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(54) Title: MODULAR AREA LUMINAIRE

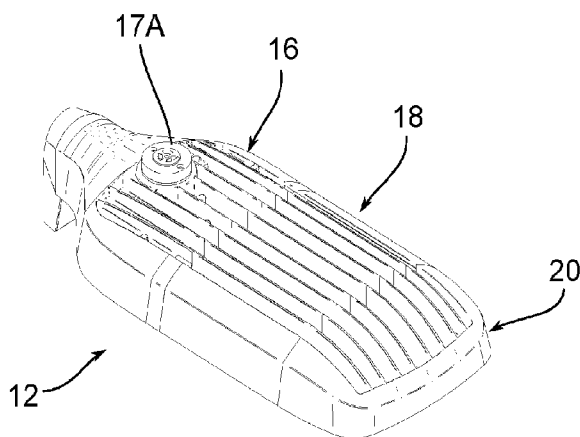


FIG. 1

(57) Abstract: A luminaire includes a housing having a rear section, a middle section removably connected to the rear section and, a front section removably connected to the middle section. A control component is positioned in the rear section. A light emitter assembly is operably connected to the control component.

PATENT APPLICATION
OF
JASON DUCKWORTH
FOR
MODULAR AREA LUMINAIRE

RELATED APPLICATION(S)

[0001] This application is based on U.S. Provisional Application Serial No. 62/155,189, filed April 30, 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 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 having a rear section, a middle section removably connected to the rear section and, a front section removably connected to the middle section. A control component is

positioned in the rear section. A light emitter assembly is operably connected to the control component.

[0005] According to another exemplary embodiment, a luminaire includes a housing having a rear section and a removable front section. A control component is positioned in the rear section. A channel extends from the rear section to the front section. A conductor conduit extends through the channel. A light emitter assembly is operably connected to the control component through the conductor conduit.

[0006] According to another exemplary embodiment, a luminaire includes a support, a housing, and a light emitter. The housing includes a mounting feature having a first fastener boss and a second fastener boss to connect the housing to the support. The light emitter is 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 top, front perspective view of an exemplary luminaire;

[0009] FIG. 2 is a bottom, front perspective view of FIG. 1;

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

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

[0012] FIG. 5 is a sectional view of FIG. 4 taken along line 5-5;

[0013] FIG. 6 is a right side view of FIG. 1;

[0014] FIG. 7 is a sectional view of FIG. 6 taken along line 7-7;

[0015] FIG. 8 is a top, front perspective view of the luminaire of FIG. 1 with a shorter middle section;

[0016] FIG. 9 is a bottom view of FIG. 8;

[0017] FIG. 10 is a top, front perspective view of the luminaire of FIG. 1 without a middle section;

[0018] FIG. 11 is a bottom view of FIG. 10;

[0019] FIG. 12 is an exploded view of an exemplary rear, middle, and front section;

- [0020] FIG. 13 is a bottom, front perspective view of the front section of FIG. 12;
- [0021] FIG. 14 is a bottom, rear perspective view of FIG. 13;
- [0022] FIG. 15 is a front view of the middle section of FIG. 12;
- [0023] FIG. 16 is a front view of the rear section of FIG. 12;
- [0024] FIG. 17 is a bottom perspective view of the rear section of FIG. 12;
- [0025] FIG. 18 is a partially exploded view of a the rear, middle, and front section and an exemplary conduit and light emitter assembly;
- [0026] FIG. 19 is a perspective view of the conduit of FIG. 18;
- [0027] FIG. 20 is a bottom view of the light emitter assembly of FIG. 18;
- [0028] FIG. 21 is a top perspective view of FIG. 20;
- [0029] FIG. 22 is an exploded view of FIG. 20;
- [0030] FIG. 23 is a bottom perspective view of the rear section and a door;
- [0031] FIG. 24 shows the door of FIG. 23 in an open position;
- [0032] FIG. 25 is a bottom perspective view of the rear section connected to a first support;
- [0033] FIG. 26 is an exploded view of FIG. 25;
- [0034] FIG. 27 is a bottom perspective view of the rear section connected to a second support;
- [0035] FIG. 28 is a front view of a pair of clamps;
- [0036] FIG. 29 is a bottom perspective view of the rear section connected to an exemplary mounting assembly;
- [0037] FIG. 30 is a rear, top perspective view of Fig. 29;
- [0038] FIG. 31 is a rear perspective view of a mounting base and mounting plate; and
- [0039] FIG. 32 is an exploded view of a mounting assembly.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0040] According to various exemplary embodiments, a luminaire 10 includes a housing 12 containing one or more light emitter assemblies 14 and one or more control components for controlling light emitters. The housing 12 includes a rear section 16, a middle section 18, and a front section 20. In various exemplary

embodiments the housing 12 is made from aluminum, although other metal, polymer, or composite materials may also be used. A lens, diffuser, or other cover (not shown) may be connected to the housing positioned beneath the light emitters. The housing 12 can have various shapes, sizes, and configurations as needed.

[0041] The rear section 16 includes a compartment housing the control components. The control components can include various combinations of drivers, surge protectors, and sensors. In the exemplary embodiment shown, a photocell or light sensor 17A extends from the top of the rear section and an occupancy sensor 17B extends from the bottom of the rear section. Other types of sensors and other electronic components and circuitry can be used to control the light emitter assemblies as would be understood by one of ordinary skill in the art. The rear section 16 can also include brackets or other structure to connect and/or support the control components.

[0042] In an exemplary embodiment, the size of the housing 12 is adjustable to fit a desired size, design, or light output. FIGS. 1-7, show an exemplary housing having a front section 20 that accommodates a single light emitter assembly 14 and a middle section 18 that accommodates two light emitter assemblies 20. FIGS. 8 and 9 show an exemplary housing 12 having a front section 20 that accommodates a single light emitter assembly 14 and a middle section 18 that accommodates a single light emitter assembly 14. FIGS. 10 and 11 show an exemplary housing having a front section 20 that accommodates a single light emitter assembly 14 that is connected to the rear section 16 and the middle section 18 is omitted. Other embodiments can incorporate longer middle sections 18 or multiple middle sections 18 to include more light emitter assemblies 14.

[0043] FIG. 12 shows an example of a method of connecting the rear, middle, and front sections 16, 18, 20 using first and second bolts 22. The bolts 22 can be connected to the rear section 16, for example with a first set of nuts. The middle and front sections 18, 20 can then be slid onto the bolts 22 and secured with a second set of nuts. Different length bolts 22 can be used depending on the size and number of housing sections used.

[0044] FIGS. 12-14 best show an exemplary embodiment of the front section 20 that includes a side wall 24 extending substantially along three sides enclosing a mounting portion 26. The mounting portion 26 includes one or more openings to receive fasteners to attach a light emitter assembly 14 and a channel 28 to receive a conductor conduit 30. One or more fins extends above the mounting portion 26 to dissipate heat from the light emitter assembly. A pair of rear walls 32 each include an opening to receive the first and second bolts 22, respectively. After the front section 20 is connected to the bolts 22 the second set of nuts can be threadably connected to the front portion of the bolts 22.

[0045] FIGS. 12 and 15 show an exemplary embodiment of the middle section 18 that includes first and second side walls 34 extending along the length of the middle section 18. The side walls 34 have first and second angled portions and a projection 36 extending from each side wall 34 to receive the first and second bolts 22, respectively. In an exemplary embodiment, the projections 36 include a substantially C-shaped member. A mounting portion 38 is positioned between the side walls 34 to receive a light emitter assembly 14. The mounting portion 38 includes one or more openings to receive fasteners to attach one or more light emitter assemblies 14 and a channel 40 to receive a conductor conduit 30. First and second angled portions 42 connect the mounting portion 38 to the first and second walls 34, respectively. The first and second angled portions 42 connect the mounting portion 38 more toward the center of the side walls 34 to help dissipate heat more evenly through the side walls 34. One or more fins are thermally connected to the mounting portion to dissipate heat from the light emitter assemblies 14. The fins closest to the sidewalls 34 are spaced from the top angled portions of the side walls 34 to provide enhanced air circulation.

[0046] FIGS. 12, 16, and 17 show an exemplary embodiment of the rear section 16. The rear section 16 includes a pair of side walls 44 and a partition wall 46 that separates the compartment. A central opening 48 is provided to receive the conduit 30. The central opening 48 can extend through the partition wall 46 so that conductors can be passed from the compartment to the rest of the housing 12. The

rear section 16 includes first and second chambers 50 having an opening for receiving the first and second bolts 22. A nut can be placed in each of the chambers 50 to threadably connect to the first and second bolts, respectively. In an exemplary embodiment, the chambers 50 can be shaped to receive the nut so that it cannot rotate. For example, the chambers 50 can have angled walls corresponding to a hexagonal nut. The rear section 16 includes one or more fins for dissipating heat.

[0047] As best shown in FIG. 18, a conduit 30 extends from the rear portion 16 to the front portion 20 and is received in the central opening 48 and the respective channels 28, 40. In the exemplary embodiment, the conduit 30 is a square tube made from one or more pieces. The conduit 30 can be made from an elastomeric material, such as silicone, to seal conductors passing from the compartment to the light emitter assemblies 14. As best shown in FIG. 21, the conduit 30 can include an opening 52 that is positioned over or near the light emitter assemblies 14. A single conduit 30 can be used that is formed to different lengths depending on the size of the housing configuration, or different sized conduits 30 can be made that are associated with each housing piece.

[0048] FIGS. 20-22 show an exemplary embodiment of the light emitter assembly 14 that includes an LED board 54, a pair of optics 56, a gasket 58, and a bezel 60. The LED board 54 includes one or more LEDs connected to a printed circuit board. The optic 56 can be connected to the printed circuit board, for example by one or more fasteners, or held in place by the gasket 58 and/or bezel 60. If the optic 56 is held in place by the gasket 58 and/or bezel 60, a plug may be provided to help seal the optic 56 where a fastener would otherwise be present. The gasket 58 can overlap the edges of the LED board 54 and the optics 56. The gasket 58 can include one or more protrusions extending toward the bezel 60 to help cushion the bezel 60 and retain the gasket 58 in place. The bezel 60 can have a recessed portion for receiving the LED board 54, optic 56, and gasket 58 so that the rear of the assembly has a substantially planar surface. In an exemplary embodiment, one or more fasteners connect the LED board 54 to the bezel 60 and one or more fasteners connect the bezel 60 to a mounting portion of one of the housing components.

[0049] Various exemplary embodiments are directed to methods of combining different housing sections to create luminaires of different sizes and with different light outputs. In an exemplary embodiment, each light emitter assembly 14 is capable of producing 5k lumens so that luminaires in increments of 5k lumens can be assembled as desired.

[0050] FIGS. 23 and 24 show an exemplary door 62 pivotably connected to the rear section 16. The door 62 can include an opening for a sensor, for example a movement or occupancy sensor. A first hinge member 64 on the door 62 connects to a second hinge member on the rear section 16. For example, the door includes a pair of arms and hinge pins extending from the arms that pivotally connect to the rear section 16. A pair of keyhole slots each receive a fastener 66, for example a knurled thumb screw. The fasteners 66 can be loosened and the door 62 slid toward the front of the housing 12 and pivoted into an open position.

[0051] FIG. 17 also shows mounting features associated with the rear section 16 for attaching the housing 16 to different types of supports. The mounting features can include a rear opening, for example a substantially U-shaped opening 68, a slot 70 positioned proximate the opening 68, a first pair of bosses 72 positioned on one side of the opening, and a second pair of bosses 74 positioned on another side of the opening. The rear section 16 can also include one or more protrusions 76 that are positioned to act as a stop for different mounting structures. For example the protrusions 76 can have a different heights in a step-like pattern to receive different sized mounting structures.

[0052] FIGS. 25 and 26 show the rear housing 16 connected to a first pole 78, for example a first roadway tenon that has a horizontal component used to position lights along streets or highways. First and second clamps 80 can be connected to the bosses 72, 74 to secure the housing 12 to the first pole 78. A shield 82 can also be positioned in the slot 70 and clip onto the pole 78 to block at least some of the excess space around the first pole 78.

[0053] FIG. 27 shows the rear housing 16 connected to a second pole 84, for example a second roadway tenon. The second pole 84 as shown has a smaller

diameter than the first pole 78. First and second clamps 80 can be connected to the bosses 72, 74 to secure the housing 12 to the second pole 84. The shield 82 can also be positioned in the slot 70 and clip onto the second pole 84 to block at least some of the excess space around the second pole 84.

[0054] As best shown in FIG. 28, the clamp 80 is configured to have a first supporting portion 86 on a first side and a second supporting portion 88 on a second side so that both the first and second sides can be used to support structures. The first supporting portion 86 can be used to support structures with a large size than capable of being supported by the second supporting 88 portion. In alternative embodiments, different clamps or other fasteners can be used.

[0055] FIGS. 29-32 show an exemplary mounting assembly 90 that is used to support the housing 12 on a substantially vertical structure, such as a wall, post, or pole. The mounting assembly 90 includes a mounting plate 92, a mounting base 94, a cover 96, and a curved adapter 98. The mounting plate 92 includes first and second arms that connect to the rear bosses 72, 74, for example through a pair of fasteners. One or more openings in the mounting plate 92 receive fasteners to connect the mounting plate 92 to the mounting base 94. The mounting base 94 includes one or more openings and a slot to receive fasteners to connect the mounting base 94 to a structure. The slot is provided so that the mounting base 94 can be connected to structures with different mounting positions. The slot or one of the openings can also be used to pass conductors through the mounting assembly 90. The cover 96 can be positioned over a portion of the mounting base 94. The cover 96 is selectively removable to allow access to a user, for example to connect or disconnect wires. The cover 96 has a keyhole slot. The curved adaptor 98 can be attached to the mounting base 94 to allow the mounting assembly 90 to be attached to a curved support structure.

[0056] In an exemplary embodiment the mounting base 94 is initially attached to a support structure and the mounting plate 92 is attached to the base 94. The rear section 16 is then slid onto the mounting plate 92 which is positioned in the slot 70. The mounting plate 92 is then secured to the rear section 16 with fasteners. In this

way, the entire housing 12 does not need to be simultaneously supported and bolted to a support.

[0057] 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.

[0058] 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 having a rear section, a middle section removably connected to the rear section and, a front section removably connected to the middle section;
 - a control component positioned in the rear section; and
 - a light emitter assembly operably connected to the control component.
2. The luminaire of claim 1, wherein the front section is configured to removably connect to the rear section.
3. The luminaire of claim 1, wherein the front section includes a mounting portion for receiving a first light emitter assembly and the middle section includes a mounting portion for receiving a second light emitter assembly.
4. The luminaire of claim 1, wherein the middle section and the front section are connected to the rear section with a first bolt and a second bolt.
5. The luminaire of claim 4, wherein the middle section includes a substantially C-shaped member receiving the first bolt.
6. The luminaire of claim 1, wherein the front section includes a first set of fins and the rear section includes a second set of fins aligned with the first set of fins.
7. The luminaire of claim 1, wherein the light emitter assembly is connected to the front section and a conductor conduit extends from the rear section to the front section.
8. The luminaire of claim 7, wherein the conduit includes a silicone member having an opening positioned over the light emitter assembly.

9. The luminaire of claim 1, wherein the middle section receives the light emitter assembly.
10. A luminaire comprising:
 - a housing having a rear section and a removable front section;
 - a control component positioned in the rear section;
 - a channel extending from the rear section to the front section;
 - a conductor conduit extending through the channel; and
 - a light emitter assembly operably connected to the control component through the conductor conduit.
11. The luminaire of claim 10, wherein a removable middle section is positioned between the front section and the rear section.
12. The luminaire of claim 11, wherein the light emitter is connected to the front section and a second light emitter is connected to the middle section and operably connected to the control component through the conductor conduit.
13. The luminaire of claim 10, further comprising a door pivotally connected to the rear section.
14. A luminaire comprising:
 - a support;
 - a housing having a mounting feature include a first fastener boss and a second fastener boss to connect the housing to the support; and
 - a light emitter connected to the housing.
15. The luminaire of claim 14, wherein the mounting feature can selectively connect the housing to a roadway tenon, a round pole, or a square pole.

16. The luminaire of claim 14, wherein the mounting feature includes a second fastener boss and a third fastener boss.
17. The luminaire of claim 14, wherein a clamp having a first orientation for supporting a first sized support and a second orientation for supporting a second sized support is connected to the mounting feature.
18. The luminaire of claim 14, further comprising a mounting assembly having a mounting plate connected to the mounting feature and a mounting base connected to the mounting plate.
19. The luminaire of claim 18, further comprising a cover connected to the mounting base.
20. The luminaire of claim 18, further comprising a curved adapter connected to the mounting base.

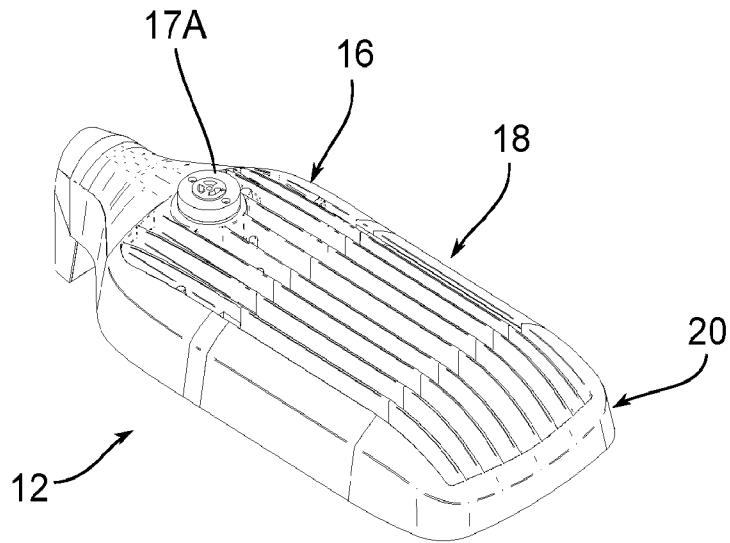


FIG. 1

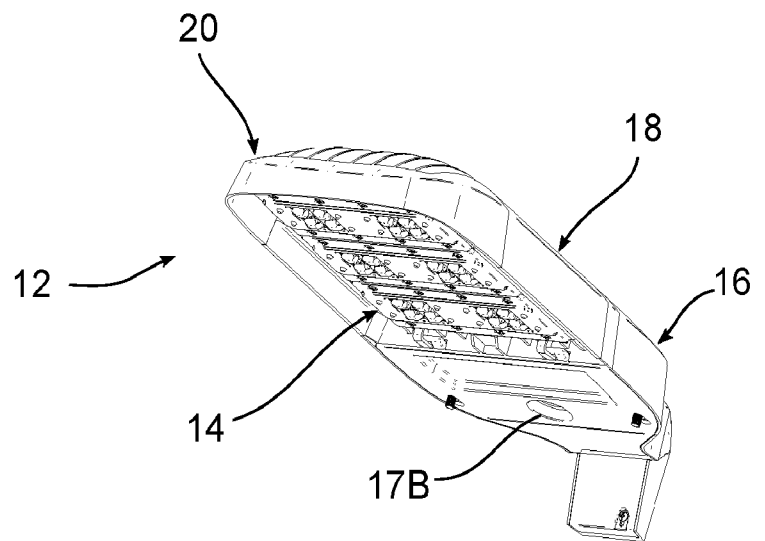


FIG. 2

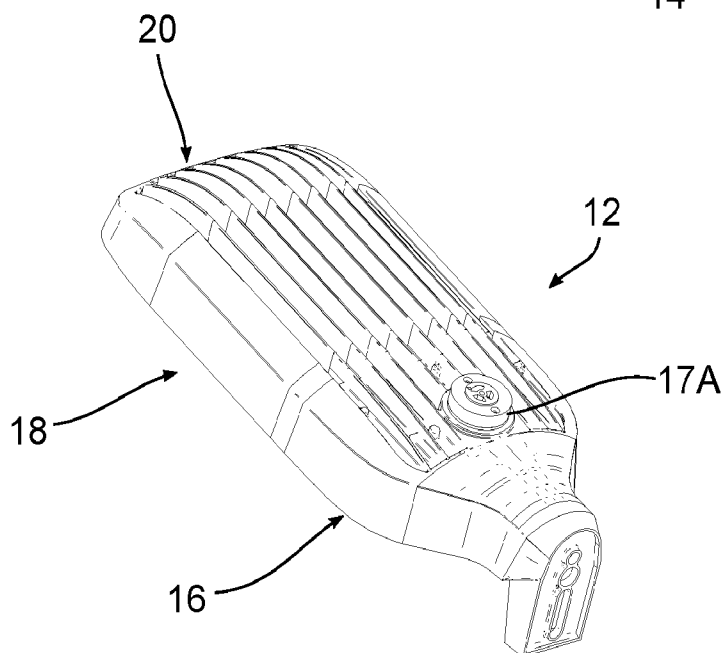


FIG. 3

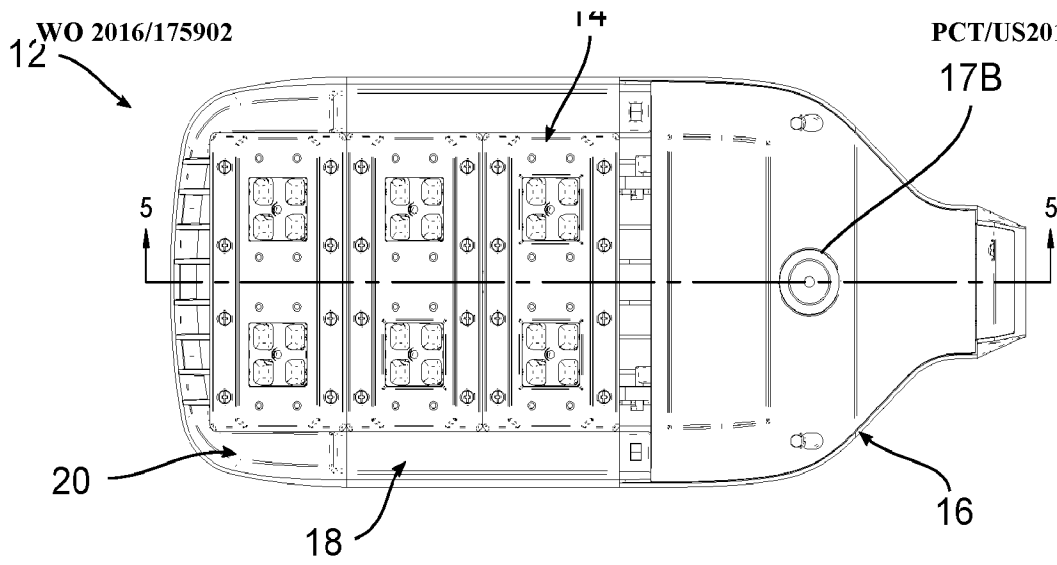


FIG. 4

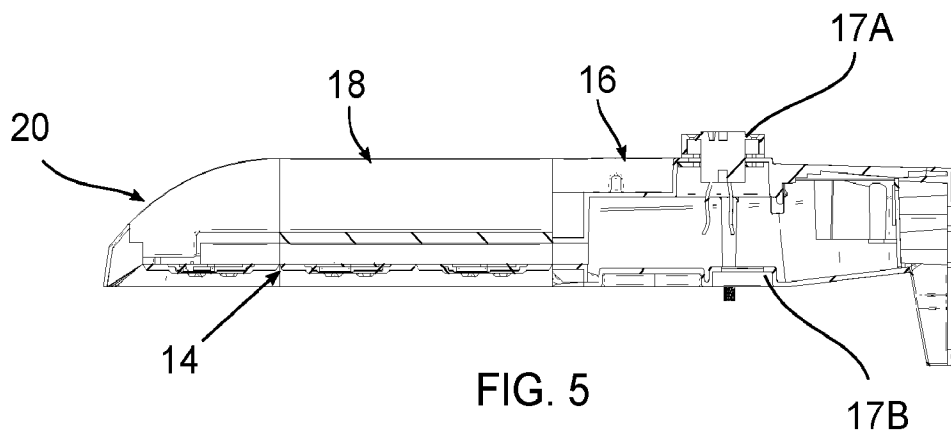


FIG. 5

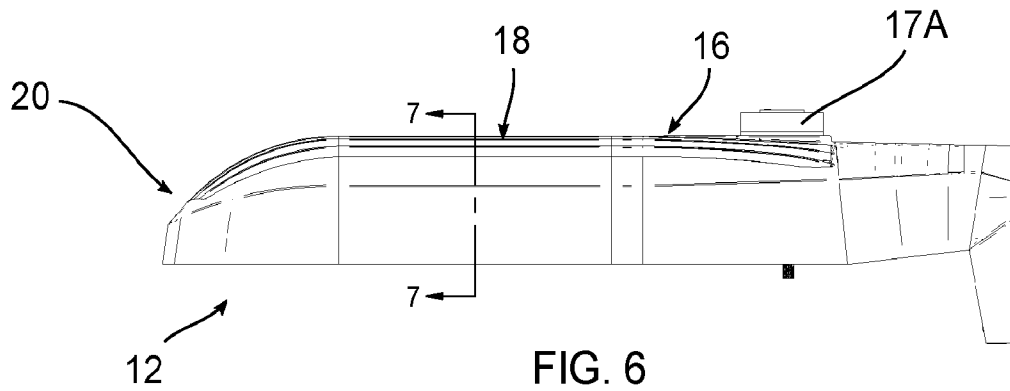


FIG. 6

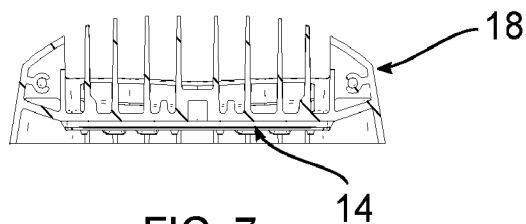


FIG. 7

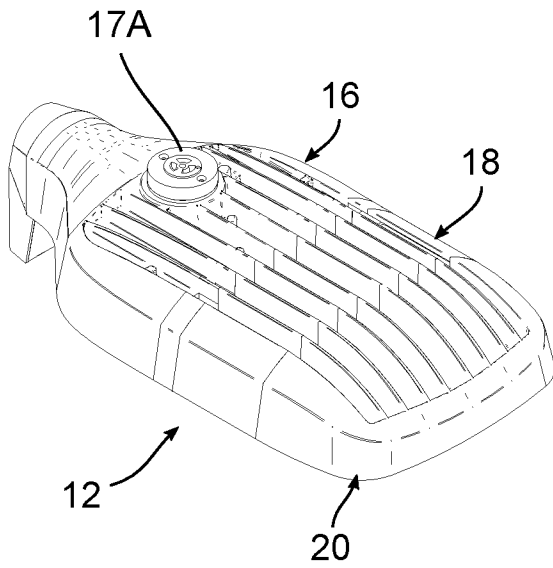


FIG. 8

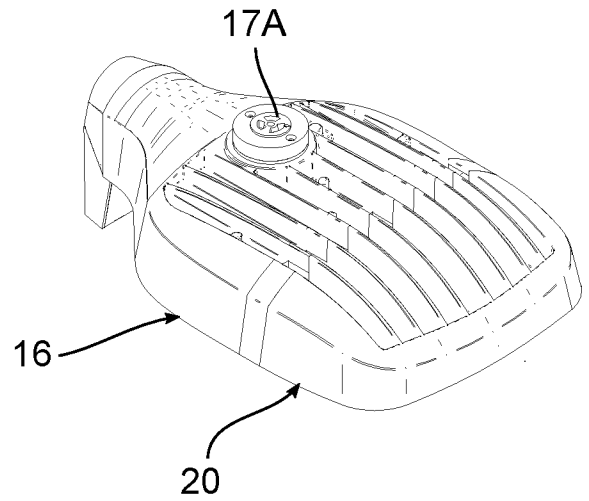


FIG. 10

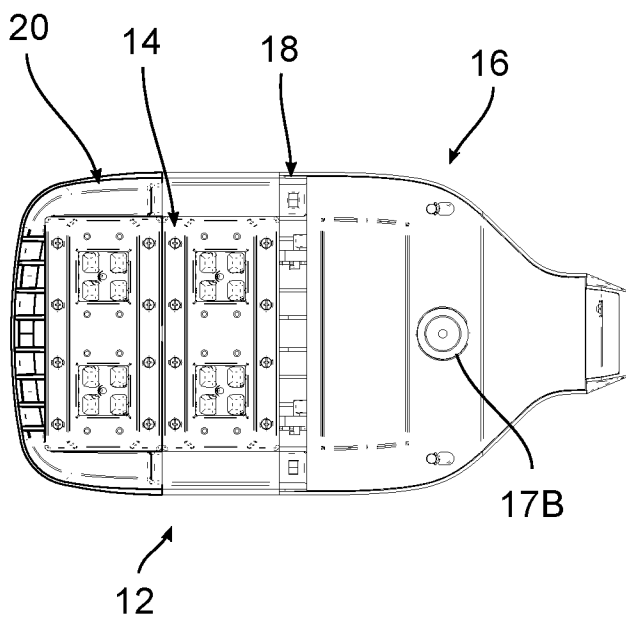


FIG. 9

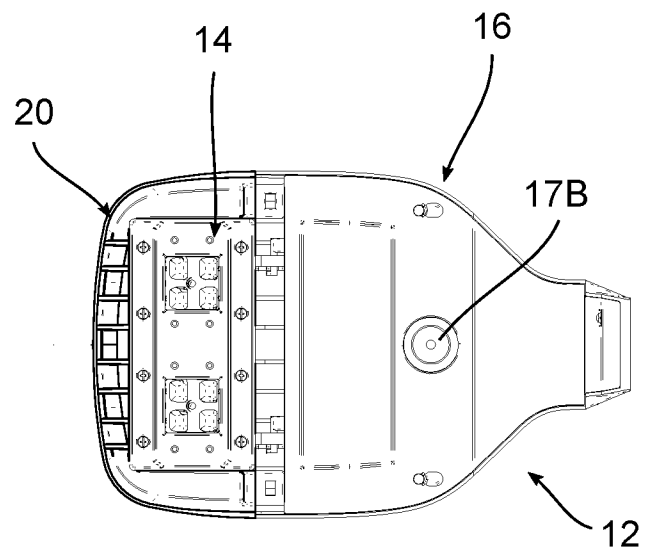


FIG. 11

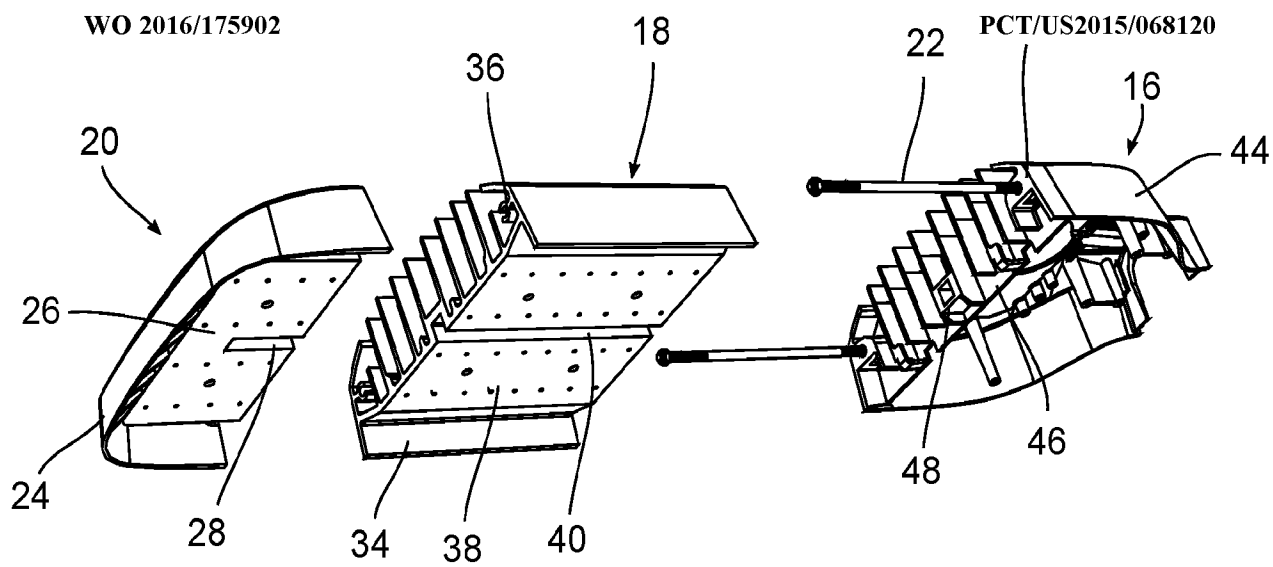


FIG. 12

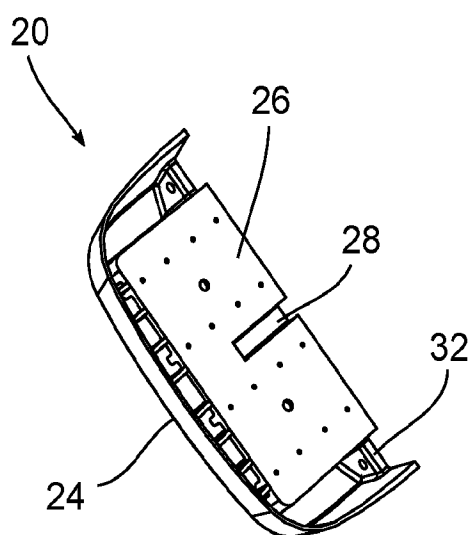


FIG. 13

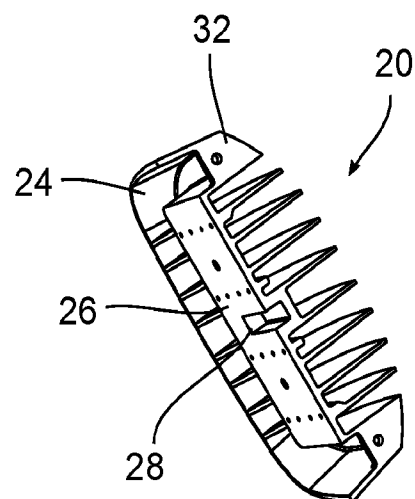


FIG. 14

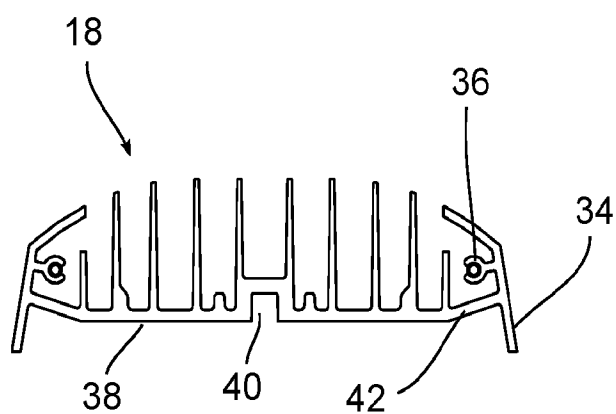


FIG. 15

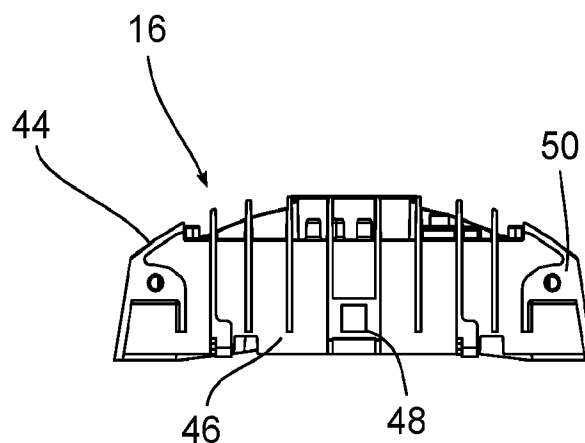


FIG. 16

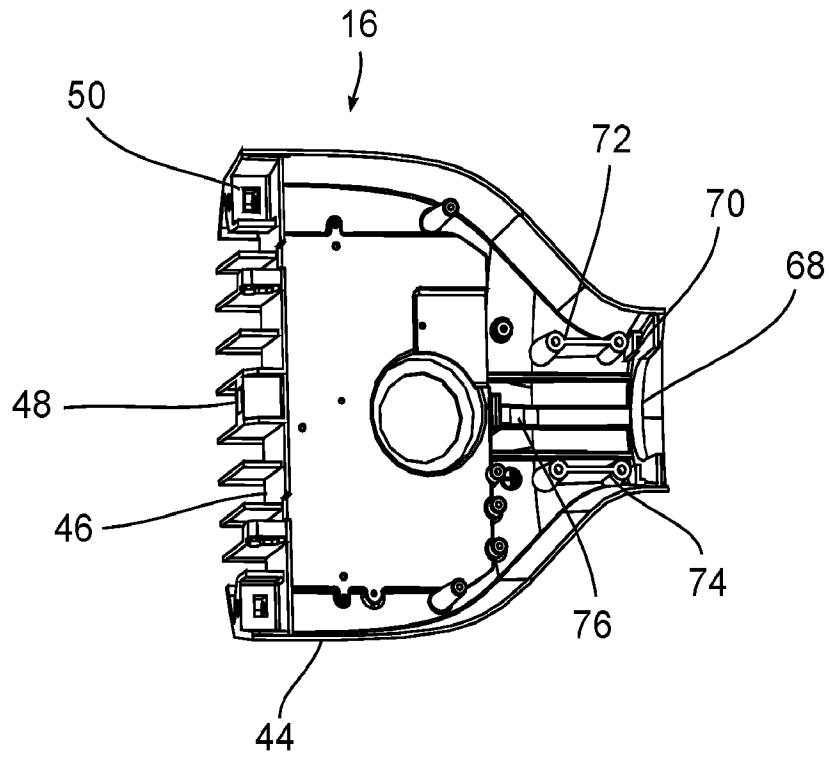


FIG. 17

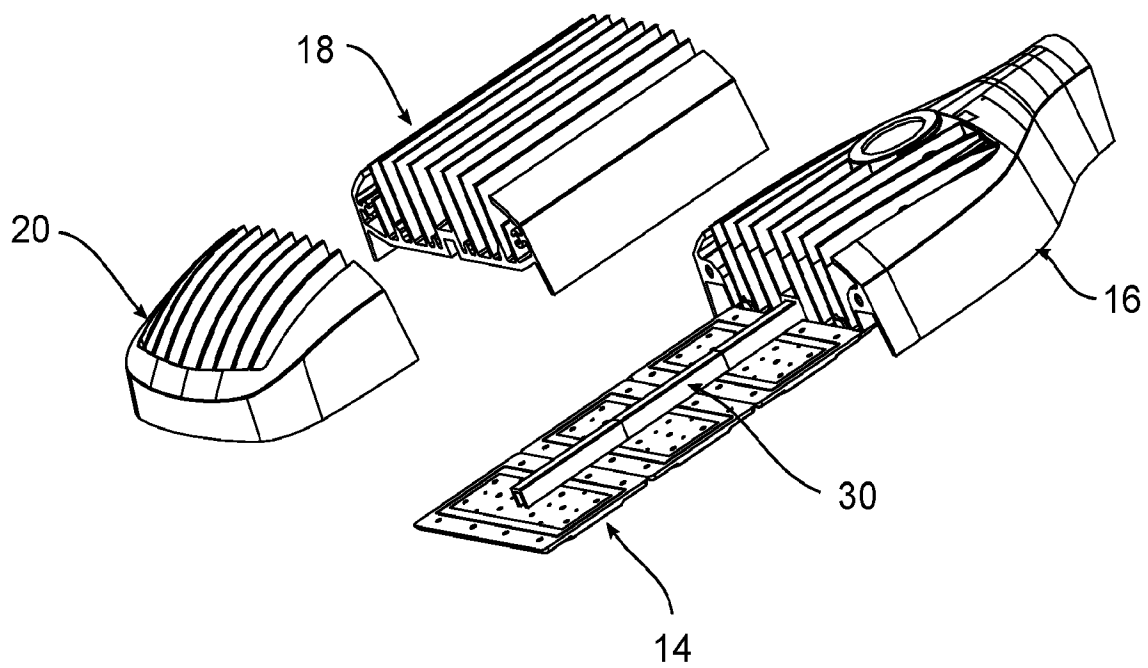


FIG. 18

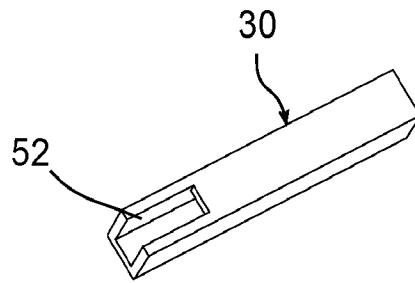


FIG. 19

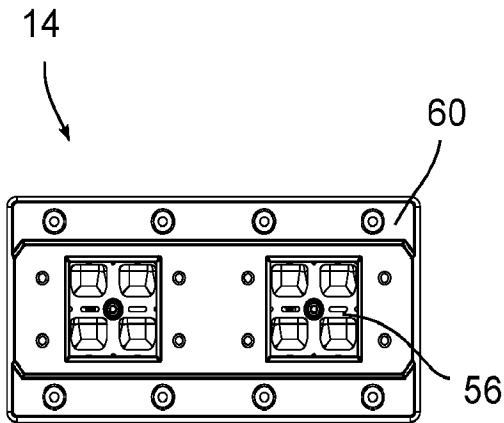


FIG. 20

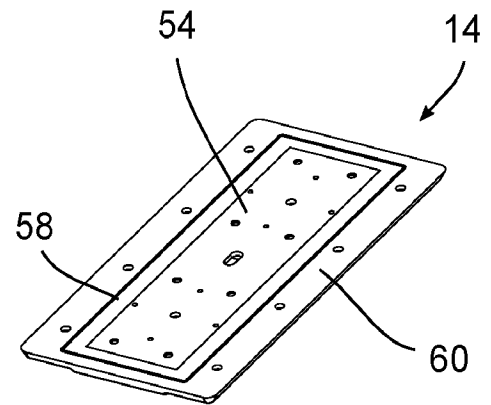


FIG. 21

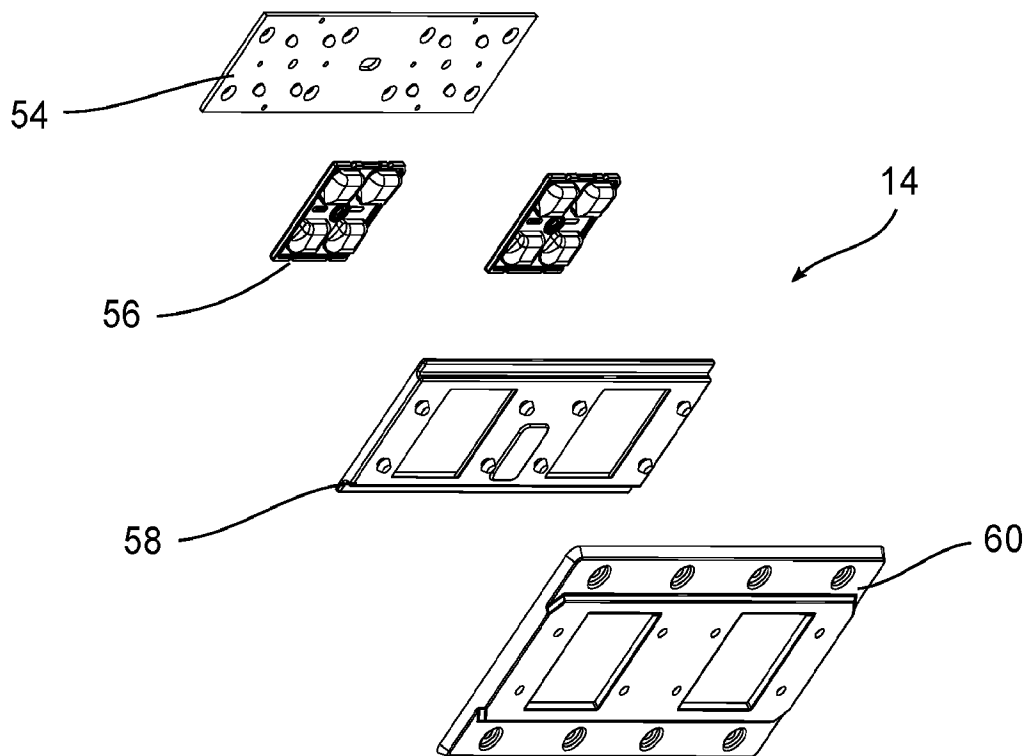


FIG. 22

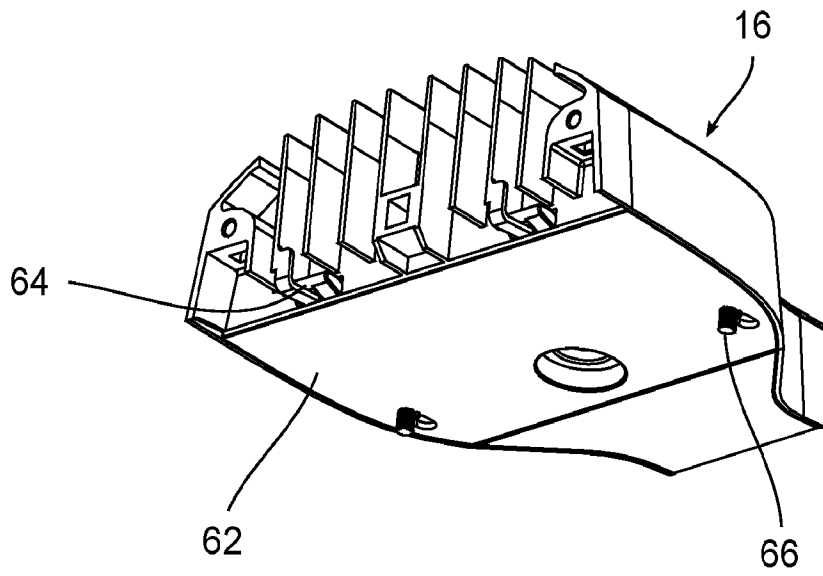


FIG. 23

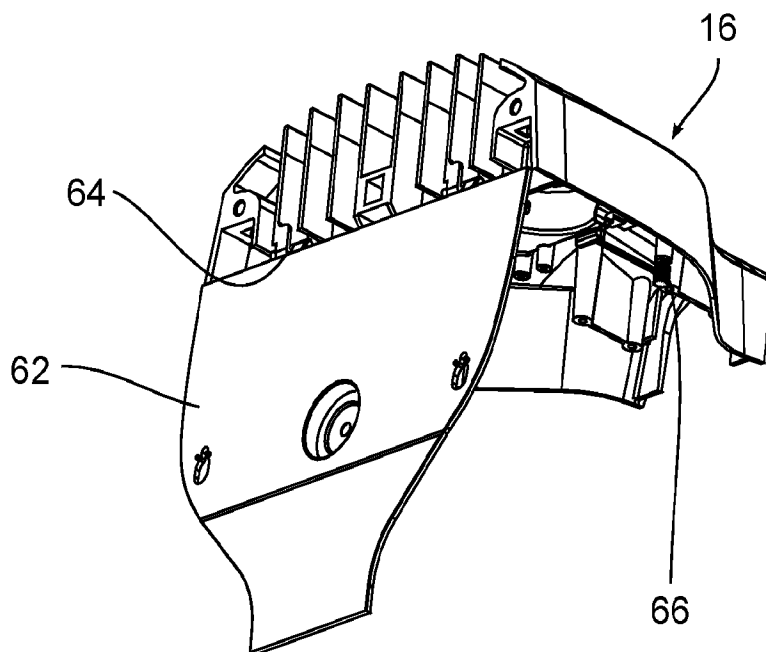


FIG. 24

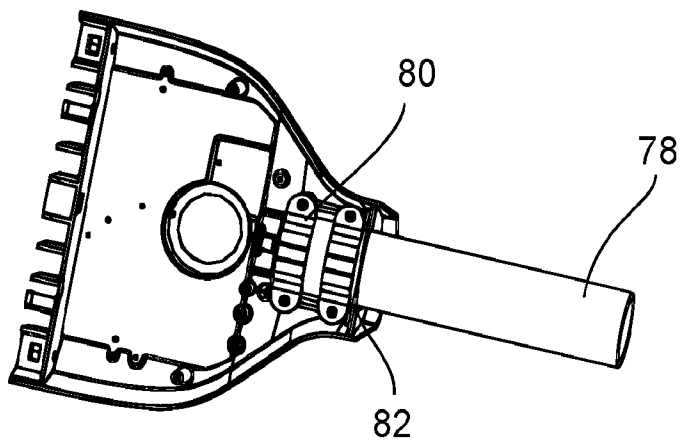


FIG. 25

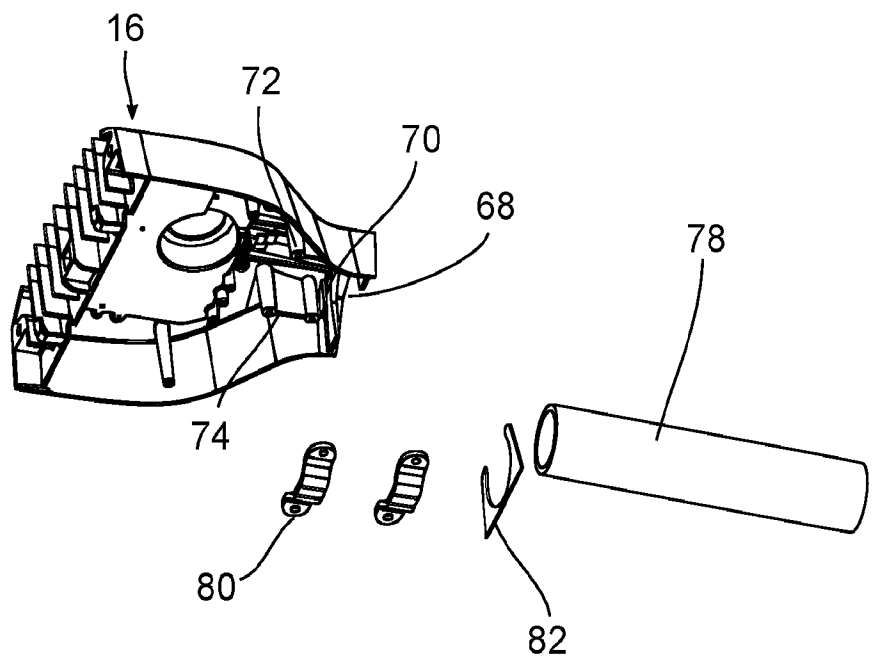


FIG. 26

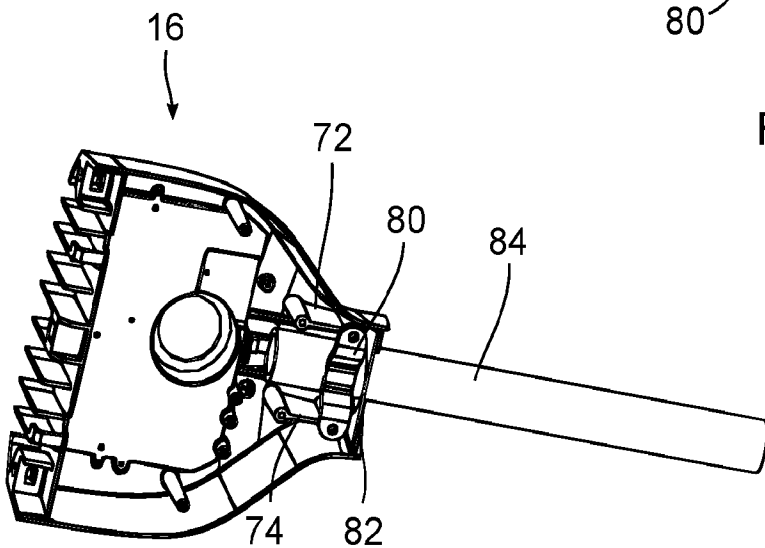


FIG. 27

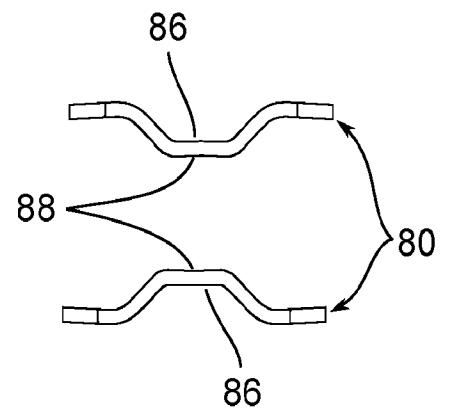


FIG. 28

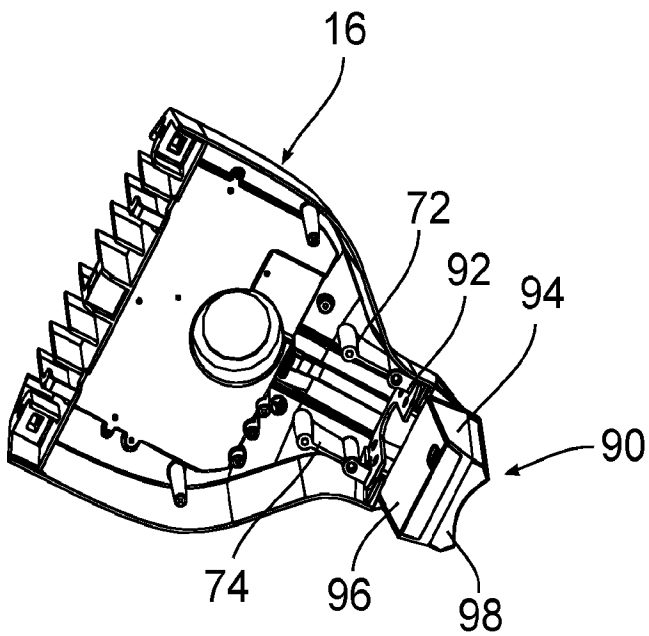


FIG. 29

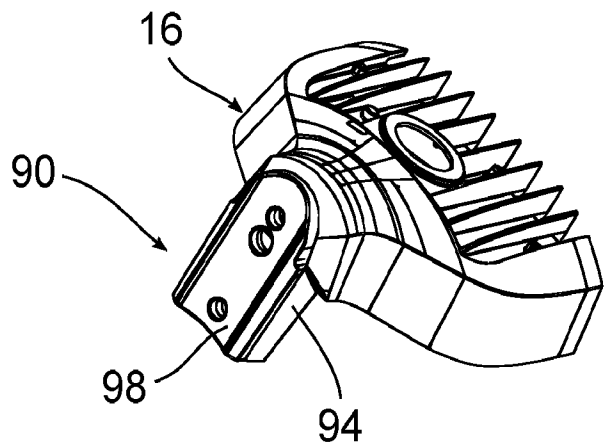


FIG. 30

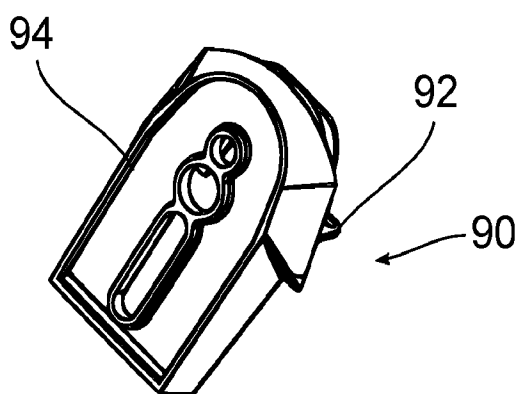


FIG. 31

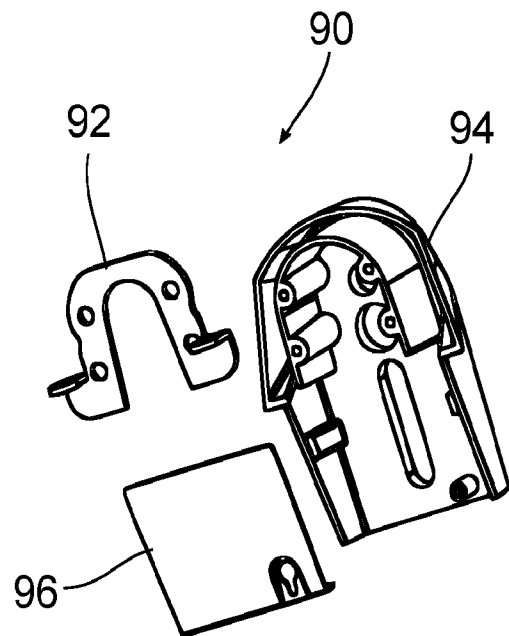


FIG. 32

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2015/068120

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F21V 7/20 (2016.01)

CPC - F21V 29/004 (2016.01)

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 7/20, 29/00 (2016.01)

CPC - F21V 29/004, 29/02, 29/2293; F21Y 2101/02, 2103/00 (2016.01)

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

USPC: 362/191, 218, 249.02, 249.03, 249.04, 249.07, 249.08, 249.09, 294, 367, 368, 373, 375 (keyword delimited)

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

Orbit, Google Patents, Google Scholar, Google

Search terms used: light, lamp, luminaire, illuminate, module, modular, interchangeable, exchangeable, substitute, connect, section, portion, chamber, component, element, unit, part, segment, piece, rear, mid, front, first, second, third, three, base, control, driver, power, ballast, sensor, detector, switch, button

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ---	US 2009/0251898 A1 (KINNUNE et al.) 08 October 2009 (08.10.2009) entire document	1, 2, 7, 9-11, 13
Y		3-6, 8, 12
X ---	US 4,426,676 A (TAYLOR) 17 January 1984 (17.01.1984) entire document	14-16, 18-20
Y		17
Y	US 2013/0215606 A1 (WANG et al.) 22 August 2013 (22.08.2013) entire document	3-5, 12
Y	EP 2600055 A1 (MARSHALLS MONO LIMITED) 05 June 2013 (05.06.2013) entire document	6
Y	US 5,000,535 A (CHURCHILL) 19 March 1991 (19.03.1991) entire document	8
Y	US 7,226,047 B1 (BEAUCHAMP) 05 June 2007 (05.06.2007) entire document	17

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

☐ See patent family annex.

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"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

16 February 2016

Date of mailing of the international search report

26 FEB 2016

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