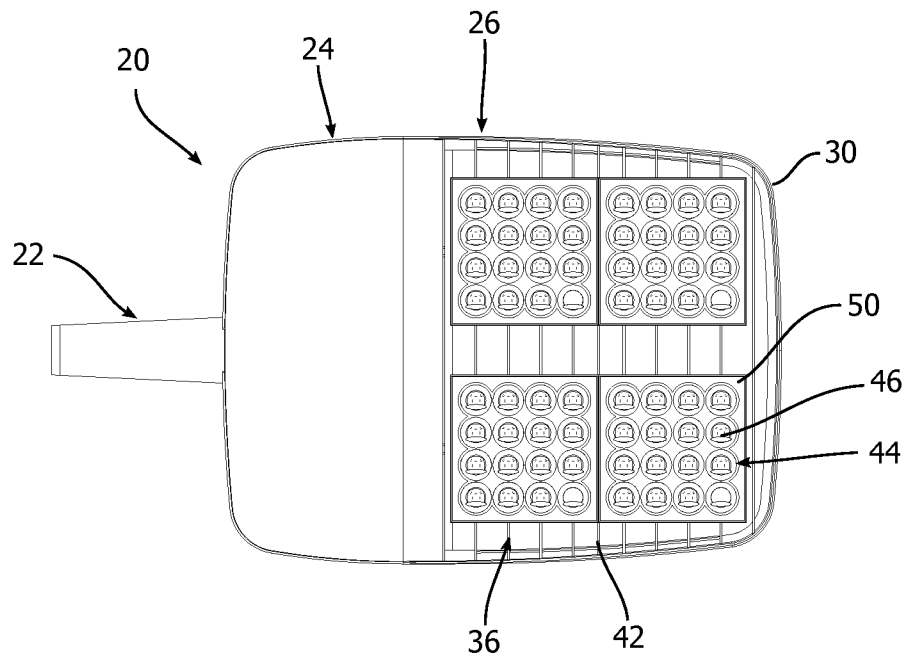


FIG. 6

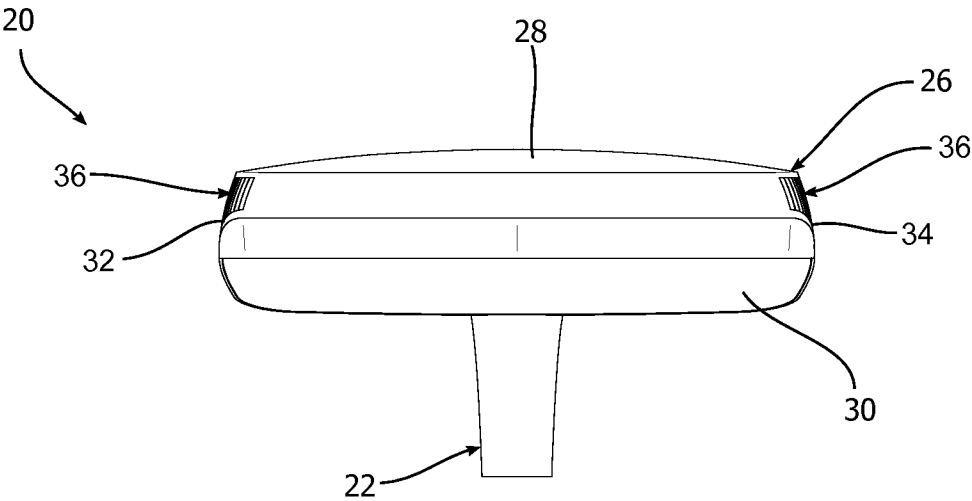


FIG. 7

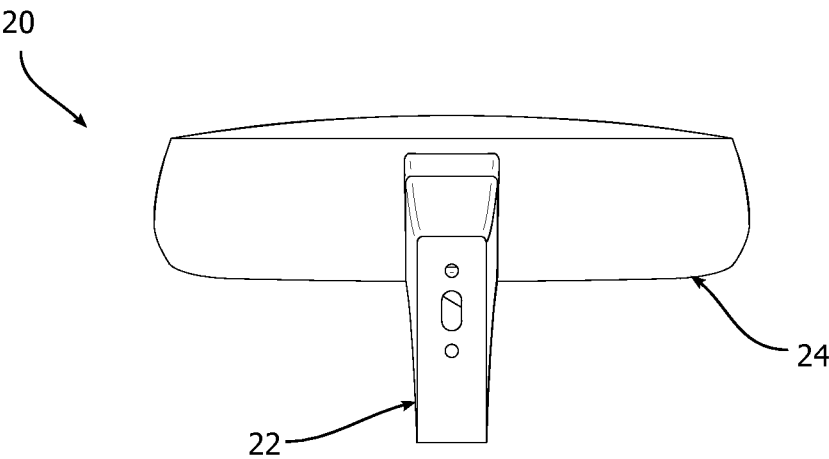


FIG. 8

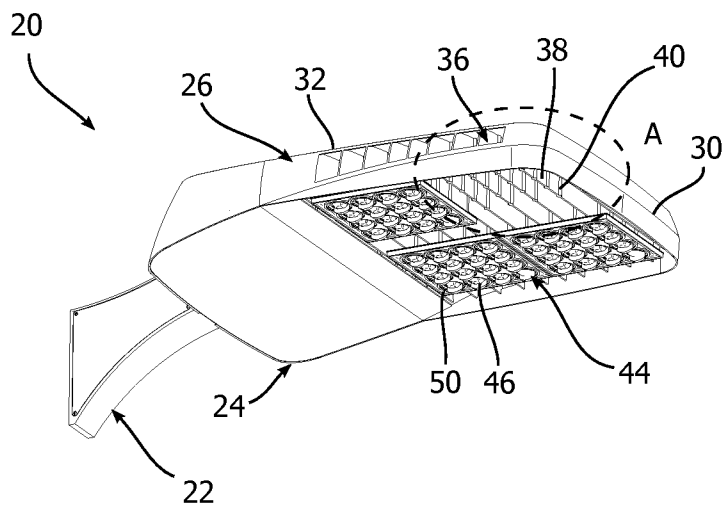


FIG. 9

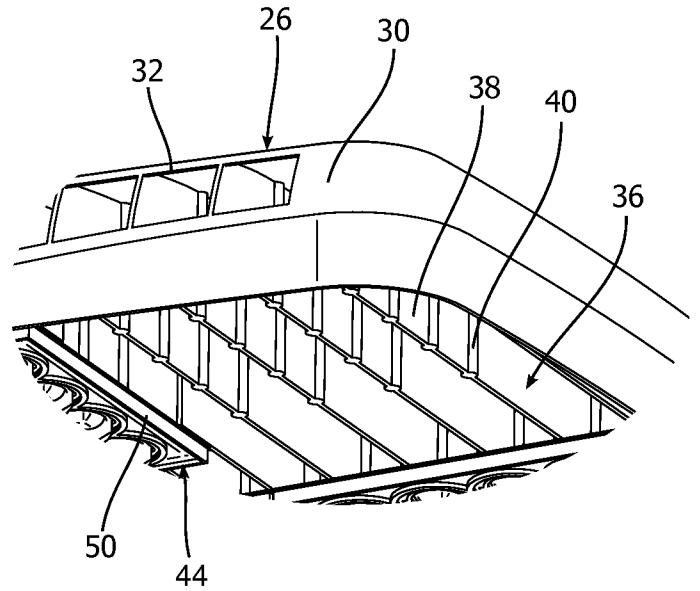


FIG. 9A

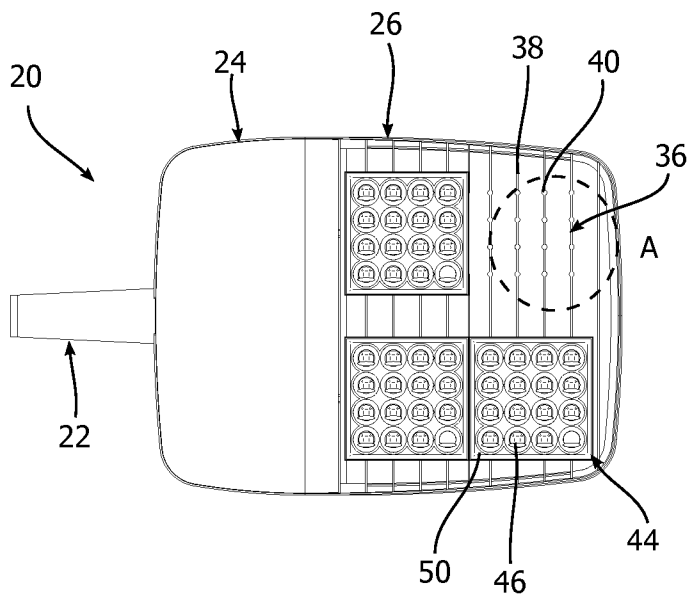


FIG. 10

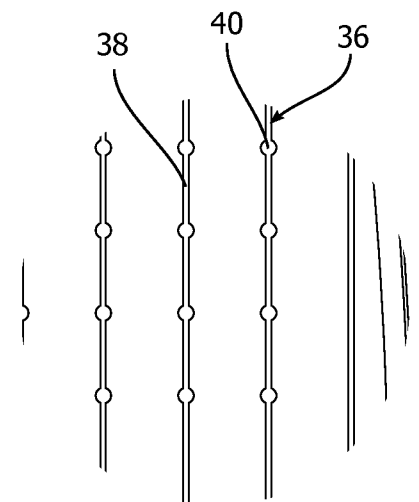


FIG. 10A

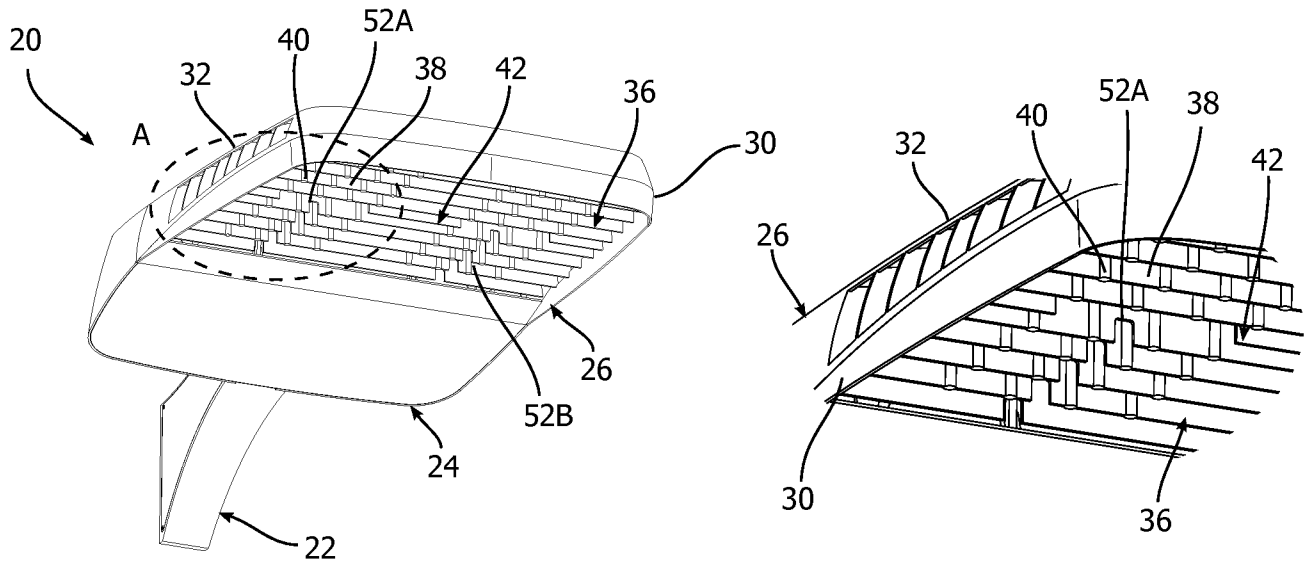


FIG. 11

FIG. 11A

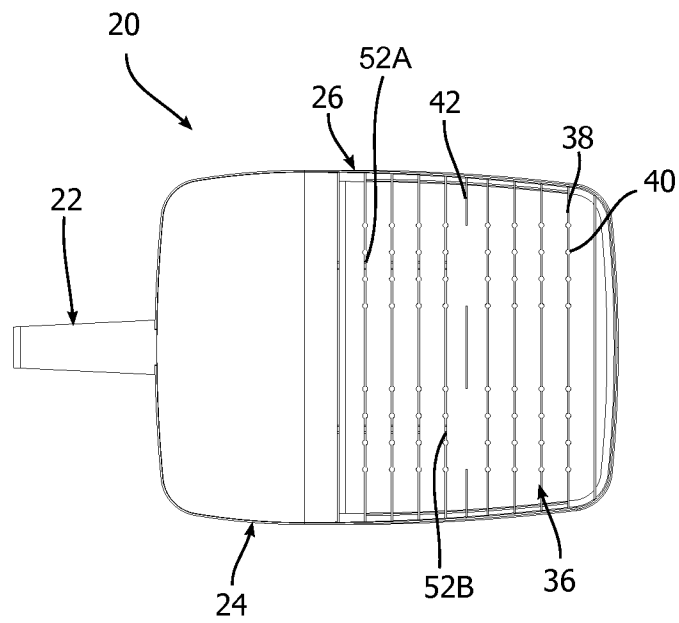


FIG. 12

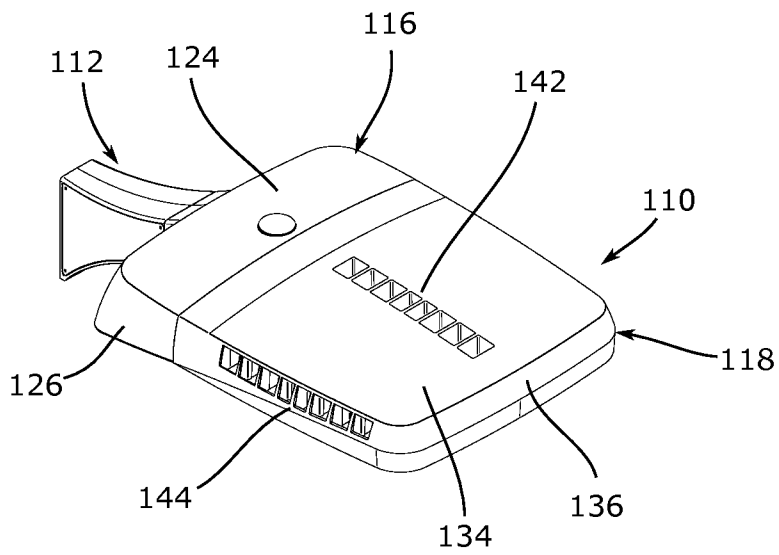


FIG. 13

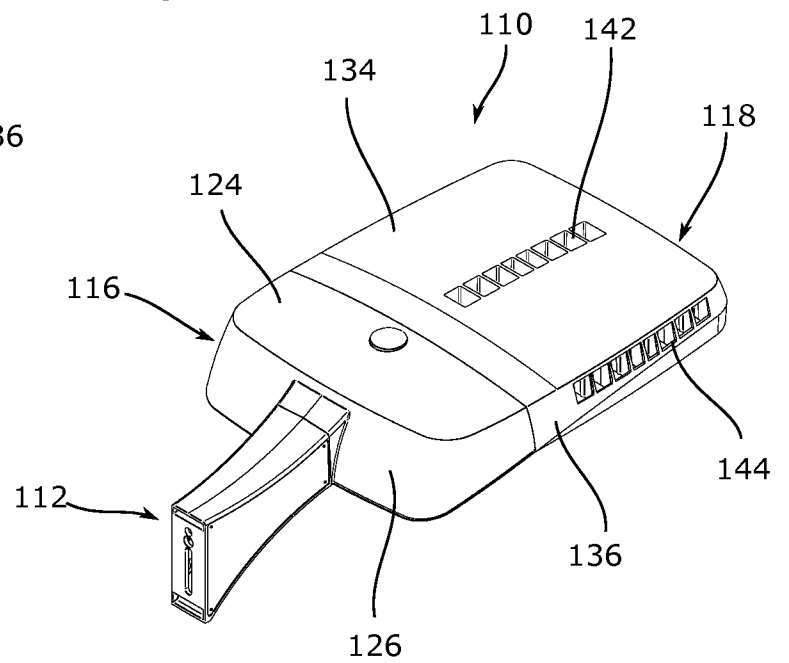


FIG. 14

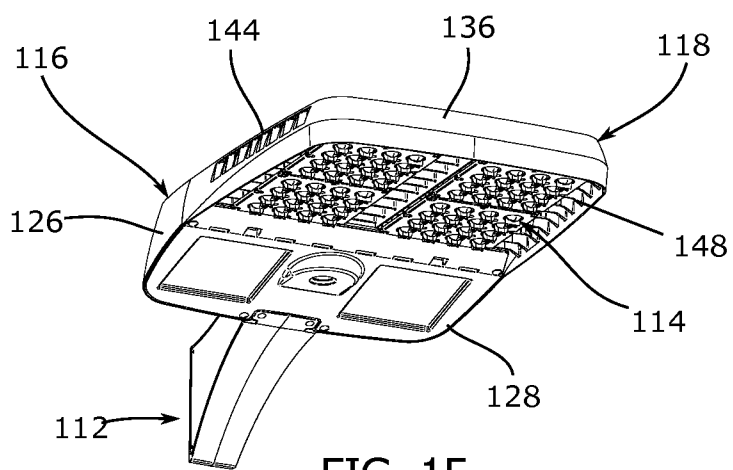


FIG. 15

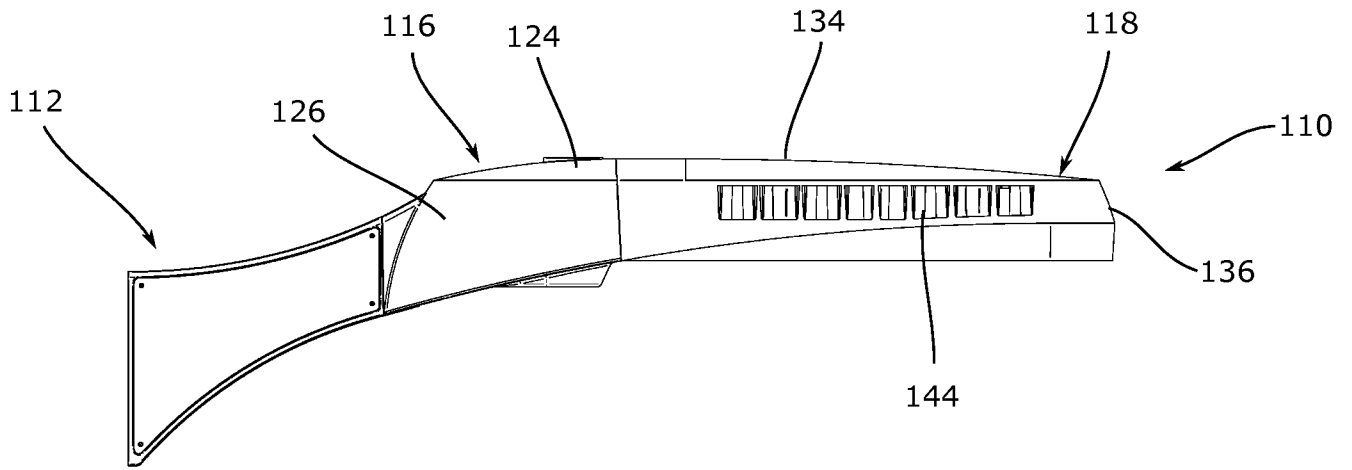


FIG. 16

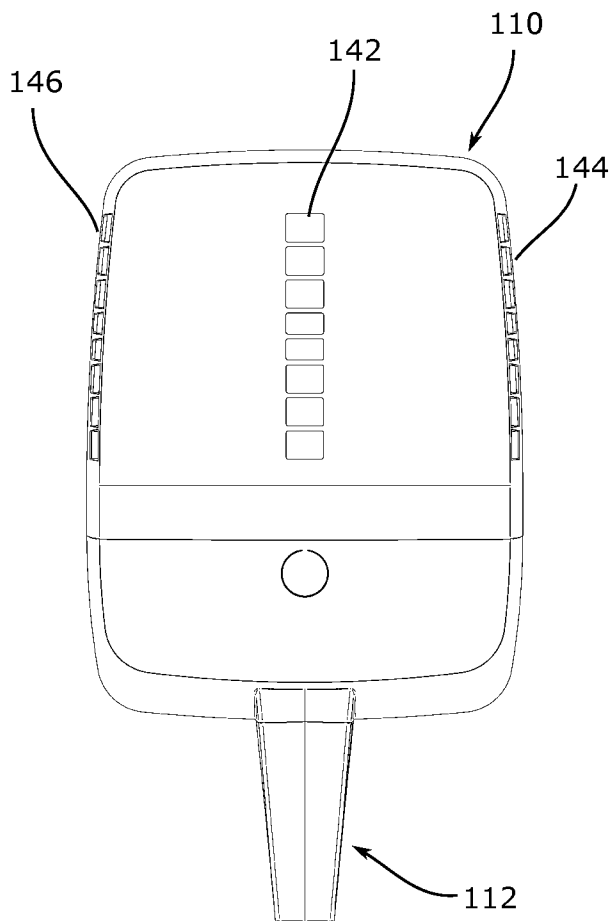


FIG. 17

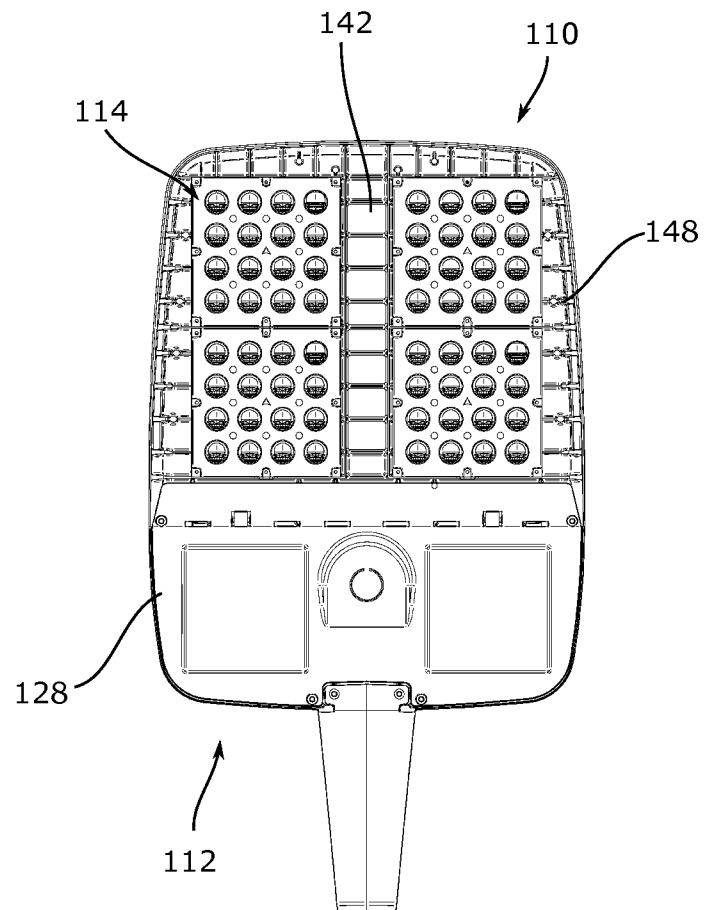


FIG. 18

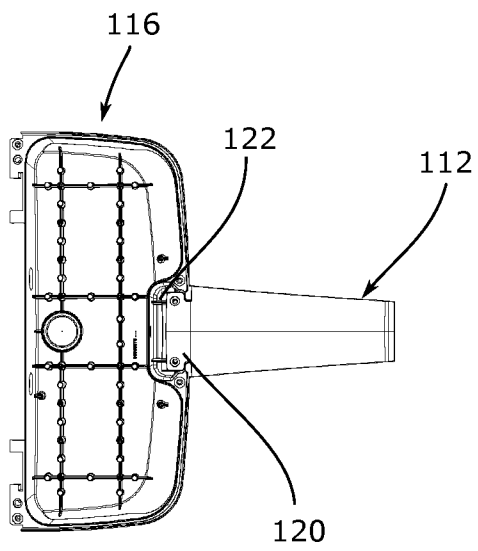


FIG. 19

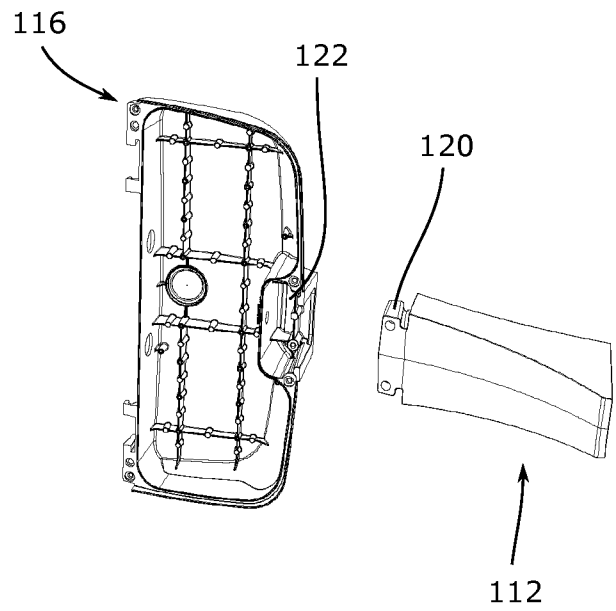


FIG. 20

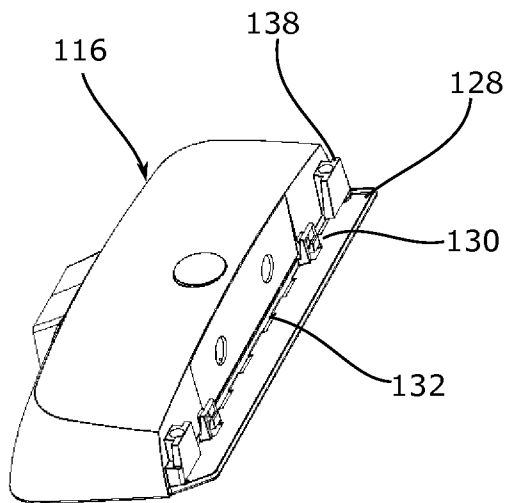


FIG. 21

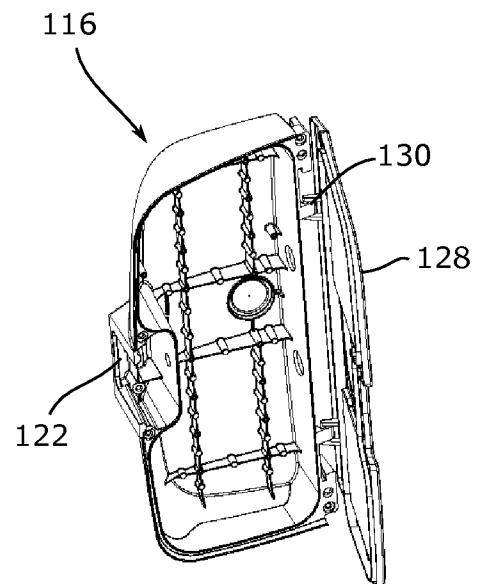


FIG. 22

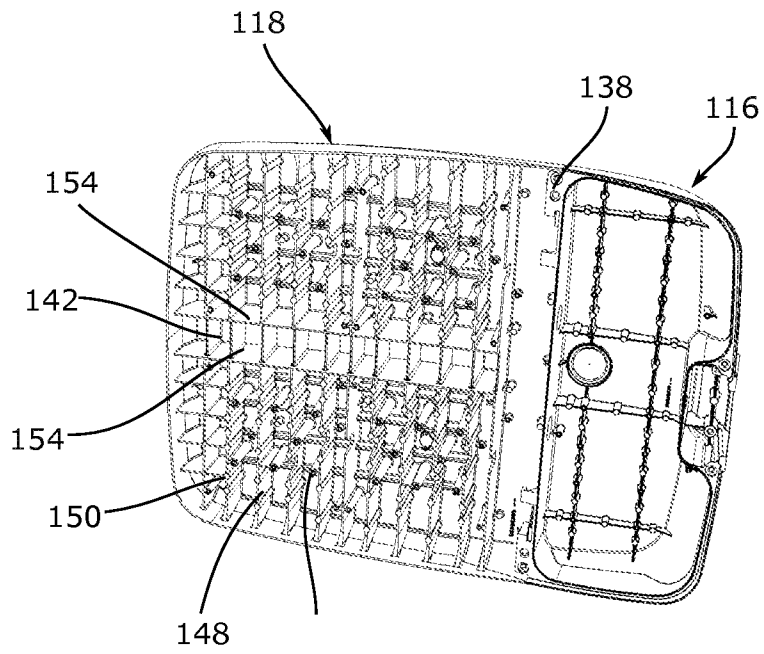


FIG. 23

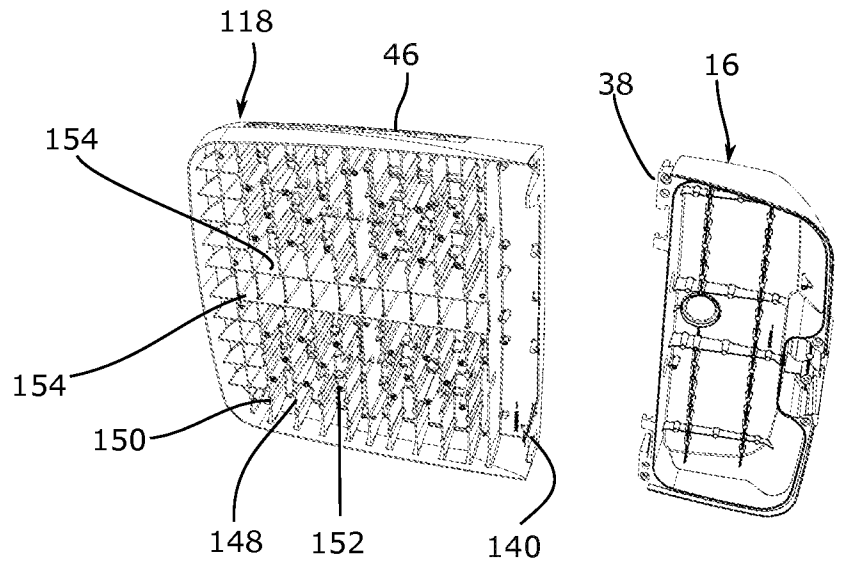


FIG. 24

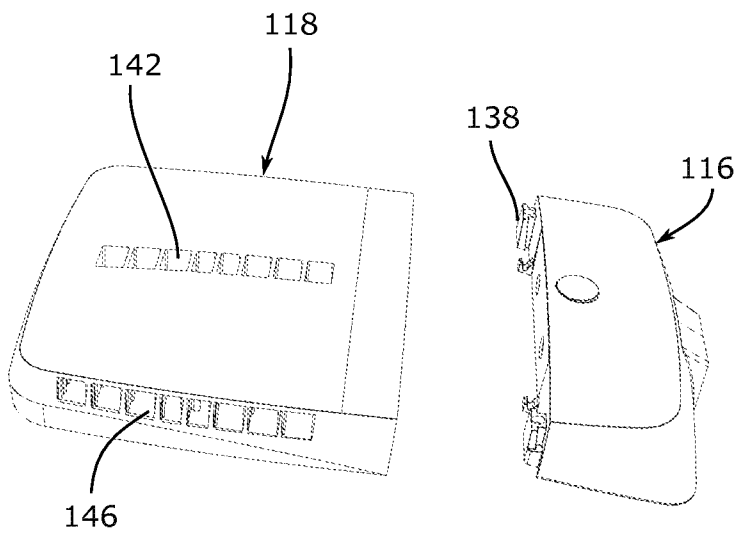


FIG. 25

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/32960

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - F21V 29/76, 29/74, 29/50 (2015.01) CPC - F21V 29/2212, 29/76, 29/74 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) Classification(s): F21V 29/76, 29/74, 29/50 (2015.01) CPC Classification(s): F21V 29/2212, 29/76, 29/74 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); Google Patent, Google Scholar, IEEE, ProQuest, Total Patent Search terms used: luminaire, lamp, LED, wall, planate, fin, housing, PCB, printed circuit board, bezel, driver		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y Y Y	US 2012/0262917 A1 (COURCELLE, G) October 18, 2012; figures 1, 2, 4-6, 7A, 7C, 8A, 8B, 9A, 10B, paragraphs [0043], [0047], [0049], [0059], [0060]-[0063], [0073], [0096], [0099] US 2014/0049961 A1 (CREE, INC.) February 20, 2014; figures 19, 13, paragraphs [0077], [0098], [0099], [0101], [0104], [0107] CN 201811032 U (HUANG, T) April 27, 2011; paragraph [0031], figures 3, 5 (see machine translation)	1-11, 13, 15, 17, 18 ---- 12, 14, 16-23 12, 14 16, 19-23
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "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 02 September 2015 (02.09.2015)		Date of mailing of the international search report 24 SEP 2015
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300		Authorized officer Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774