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(71) Applicant: **HUBBELL INCORPORATED** [US/US]; 40 Waterview Drive, P.O. Box 1000, Shelton, CT 06484 (US).

(72) Inventors: **RECTOR, David, J.**; 517 Cranberry Hill Circle, Mauldin, SC 29662 (US). **BROWN, Raymond, A.**; 508 Peppercorn Court, Greer, SC 29650 (US). **SPITZER, Jeffrey, A.**; 622 Meece Bridge Road, Taylors, SC 29687 (US). **MACINTOSH, Kenneth, W.**; 30 Beverly Hills Drive, Ivyland, PA 18974 (US). **VANG, Seng**; 1409 Roper Mountain Road, Apt. 292, Greenville, SC 29615 (US). **JACKSON, Duncan, D.P.**; 2400 N. Lakeview Avenue, Apt. 2003, Chicago, IL 60614 (US). **JAMISON, Aidan**; 135 Prospect Park SW, Apt. A10, Brooklyn, NY 11218 (US). **BLACK, Andrew, M.**; 1300 N. Astor Street, Apt. 22C, Chicago, IL 60610 (US). **DENEKAMP, Niels**; 2400 N. Lakeview Avenue, Apt. 511, Chicago, IL 60614 (US). **BILLINGS, Eoin**; Flat 2C, Andrews Road, London E8 4QL (GB).

(74) Agent: **BARNER, Kevin, M.**; Michael Best & Friedrich, 601 Pennsylvania Avenue NW, Suite 700 South, Washington, DC 20004 (US).

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[Continued on next page]

(54) Title: LUMINAIRE

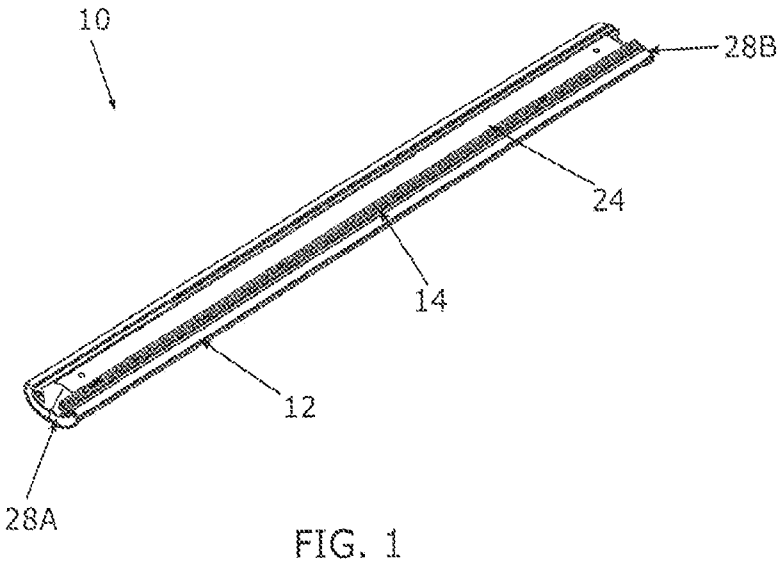


FIG. 1

(57) Abstract: A luminaire includes a support, a lens, an LED sheet, a top cover, a driver, an end bracket, and an end cap. The lens is connected to the support. The LED sheet is connected to the support between the lens and the support. The LED sheet has a plurality of LEDs, wherein a first LED is positioned in a first direction and a second LED is positioned in a second direction different from said first direction. The top cover is connected to the support. The driver is positioned in the support and electrically connected to the plurality of LEDs. The end bracket is connected to the support and the end cap is connected to the support covering the end bracket.

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INTERNATIONAL PATENT APPLICATION

OF

DAVID RECTOR

RAYMOND BROWN

JEFFREY SPITZER

KENNETH MACINTOSH

SENG VANG

DUNCAN JACKSON

AIDAN JAMISON

ANDREW BLACK

NIELS DENEKAMP

AND

EOIN BILLINGS

FOR

LUMINAIRE

RELATED APPLICATIONS

[0001] The present application claims priority to U.S. Provisional Applications 62/002,653, filed on May 23, 2014, and 62/088,253, filed on December 5, 2014, the disclosures of which are hereby incorporated by reference in their entirety.

FIELD OF THE INVENTION

[0002] Various exemplary embodiments of the invention relate to luminaires, for example indoor luminaire.

BACKGROUND OF THE INVENTION

[0003] Luminaires, or light fixtures, are used with electric light sources to provide aesthetic and functional housing in both interior and exterior applications. Various types of interior luminaires include overhead, ceiling, or suspended luminaires, which are designed to be positioned near, or suspended from, the ceiling. Interior

luminaires are typically made with either direct or indirect lighting elements. In recent years, lighting applications have trended towards the use of light emitting diodes (LEDs) as the light source in place of conventional incandescent and fluorescent lamps.

[0004] SUMMARY

[0005] According to an exemplary embodiment, a luminaire includes a support, a lens, an LED sheet, a top cover, a driver, an end bracket, and an end cap. The lens is connected to the support. The LED sheet is connected to the support between the lens and the support. The LED sheet has a plurality of LEDs, wherein a first LED is positioned in a first direction and a second LED is positioned in a second direction different from said first direction. The top cover is connected to the support. The driver is positioned in the support and electrically connected to the plurality of LEDs. The end bracket is connected to the support and the end cap is connected to the support covering the end bracket.

[0006] According to another exemplary embodiment, a luminaire includes a first support having an open first end. A first lens is connected to the first support. A second support has an open second end and a second lens is connected to the second support. A joiner rail is connected to the open first end of the first support and the open second end of the second support.

[0007] According to another exemplary embodiment, a luminaire includes a support, a lens, a light element, a tray, and a control component. The lens is connected to the support. The light element is positioned between the support and the lens. The tray is connected to the support and a control component is received in the tray.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] 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:

[0009] FIG. 1 is a perspective view of a luminaire according to a first exemplary embodiment;

[0010] FIG. 2 is an exploded, perspective view of the luminaire of FIG. 1;

[0011] FIG. 3 is a front view of the lens of FIG. 2;

[0012] FIG. 3A is an enlarged front view of section A of FIG. 3;

[0013] FIG. 3B is an enlarged front view of section B of FIG. 3;

[0014] FIG. 3C is an enlarged front view of section C of FIG. 3;

[0015] FIG. 3D is an enlarged front view of section D of FIG. 3C;

[0016] FIG. 4 is a perspective view of the light rail of FIG. 2;

[0017] FIG. 5 is a right side view of the light rail of FIG. 4;

[0018] FIG. 6 is a top view of the light rail of FIG. 4;

[0019] FIG. 7 is a front view of the light rail of FIG. 4;

[0020] FIG. 7A is a partial, sectional view of FIG. 7 taken along line A-A and viewed in direction of the arrows;

[0021] FIG. 8 is a right side view of the light sheet of FIG. 2;

[0022] FIG. 9 is a top view of the light sheet of FIG. 8;

[0023] FIG. 9A is an enlarged view of section A of FIG. 9;

[0024] FIG. 10 is a perspective view the driver bracket of FIG. 2;

[0025] FIG. 11 is a front view of the driver bracket of FIG. 10;

[0026] FIG. 12 is a perspective view of the grounding bracket of FIG. 2;

[0027] FIG. 13 is an exploded, perspective view of the grounding bracket and ground wire of FIG. 2;

[0028] FIG. 14 is a top view of the top cover of FIG. 2;

[0029] FIG. 15 is a right side view of the top cover of FIG. 14;

[0030] FIG. 16 is a front view of the top cover of FIG. 14;

[0031] FIG. 16A is an enlarged view of area A of FIG. 16;

[0032] FIG. 17 is a perspective view of the side cover of FIG. 2;

[0033] FIG. 18 is a front perspective view of the end cap of FIG. 2;

[0034] FIG. 19 is a rear perspective view of the end cap of FIG. 18;

[0035] FIG. 20 is a right side view of the end cap of FIG. 18;

[0036] FIG. 21 is another rear perspective view of the end cap of FIG. 18;

[0037] FIG. 22 is a bottom view of the end cap of FIG. 18;

[0038] FIG. 22A is a right side sectional view of FIG. 22 taken along line A-A and viewed in direction of the arrows;

[0039] FIG. 23 is a perspective, partially exploded view of a luminaire according to an exemplary embodiment;

[0040] FIG. 24 is a perspective view of an extending cover according to an exemplary embodiment;

[0041] FIG. 25 is a front view of the extending cover of FIG. 24;

[0042] FIG. 26 is a right side view of the extending cover of FIG. 24;

[0043] FIG. 26A is an enlarged sectional view of FIG. 26 taken along line A-A and viewed in direction of the arrows;

[0044] FIG. 27 is a top perspective view of a luminaire and a sensor module according to an exemplary embodiment;

[0045] FIG. 28 is a bottom perspective view of the luminaire and sensor module of FIG. 27;

[0046] FIG. 29 is an exploded, bottom perspective view of the luminaire and sensor module of FIG. 27;

[0047] FIG. 30 is an exploded, top perspective view of the luminaire and sensor module of FIG. 27;

[0048] FIG. 31 is another exploded, perspective view of the luminaire and sensor module of FIG. 27;

[0049] FIG. 32 is a bottom perspective view of a first sensor module used with the luminaire according to various exemplary embodiments;

[0050] FIG. 33 is a bottom perspective view of a second sensor module used with the luminaire according to various exemplary embodiments;

[0051] FIG. 34 is a perspective view of a connector plate and optical spacer according to an exemplary embodiment;

[0052] FIG. 35 is a perspective view of the connector plate of FIG. 34;

[0053] FIG. 36 is a top view of the connector plate of FIG. 35;

[0054] FIG. 37 is a front view of the connector plate of FIG. 35;

[0055] FIG. 38 is a perspective view of the optical spacer of FIG. 34;

[0056] FIG. 39 is a top plan view of the optical spacer of FIG. 38;

[0057] FIG. 40 is a front view of the optical spacer of FIG. 38;

[0058] FIG. 40A is a sectional view of the optical spacer of FIG. 40 taken along line A-A and viewed in direction of the arrows;

[0059] FIG. 40B is an enlarged view of the area B of FIG. 40;

[0060] FIG. 41 is a perspective view of the connector plate and optical spacer of FIG. 34 partially inserted into a first luminaire;

[0061] FIG. 42 is a perspective view of the connector plate and optical spacer of FIG. 34 fully inserted into a first luminaire;

[0062] FIG. 43 is a perspective view of a first and second luminaire connected with the connector plate and optical spacer of FIG. 34;

[0063] FIG. 44 is a perspective view of a suspension bracket connected to a luminaire according to an exemplary embodiment;

[0064] FIG. 45 is a perspective view of the suspension bracket of FIG. 44;

[0065] FIG. 46 is a top view of the suspension bracket of FIG. 45;

[0066] FIG. 47 is a front view of the suspension bracket of FIG. 45;

[0067] FIG. 48 is an exploded, perspective view of another exemplary luminaire;

[0068] FIG. 49 is a perspective view of the luminaire of FIG. 48;

[0069] FIG. 50 is a top view of the luminaire of FIG. 48;

[0070] FIG. 51 is a left side view of the luminaire of FIG. 48;

[0071] FIG. 52 is a front view of the luminaire of FIG. 48;

[0072] FIG. 53 is a partial perspective view of the light rail of FIG. 48;

[0073] FIG. 54 is a front view of the light rail of FIG. 53;

[0074] FIG. 54A is an enlarged view of area A of FIG. 54;

[0075] FIG. 54B is an enlarged view of area B of FIG. 54;

[0076] FIG. 55 is a front view of the lens of FIG. 48;

[0077] FIG. 55A is an enlarged view of area A of FIG. 55;

[0078] FIG. 55B is an enlarged view of area B of FIG. 55;

[0079] FIG. 56 is a top view of the cover of FIG. 48;

[0080] FIG. 57 is a front view of the cover of FIG. 56;

[0081] FIG. 58 is a perspective view of the end bracket of FIG. 48;

[0082] FIG. 59 is a top view of the end bracket of FIG. 58

[0083] FIG. 60 is a right side view of the end bracket of FIG. 58;

[0084] FIG. 61 is a rear view of the end bracket of FIG. 61;

[0085] FIG. 62 is an exploded, perspective view of another exemplary luminaire;

[0086] FIG. 63 is a perspective view of the luminaire of FIG. 62;

[0087] FIG. 64 is a perspective view of the center bracket of FIG. 62;

[0088] FIG. 65 is a top view of the center bracket of FIG. 64;

[0089] FIG. 66 is a front view of the center bracket of FIG. 64;

[0090] FIG. 67 is a partially exploded, perspective view of another exemplary luminaire;

[0091] FIG. 68 is a perspective view of the luminaire of FIG. 67;

[0092] FIG. 69 is an exploded, perspective view of the first portion of the luminaire of FIG. 67;

[0093] FIG. 70 is a perspective view of the first portion of the luminaire of FIG. 67;

[0094] FIG. 71 is a top view of the luminaire of FIG. 67;

[0095] FIG. 72 is a top view of the first portion of the luminaire of FIG. 67;

[0096] FIG. 73 is a right side view of the first portion of the luminaire of FIG. 67;

[0097] FIG. 74 is a top view of the joiner rail of FIG. 67;

[0098] FIG. 75 is a front view of the joiner rail of FIG. 64;

[0099] FIG. 75A is a partial, sectional view of FIG. 75 taken along line A-A and viewed in direction of the arrows;

[00100] FIG. 76 is a perspective view of the joiner bracket of FIG. 67;

[00101] FIG. 77 is a top view of the joiner bracket of FIG. 76;

[00102] FIG. 78 is front view of the joiner bracket of FIG. 76;

[00103] FIG. 79 is a perspective view of the optical spacer of FIG. 67;

[00104] FIG. 80 is a top view of the optical spacer of FIG. 79;

[00105] FIG. 81 is a front view of the optical spacer of FIG. 79;

[00106] FIG. 81A is a sectional view of FIG. 81 taken along line A-A and viewed in direction of the arrows;

[00107] FIG. 81B is an enlarged view of area B in FIG. 81;

[00108] FIG. 82 is a right side view of the optical spacer of FIG. 79;

[00109] FIG. 83 is an exploded, perspective view of another exemplary luminaire;

[00110] FIG. 84 is an exploded, perspective view of the tray of FIG. 83 and an exemplary sensor unit;

[00111] FIG. 85 is an exploded, perspective view of the tray of FIG. 83 and another exemplary sensor unit;

[00112] FIG. 86 is a partial top view of the rail of FIG. 83;

[00113] FIG. 87 is a perspective view of the tray of FIG. 83;

[00114] FIG. 88 is a top view of the tray of FIG. 87;

[00115] FIG. 89 is a right side view of the tray of FIG. 87;

[00116] FIG. 90 is a front view of the tray of FIG. 87;

[00117] FIG. 91 is a top view of the lens of FIG. 83;

[00118] FIG. 92 is a top view of another exemplary lens;

[00119] FIG. 93 is a top view of the shield of FIG. 83;

[00120] FIG. 94 is a top view of another exemplary shield;

[00121] FIG. 95 is an exploded, perspective view of another exemplary luminaire with a control module;

[00122] FIG. 96 is a perspective view of another exemplary shield;

[00123] FIG. 97 is a front view of the shield of FIG. 96;

[00124] FIG. 98 is a perspective view of a partially assembled luminaire according to another exemplary embodiment;

[00125] FIG. 99 is a perspective view of the partially assembled luminaire of FIG. 98 with the light rail partially removed from the lens;

[00126] FIG. 100 is a front view of the partially assembled luminaire of FIG. 98;

[00127] FIG. 101 is a perspective view of a side cover for use with the luminaire of FIG. 98 according to an exemplary embodiment;

[00128] FIG. 102 is a front view of a light rail according to another exemplary embodiment;

[00129] FIG. 102A is an enlarged view of the area A of FIG. 102;

[00130] FIG. 103 is a front view of a lens according to another exemplary embodiment;

[00131] FIG. 103A is an enlarged view of the area A of FIG. 103; and

[00132] FIG. 103B is an enlarged view of the area B of FIG. 103.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[00133] According to various exemplary embodiments as illustrated in one or more of the drawings, a luminaire 10 includes a lens 12 connected to a support, for example a light rail 14. A flexible light emitting diode (LED) sheet 16 is connected to the light rail 14 and positioned between the light rail 14 and the lens 12. A driver 18 is positioned on the light rail 14 and connected by one or more driver brackets 20. The driver 18 is electrically connected to the LED sheet 16. A grounding bracket 22 electrically grounds the driver 18 to the light rail 14. A top cover 24 is connected to the light rail 14 over the driver 18. First and second side covers 26A, 26B are connected to the light rail 14 to enclose the sides of the driver. First and second end caps 28A, 28B are connected to the light rail 14 to enclose the sides of the light rail 14 and lens 12.

[00134] As best shown in FIG. 3, and in accordance with further exemplary embodiments, the lens 12 includes a bottom section 30 and first and second top sections 32. In various exemplary embodiments, the lens 12 is made from a polymer material, for example acrylic, and is extruded to any desired length. In alternative embodiments, other materials and methods of manufacture may be used. The

bottom section 32 has a concave curve extending to a first and second corner. The bottom section 32 includes an outer surface having a plurality of prisms 34. The term prism is used herein not to describe a specific structure, but to refer to a feature for directing, dispersing, diffusing, or otherwise modifying emitted light. According to an exemplary embodiment, the prisms 34 are rounded prisms as shown, for example, in FIG. 3A. The size, shape, spacing, and configuration of the prisms 34 can vary depending on the desired light output.

[00135] The first and second top sections 32 extend from the bottom section 30 towards the center of the lens 12. A first set of prisms 36 extends from the inner surface of the first and second top sections 32. A first and second arm 38 extend from the first and second top sections 32, respectively. According to the exemplary embodiment, the first and second arms 38 include various curvilinear and rectilinear inner and outer surfaces as shown in FIG. 3B. First and second cylindrical grooves 40 extend into the first and second arms 38, respectively. A plurality of prisms 42 extend from the inner surface of the grooves 40. According to an exemplary embodiment, the prisms 36 extending from the first and second top sections and the prisms 42 extending from the cylindrical grooves 40 are rounded prisms as shown in FIGS. 3B-3D. The size, shape, spacing, and configuration of the prisms 36, 42 can vary depending on the desired light output. A first flange 44 and a second flange extend from the first and second arms 38, respectively.

[00136] As best shown in FIGS. 4-7A, and in accordance with further exemplary embodiments, the support or light rail 14 includes a bottom portion 46, first and second side hooks 48, and first and second arms 50 extending form the side hooks 48. In various exemplary embodiments, the light rail 14 is made from metal, for example aluminum, and is extruded to any desired length. In alternative embodiments, other materials and methods of manufacture may be used. Various exemplary embodiments of the light rail 14 have the capability to flex or bow a certain amount depending on the luminaire configuration. As best shown in FIG. 7, the bottom portion 46 has a concave curve extending to a first end and a second end.

The hooks 48 extend from the bottom section proximate the first and second ends. The first and second arms 50 extend from the first and second hooks 48. Both sides of the light rail 14 have similar configurations and only one side may be described herein for clarity.

[00137] According an exemplary embodiment, the hooks 48 have a substantially planar first section 52 extending from the bottom portion 46 at an oblique angle away from the center of the light rail 14, a substantially planar second section 54 extending from the first section 52 at an oblique angle away from the center of the light rail 14, and a curved third section 56 curving from the second section 54 downwardly and back towards the center of the light rail 14. The first and second hooks 48 bound a first and second hook channel 58, respectively, with the free end of the first and second hooks 48 spaced from the bottom section 46 to define an opening.

[00138] The first and second arms 50 include a first portion 60 and a second portion 62. In various exemplary embodiments, the first portion 60 of the first and second arms 50 extends from the first section 52 of the first and second hooks 48 at an oblique angle towards the center of the light rail 14. Each of the first portions 60 include a first notch 64 extending into an outer surface and first protrusions 66 extending outwardly from the outer surface. As best shown in FIG. 7A, the first portions 60 include one or more openings 68, for example wireway or alignment openings. In various exemplary embodiments, the second portions 62 extend outwardly from the respective first portions 60 with a substantially vertical orientation. A first end of the second portions extends below the first portion to form a lip 70. Each of the second portions 62 include a second notch 72 formed into an inner surface, outwardly facing second protrusions 74 having an angled prong extending from an outer surface, and outwardly extending third protrusions 76 extending from the outer surface. The first and second protrusions 66, 74 bound a first side channel 78 and the second and third protrusions 74, 76 bound a second side

channel 80. The light rail bottom 46, first and second hooks 48, and first and second arms 50 bound a center channel 82.

[00139] As best shown in FIGS. 8-9A, and in accordance with further exemplary embodiments, the LED sheet 16 includes a sheet of flexible material 84 with a plurality of LEDs. In various exemplary embodiments, the LEDs are LED modules 86 that are contained units having a dome-shaped lens surrounding one or more light generating elements and necessary circuitry (not shown). Various types of LED modules 86 may be used depending on the performance requirements and the desired output as would be understood by one of ordinary skill in the art. The LED modules 86 extend from a single surface of the flexible material 84. According to an exemplary embodiment, the flexible material 84 is a polymer or composite sheeting or other suitable material having one or more layers, for example, two layers of polymer sheeting sandwiching conductor pathways and LED modules 86.

[00140] As shown in FIG. 9, the LED modules 86 are arranged in different patterns, for example, an outer pattern and an inner pattern. In various exemplary embodiments, the outer most rows of LED modules 86 on each side of the LED sheet 16 are configured for up-lighting or indirect lighting, while the remaining LED modules 86 are configured for down-lighting or direct lighting.

[00141] Connectors 88 are positioned at first and second corners of the LED sheet. The connectors 88 are electrically connected to one or more drivers 18, for example through a conductor. Multiple paths or traces electrically connect the connectors 88 to the plurality of LED modules 86. In various exemplary embodiments, the connectors 88 are surface mount terminal block type connectors. The connectors 88 can be configured to connect to one or more similar or identical connectors, for example through conductors or connecting links, so that multiple LED sheets 16 can be connected together as desired.

[00142] As best shown in FIG. 2, and in accordance with further exemplary embodiments, the driver 18 is connected to the light rail 14 through one or more driver brackets 20. An exemplary embodiment of the driver bracket 20 is shown in

FIGS. 10 and 11. The driver bracket 20 has a substantially U-shaped body with a top section 90, first and second side sections 92, and first and second flanges 94 extending from the first and second side sections 92, respectively. In various exemplary embodiments, the driver bracket 20 is made from metal, for example stainless steel, although in alternative embodiments, other materials may be used.

[00143] The driver 18 is grounded to the light rail 14 through a grounding bracket 22. According to the exemplary embodiment shown in FIGS. 12 and 13 the grounding bracket 22 is substantially U-shaped having a bottom section 96 and first and second sides 98 extending upwardly from the bottom section 96. In various exemplary embodiments, the grounding bracket 22 is made from metal, for example stainless steel, although in alternative embodiments, other materials may be used. The bottom section 96 includes an aperture 100 and the first and second sidewalls each include an outwardly extending tine 102.

[00144] According to an exemplary embodiment, the grounding bracket 22 is positioned on the light rail 14 with a post 104 extending through the aperture 100. A grounding wire 106 having an eyelet 108 extends from the driver 18 and is positioned on the post 104 and secured thereto. In various exemplary embodiments, the post 104 is threaded and a nut 110 is fastened to the post 104 to secure the grounding wire 106. In other embodiments, the grounding wire 106 may be soldered to the post 104.

[00145] As best shown in FIGS. 14-16A, and in accordance with further exemplary embodiments, the cover 24 is substantially U-shaped with a curved top surface 112 and first and second sides 114 extending downwardly from the top surface 112. The first and second sides 112 include one or more protrusions 116 extending from an outer surface away from the center of the cover 24. The protrusions 116 may be formed through pressing, stamping, or punching the first and second sides to form rounded deformations therein. One or more top apertures 118 extend through the top of the cover 24 and one or more side apertures 120 extending through the sides of the cover 24. In various exemplary embodiments, the cover 24 is made from

metal, for example aluminum, and is extruded to any desired length. In alternative embodiments, other materials and methods of manufacture may be used.

[00146] A driver 18 can be positioned in the light rail 14 center channel 82 and one or more driver brackets 20 are positioned over the driver 18 and connected to the light rail 14, for example through engagement of the driver bracket 20 flange 94 and the lip 70 formed between the first and second portions 60, 62 of the first and second arms 50. The driver bracket 20 may be slidable connected or snap fit to the light rail 14. Also, the grounding bracket 22 is connected to the light rail 14 center channel 82, for example through engagement of the tines 102 and the lip 70 formed between the first and second portions 60,62 of the first and second arms 50. The grounding bracket 22 may be slidable connected or snap fit to the light rail 14. The top cover 24, shown in the exemplary embodiment of FIGS. 14-16A, is connected to the light rail 14 by engagement of the protrusions 116 with the second notches 72 formed in the second portions 62 of the light rail 14 first and second arms 50. The top cover 24 may be slidable connected to snap fit to the light rail 14.

[00147] FIG. 17 shows an exemplary embodiment of a side cover 26 having a top section 130 and a bottom section 132. In various exemplary embodiments, the side 26 cover is configured to mate with the light rail 14 shown in FIGS. 3-6. The bottom section 132 has first and second shoulders 134 that are wider than the top section and include at least one substantially horizontal edge 136. The shoulders 134 are designed to abut the lip 70 formed between the first and second portions 60, 62 of the first and second arms 50. One or more protursions (shown in FIG. 1A) may extend from the bottom section 132 to position the side cover 26 on the light rail 14. The first side cover 26 includes a top slot 138 and a bottom slot 140 for mating with an end cap 28.

[00148] FIGS. 18-22A show an exemplary end cap 28. The end cap 28 includes a front surface 144 and a rear surface 146. The front surface 144 has an angled wall 148 extending away from the front surface 144. Extending from the angled wall 148 is a top flange 150. A bottom flange 152 extends from the rear surface 146. First and

second mounting posts 154 extend from the rear surface 146 and have a substantially sideways V-shape with a rounded corner. A first tab 156 and a second tab 158 extend from the angled wall 148. In various exemplary embodiments, the end cap 28 is translucent to allow light emitted from the luminaire to diffuse through the ends. In other alternative embodiments, the end cap 28 is opaque or has a varying degree of opacity.

[00149] FIG. 23 shows the exemplary side cover 26 and the exemplary end cap 28 being inserted into the light rail 14. The side cap 26 is slid into the center channel 82 of the light rail 14 so that the shoulder abuts 134 or fits inside the lip 70. The end cap 28 is then inserted so that the bottom flange 152 engages the inner surface of the of the bottom section 30 of the lens 12 and the first and second mounting posts 154 extend into the first and second hook channels 58, respectively. The first tab 156 of the end cap 28 engages the bottom slot 140 of the side cover 26 and the second tab 158 of the first end cap engages the top slot 138 of the side cover 26. The end cap top flange 150 is positioned over the light rail 14 and adjacent to, in direct contact with, or overlapping the top cover 24. Another end cap and side cover are connected to the opposite side of the light rail 14. The side covers 62 provide an enclosure for the driver 18.

[00150] In accordance with various exemplary embodiments, the luminaire 10 is modular and capable of connecting with other modules as discussed in further detail below. FIGS. 24-26A show an exemplary extending cover 160 for use with the luminaire 10. The extending cover 160 includes a curved top surface 162 and first and second sides 164 extending downwardly from the top surface 162. The first and second sides 164 include one or more protrusions 166 extending from an outer surface away from the center of the extending cover 160. The protrusions 166 may be formed through pressing, stamping, or punching the first and second sides 164 to form rounded deformations therein. One or more side apertures 168 extend through the sides 164 of the extending cover 160. In various exemplary embodiments, the extending cover 160 is made from metal, for example aluminum, and is extruded to

any desired length. In alternative embodiments, other materials and methods of manufacture may be used.

[00151] As best shown in FIGS. 27-33, and in accordance with further exemplary embodiments, the extending cover 160 is used to connect a sensor module 170 to the luminaire 10. The sensor module 170 includes a sensor cover 172 connected to a sensor rail 174. In an exemplary embodiment, the sensor cover 172 has similar features to the lens 12 and the sensor rail 174 has similar features to the light rail 172. The extending cover 160 protrusions 166 connect to the second notch 72 on the light rail 14 and a similar inner notch 176 on the sensor rail 174.

[00152] As best shown in FIG. 31, the sensor cover 172 includes a first aperture 178, for example a circular opening, and an adapter plate 180 positioned in the aperture. The sensor rail 174 includes a second aperture 182, for example a substantially rectangular opening. A sensor 184 is positioned adjacent the first aperture 178 in the sensor cover 172 and extends through the second aperture 182 in the sensor rail 174. In the exemplary embodiment shown in FIGS. 29 and 32, the adaptor plate 180 includes two openings and can be used with a sensor 184 having more than one detection capability, or two integrated sensors. As best shown in FIGS. 31-33, and in accordance with further exemplary embodiments, the adaptor plate 180 is interchangeable with other adaptor plates, for example the adaptor plate 181 with a single opening, so that different types of sensors may be used with the same sensor module 170. Various types of exemplary sensors include, but are not limited to, infrared sensors, dimming photosensors, motion sensors, noise sensors, occupancy sensors, and daylight sensors.

[00153] In various exemplary embodiments, the extending cover 160 is used in connection with a connector plate 186 and an optical spacer 198 to connect multiple luminaries. As best shown in FIGS. 34-37, and in accordance with further exemplary embodiments, the connector plate 186 includes a first and second ends 188, 190, first and second side flanges 192, and first and second tines 194. The first and second side flanges 192 extend at an angle away from the center of the connector plate 186. The

first and second tines 194 extend outwardly from a central region of the connector plate 186 and include an aperture for receiving a mechanical fastener, for example a set screw (not shown). In various exemplary embodiments, the first and second side flanges 192 and the first and second tines 194 are resilient. The first and second flanges 192 include a notch 196. In various exemplary embodiments, the connector is made from metal, for example galvanized steel, although other materials may be used.

[00154] As best shown in FIGS. 38-40B, and in accordance with further exemplary embodiments, the optical spacer 198 includes a central region 200 surrounded by an outer rim 202. The outer rim 202 has a substantially concave bottom section and first and second top sections. An outer flange 204 extends from the outer rim 202 on the bottom section and the first and second top sections. First and second spacer arms 206 extend from the first and second top sections, respectively. The first and second spacer arms 206 include a circular portion 208 and an angled planar portion 210. The central region 200 bounds a spacer channel 212. First and second projections 214 extend from the central region 200 into the spacer channel 212. In various exemplary embodiments, the optical spacer 198 is made from a polymer, for example acrylic. The optical spacer 198 can be translucent to allow light to pass through the spacer or it may be opaque.

[00155] As best shown in FIGS. 41-43, the connector plate 186 is slid into the light rail 14 center channel 82 of a first luminaire 10A so that the first and second side flanges 192 abut the light rail 14, for example the first and second arms 20, or the lip 70 formed between the first and second portions 60, 62 of the first and second arms 50. The optical spacer 198 is then slid onto the connector plate 186 with the connector plate 186 sliding through the spacer channel 212 and the first and second projections 214 abutting the first and second side flanges 192 and resting in the notch 196. The optical spacer 198 is positioned so that the outer rim 202 extends into the first luminaire 10A lens 12, with the circular portion 208 of the first spacer arm 206 extending into the cylindrical groove 40 of the lens 12. A set screw may then be

inserted into the first tine 194 of the connector plate 186 and tightened to assist in securing the connector plate 186 to the light rail 14. A second luminaire 10B is then similarly connected to the other side of the connector plate 186. When two luminaires 10A, 10B are connected, the outer flange 204 extending from the outer rim 202 of the optical spacer 198 is positioned between the two. The extending cover 160 can be slidably connected to the assembly prior to connection of the second luminaire 10B, or the extending cover 160 can be press fit into place after both luminaires 10A, 10B are connected.

[00156] FIG. 44 shows a luminaire 10 connected to a suspension assembly 216 having a cable 218, a mounting adapter 220, and a suspension bracket 222. As best shown in FIGS. 46 and 47, and in accordance with further exemplary embodiments, the suspension bracket 222 includes a top section 224, first and second sides 226, and first and second hooks 228. The top section 224 includes a top aperture 230 for receiving the mounting adapter 220. The first and second sides 226 include side apertures 230 to reduce the weight and material of the suspension bracket and to increase the flexibility of the sides 226. The hooks 228 connect to a light rail 14, for example with the third protrusion 75 and/or the second side channel 80.

[00157] FIGS. 48-52 depict another exemplary a luminaire 310 that includes a support, for example a light rail 312 or other suitable support, and a lens 314 connected to the light rail 312. A flexible light emitting diode (LED) sheet is connected to the light rail 312 and positioned between the light rail 312 and the lens 314. A driver 318 is positioned on the light rail 312 and connected by one or more driver brackets 320. The driver 318 is electrically connected to the LED sheet. A top cover 324 is connected to the light rail 312 over the driver 318. First and second end brackets 326A, 326B are connected to the light rail 312 to enclose the sides of the driver 318. First and second end caps 328A, 328B are connected to the light rail 312 to enclose the sides of the light rail 12 and lens 14. In an exemplary embodiment, the components of the luminaire 10 can be configured as a two foot through four foot luminaire.

[00158] As best shown in FIGS. 53-54B, and in accordance with further exemplary embodiments, the light rail 312 includes a bottom portion 330, first and second side hooks 332, and first and second arms 334 extending form the side hooks 332. In various exemplary embodiments, the light rail 312 is made from metal, for example aluminum, and is extruded to any desired length. In alternative embodiments, other materials and methods of manufacture may be used. Various exemplary embodiments of the light rail 312 have the capability to flex or bow a certain amount depending on the luminaire configuration. As best shown in FIG. 54 the bottom portion 330 has a concave curve extending to a first end and a second end. The first and second hooks 332 extend from the bottom section 330 proximate the first and second ends. The first and second arms 334 extend from the first and second hooks 332. The bottom portion includes a notch 336 in the outer surface and a pair of protrusions 338 extending from the inner surface. The notch 336 acts as a drill point guide and the protrusions 338 assist in retaining a joiner rail 388 as discussed in further detail below.

[00159] According to an exemplary embodiment, the first and second hooks 332 have a substantially planar first section extending from the bottom portion 330 at an

oblique angle away from the center of the light rail 312, a substantially planar second section extending from the first section at an oblique angle away from the center of the light rail 312, and a third section curving from the second section downwardly and back towards the center of the light rail 312. The first and second hooks 332 bound a first and second hook channel 340, respectively, with the free end of the first and second hooks 332 spaced from the bottom section 330 to define an opening.

[00160] The first and second arms 334 include a first portion and a second portion. In various exemplary embodiments, the first portion of the first and second arms 334 extends from the first section of the first and second hooks 332 at an oblique angle towards the center of the light rail 312. Each of the first portions include a first notch extending into an outer surface and first protrusions extending outwardly from the outer surface. In an exemplary embodiment, the first portions include one or more wireway openings (not shown). In various exemplary embodiments, the second portions extend outwardly from the respective first portions with a substantially vertical orientation. A first end of the second portion extends below the first portion to form a lip. Each of the second portions include a second notch formed into an inner surface, outwardly facing second protrusions having an angled prong extending from an outer surface, and outwardly extending third protrusions extending from the outer surface. The first and second protrusions bound a first side channel 342 and the second and third protrusions bound a second side channel 344. The light rail bottom 330, first and second hooks 332, and first and second arms 334 bound a center channel 346.

[00161] As best shown in FIGS. 55-55B, and in accordance with further exemplary embodiments, the lens 314 includes a bottom section 348, and first and second top sections 350. In various exemplary embodiments, the lens 314 is made from a polymer material, for example acrylic, and is extruded to any desired length. In alternative embodiments, other materials and methods of manufacture may be used. The bottom section 348 has a concave curve extending to a first and second corner. The bottom section 348 includes an outer surface having a plurality of prisms 352.

According to an exemplary embodiment, the prisms 352 are rounded prisms as shown, for example, in FIG. 55. The size, shape, spacing, and configuration of the prisms 352 can vary depending on the desired light output.

[00162] The first and second top sections 350 extend from the bottom section 348 toward the center of the lens 314. The first and second top sections 348 each have an inner surface and a set of prisms 352 extending from the inner surface. First and second flanges 354 extend from the first and second top sections 348, respectively. When assembled, the first and second flanges 354 engage with the first side channel 342 of the rail 312.

[00163] As best shown in FIG. 48, and in accordance with further exemplary embodiments, the driver 318 is connected to the light rail 312 through one or more driver brackets 320. The driver bracket 320 has a substantially U-shaped body with a top section, first and second side sections, and first and second flanges extending from the first and second side sections, respectively. In various exemplary embodiments, the driver bracket 320 is made from metal, for example stainless steel, although in alternative embodiments, other materials may be used.

[00164] Although not shown, the driver 318 may be positioned in the light rail 312 center channel 346 and one or more driver brackets 320 are positioned over the driver 318 and connected to the light rail 312, for example through engagement of the driver bracket 320 flange and the lip formed between the first and second portions of the first and second arms 334. The driver bracket 320 may be slidable connected or snap fit to the light rail 312.

[00165] As best shown in FIGS. 56 and 57, and in accordance with further exemplary embodiments, the cover 324 is substantially U-shaped with a curved top surface and first and second sides extending downwardly from the top surface. The cover 324 has a first end and a second with a substantially U-shaped slot 356 positioned at each end. An aperture 358 is positioned near each slot 356. The slot 356 accommodates for the passage of one or more conductors, for example a cable 360 that connects the driver to a power source such as a hard-wired connection. The

aperture 358 allows for passage of a fastener to connect the cover 324 to the end bracket 326. In various exemplary embodiments, the cover 324 is made from metal, for example aluminum, and is extruded to any desired length. In alternative embodiments, other materials and methods of manufacture may be used.

[00166] FIGS. 58-61 shows a first exemplary embodiment of an end bracket 326 having a top section 362, an angled front wall 364, first and second side walls 366, and first and second flanges 368 extending from the first and second side walls 366, respectively. The top section 362 includes a center portion and angled side portions. The center portion includes a first aperture 370 and a second aperture 372. The first aperture 370 of the end bracket 326 aligns with the aperture 358 of the cover 324 to receive a fastener, connecting the cover 324 to the end bracket 326. The second aperture 372 of the end bracket 326 aligns with the substantially U-shaped slot 356 of the cover 324. The cable 360 extends through the slot 356 and the second aperture 372 to connect to the driver 320. The edges of the cover 324 surrounding the slot 356 extend over at least a portion of the end bracket 326, for example the angled side portions. The front wall 364 includes a stud 374 for a grounding connection. In an exemplary embodiment, a grounding wire and eyelet (not shown) are fastened with a hex nut and connected to the stud 375. This connection provides grounding for the driver 318. The end bracket 326 is connected to the light rail 312 with the first and second flanges 368 retaining the end bracket 326 in the center channel 346 of the light rail 312. In various exemplary embodiments, the end bracket 326 can be slidably connected and/or snap connected to the light rail 312.

[00167] The end cap 328 is connected to the light rail 312 over the end bracket 326. In an exemplary embodiment, the end cap includes a bottom flange, and first and second mounting posts extending from a rear surface as shown in FIGS. 18-22. The end cap 328 is inserted into the light rail 312 so that the bottom flange engages the inner surface of the of the bottom section of the lens 314 and the first and second mounting posts extend into the first and second hook channels, respectively. The end

cap 328 can include an angled wall that aligns with the angled front wall of the end bracket 326

[00168] In accordance with various exemplary embodiments, the luminaire 310 is modular and capable of connecting with other modules. FIGS. 62 and 63 show another exemplary luminaire, configured as a longer luminaire, for example a six through eight foot luminaire. The luminaire includes a light rail 312 and a lens 314 connected to the light rail 312. The light rail 312 and lens 314 can be the same or similar to those of the luminaire 310 shown in FIG. 48, but formed longer. A flexible LED sheet is connected to the light rail 312 and positioned between the light rail 312 and the lens 314. A single LED sheet or multiple LED sheets may be used. A first driver 318A and a second driver 318B are positioned on the light rail 312 and connected by one or more driver brackets 320. The drivers 318A, 318B are electrically connected to the one or more LED sheets. A first top cover 324A and a second top cover 324B are connected to the light rail 312 over the drivers 318A, 318B. A center bracket 376 is positioned in the light rail 312 to connect the first and second top covers 324A, 324B. First and second end brackets 326A, 326B are connected to the light rail 312 to enclose the sides of the drivers 318A, 318B. First and second end caps 328A, 328B are connected to the light rail 312 to enclose the sides of the light rail 312 and lens 314.

[00169] FIGS. 64-66 show a center bracket 376 according to an exemplary embodiment. The center bracket 376 includes a top section 378, first and second side walls 380, and first and second flanges 382 extending from the first and second side walls 380, respectively. The top section 378 includes a first aperture 384 and a second aperture 386. The first aperture 384 of the center bracket 376 aligns with the aperture 358 of the first cover 324A to receive a fastener, connecting the first cover 324A to the center bracket 376. The second aperture 386 of the center bracket 376 aligns with the aperture 358 of the second cover 324B to receive a fastener, connecting the second cover 324B to the center bracket 376. In various exemplary embodiments, the center bracket 376 can be slidably connected and/or snap

connected to the light rail 312, for example the center channel 346, with the first and second flanges 382 assisting to secure the center bracket 376 to the light rail 312.

[00170] FIGS. 67-73 show an exemplary embodiment of an extension assembly that can connect multiple luminaires or connect a similar extension to a luminaire, for example first and second luminaires 310A, 310B. The extensions assembly includes a joiner rail 388, a joiner bracket 390, and an optical spacer 392. The joiner rail 388 connects to the light rails 312A, 312B of the first and second luminaires 310A, 310B. The joiner bracket 390 connects to the joiner rail 388 and first and second top covers 324A, 324B. The optical spacer 392 connects to the joiner rail 388 and the first and second lens 314A, 314B.

[00171] FIGS. 67 and 68 also show the luminaire connected to a suspension assembly having a cable 394, a mounting adapter 396, and a suspension bracket 398. In an exemplary embodiment, the suspension bracket 398 includes a top section, first and second sides, and first and second hooks. The top section includes a top aperture for receiving the mounting adapter 396. The first and second sides include side apertures to reduce the weight and material of the suspension bracket and to increase the flexibility of the sides. The hooks connect to the light rail 312, for example with the third protrusion and/or the second side channel 344.

[00172] FIGS. 74-75A show an exemplary embodiment of the joiner rail 388. The joiner rail 388 includes a bottom portion 400 and first and second arms 402 extending from the bottom portion 400. The bottom portion 400 includes a channel 404 bound by angled side walls and a top wall. The side walls engage the protrusions 338 that extend from the bottom 330 of the light rail 312, to help keep the joiner rail 388 in place. The bottom portion 400 includes a first pair of apertures to receive set screws to secure the joiner rail 388 to the light rail 312. The bottom portion 400 and the first and second arms 402 meet at a shoulder. When the joiner rail 388 is connected to the light rail 312, the shoulders slide into the center channel 346. The first and second arms 402 each include a second pair of apertures, as best shown in

FIG. 75A, that are used to align the joiner rail 388 in the proper position with the light rail 312.

[00173] FIGS. 76-78 show an exemplary embodiment of the joiner bracket 390. The joiner bracket 390 includes a top section 406 and first and second side walls 408. The top section 406 includes a first aperture 410 and a second aperture 412. The first aperture 410 of the joiner bracket 390 aligns with the aperture 358 of the first cover 324A to receive a fastener, connecting the first cover 324A to the joiner bracket 390. The second aperture 412 of the joiner bracket 390 aligns with the aperture 358 of the second cover 324B to receive a fastener, connecting the second cover 324B to the joiner bracket 390. In various exemplary embodiments, the joiner bracket 390 is slidably connected to the light rails 312A, 312B. In an alternative embodiment, the joiner bracket 390 can include first and second flanges assisting to secure the joiner bracket to the light rails 312A, 312B, similar to the center bracket 376.

[00174] FIGS. 79-81B show an exemplary embodiment of the optical spacer 392. The optical spacer 392 includes a central region 414 surrounded by an outer rim 416. The outer rim 416 has a substantially concave bottom section and first and second top sections. An outer flange 418 extends from the outer rim 416 on the bottom section and the first and second top sections. The outer flange 118 includes a plurality of prisms 420. According to an exemplary embodiment, the prisms 420 are rounded prisms as shown, for example, in FIG. 81B. The size, shape, spacing, and configuration of the prisms 420 can vary depending on the desired light output. In an exemplary embodiment, the prisms 420 of the optical spacer 392 match the prisms 352 of the lens 314. The central region 414 bounds a channel 422 that slidable connects with the joiner rail 388. In various exemplary embodiments, the optical spacer 392 is made from a polymer, for example acrylic. The optical spacer 392 can be translucent to allow light to pass through the spacer or it may be opaque.

[00175] The joiner rail 388 is slid into the light rail 312A center channel 346 of a first luminaire 310A so that the first and second shoulders of the joiner rail 388 abut

the light rail 312A. The cover 324A of the first luminaire 310A is connected to the joiner bracket 390 with a fastener. A set screw may then be inserted into the joiner rail 388 and tightened to assist in securing the joiner rail 388 to the light rail 312A. The optical spacer 392 can also be slid onto the joiner rail 388. The optical spacer 392 is positioned so that the outer rim 416 extends into the first luminaire 310A lens 314A. A second luminaire 310B is then similarly connected to the other side of the joiner rail 388. When two luminaires 310A, 310B are connected, the outer flange 418 extending from the outer rim 416 of the optical spacer 392 is positioned between the two lenses 314A, 314B.

[00176] FIG. 83 shows another exemplary embodiment of a luminaire used in connection with a control component, for example a sensor module 510, such as an occupancy sensor. The control component can include any device that is used to control or monitor the luminaire 500. Similar to the embodiments discussed above, the luminaire includes a light rail 512, a lens 514, an LED sheet (not shown), a driver 518 connected by one or more driver brackets 520, a top cover 524, first and second end brackets 526A, 526B, and first and second end caps 528A, 528B. The luminaire also includes a tray 530 and a shield 532. The tray 530 retains the sensor module 510 components and slidably connects to the light rail 512. A bracket 534 helps secure the sensor module 510 to the tray 530 and the light rail 512. The shield 532 is positioned between the light rail 512 and the lens 514 to cover the tray 530 and sensor components from view. FIG. 84 depicts a first exemplary type of sensor 510A having a round sensor. FIG. 85 depicts a second exemplary type of occupancy sensor 510B having a rectangular sensor. The configuration and components of such sensors are commercially available and would be understood by one of ordinary skill in the art. Different types of sensors, including occupancy, motion, and light sensors, can be used.

[00177] As shown in FIG. 86, and according to an exemplary embodiment, the light rail 512 of the luminaire is similar to the light rails of the luminaires shown in in the prior figures except that the light rail 512 has am open slot 536 for receiving the tray

530. FIGS. 87-90 show an exemplary embodiment of the tray 530. The tray 530 includes a bottom 538, first and second side walls 540, and first and second end walls 542. First and second flanges 544 extend from the first and second side walls 540, respectively. The bottom 538 includes a circular opening 546 and a primary rectangular opening 548. The tray 530 can be inserted into the light rail 512 with either the circular opening 546 or rectangular opening facing outwardly 548, toward the end of the light rail 312, depending on the type of sensor module used. The light rail 512 and the tray 530 can be used with different luminaire components depending on the type of sensor module. The tray 530 may be modified to include any size, shape, or configuration of opening to accommodate different sensors.

[00178] FIG. 91 depicts an exemplary lens 514A for use with the round sensor 510A. The lens includes a round aperture 550 to allow the sensor to pass through the lens. FIG. 92 depicts and exemplary lens 514B for use with the rectangular sensor 510B. The lens 514B includes a rectangular aperture 552 to allow the sensor 310B to pass through the lens 514B.

[00179] FIG. 93 depicts an exemplary shield 532A for use with the round occupancy sensor 510A. The shield 532A includes a round aperture 554 to allow the sensor to pass through the shield 532A. FIG. 94 depicts an exemplary shield 532B for use with the rectangular sensor 510B. The shield 532B includes a rectangular aperture 556 to allow the sensor to pass through the shield 532B. The appropriate shield 532 can be positioned inside of the lens 514 to hide the tray 530 and sensor components from view through the lens 514. In an exemplary embodiment, the shield 532 is made from an opaque material. The shield 532 can be made from a thin solid piece of material that can be flexed or bent to fit within the lens 514. For example, the shield 532 may flex along the broken lines shown in FIGS. 93 and 94. The shields 532 can be made from a polymer, for example PVC, metal, elastomer, or other suitable flexible material.

[00180] FIG. 95 depicts the luminaire used with a control system 510C, for example a wireless automation and control system, that is placed in the tray 530 and

connected to the light rail 512 as discussed above. An exemplary commercial embodiment of such a system is the wiHUBB™ system by Hubbell Incorporated. The control system 510C does not utilize a sensor, and therefore is used in connection with a shield 510C that does not have an opening and covers the entire tray 530. The control system 510C is connected to one or more drivers 518 to control the light output of the luminaire 500.

[00181] FIGS. 98-100 illustrate another exemplary luminaire 610. The LED light sheet 616 is mounted to the light rail 614 with the LED sheet 616 wrapping around the bottom section 630 and first and second hooks 648 of the light rail 614. The LED light sheet 616 is arranged on the light rail 614 so that at least one row of LEDs 686 is positioned in or substantially underneath the cylindrical groove 640 of the lens 612. According to an exemplary embodiment, the LED light sheet 616 is connected to the light rail 614 through an adhesive, for example a double-sided tape, although other adhesives or a mechanical connection, such as clips or fasteners, may also be used.

[00182] The lens 612 is connected to the light rail 612 by connecting the first and second flanges 644 of the first and second arms 650 of the lens 612 with the first side channel 678 of the light rail 614, respectively. The first and second flanges 650 can be slidably connected into the first side channels 678 or they may be snap or pressed fit into the channels, with the flanges 644 pressing past and flexing the angled surface of the angled prong.

[00183] A top cover 624 is connected to the light rail 614 by engaging a flange of the top cover 624 with the second notches 672 formed in the second portions 662 of the light rail 614 first and second arms 650. The top cover 24-2 may be slidable connected or snap fit to the light rail 614. A suspension bracket 722 having a top, angled sides, and a hook is connected to the light rail 614, for example through engagement of the suspension bracket hook and the light rail third protrusion 676 and/or second side channel 680. The suspension bracket 722 may be slidable connected, snap fit, or press fit to the light rail 614. For example the suspension bracket 722 may be resilient and expand as it is pressed over the light rail 614, with

the hooks springing back towards their initial position after clearing the third protrusion 672. The top of the suspension bracket 722 includes an aperture for connecting to a suspension cable (not shown). The driver 618 is positioned in the light rail center channel 682 and connected to the light rail 614 through one or more driver brackets 622. The driver bracket 622 shown in FIGS. 97-100 has a bottom section 724 and first and second sidewalls 726 extending at an angle upwardly from the bottom section 724. The first and second sidewalls 726 engage an inwardly extending protrusion 728 on the first portions 660 of the light rail first and second arms 650. An aperture receives a fastener (not shown) to connect the driver bracket with a flange on the driver 618. The driver bracket 122-2 may be slidable connected or snap fit to the light rail 614. One or more electrical conductors extend from the driver 618 through the light rail 614 to connect to the LED sheet 616.

[00184] FIG. 101 shows a second exemplary embodiment of a side cover 626 having a top section 730 and a bottom section 732. In various exemplary embodiments, the second side cover 626 is configured to mate with the light rail 614 shown in FIGS. 97-100. The bottom section 732 has a shoulder 734 that is wider than the top section 730, but lacks the substantially horizontal edge 736 of the first side cover. One or more projections 742 extend from the bottom section 732 to position the second side cover 726 on the light rail 714. The projections 742 abut the inwardly extending protrusion 728 on the first portions of the light rail 614 first and second arms 650. In various exemplary embodiments, the side cover 626, is made from metal, for example stainless steel or aluminum. Other materials and configurations of side covers may be used depending on the configuration of the light rail 614 and the driver 618.

[00185] FIGS. 102-103A show another alternative embodiment of a light rail 834 and lens 836 assembly. The light rail 834 has first and second arms 838 having a free end with a substantially V-shaped notch 840. The lens 836 has a series of substantially V-shaped protrusions 842 configured to mate with the V-shaped notch

840 of the light rail 834. The light rail 836 is adjustably positioned on the light rail 834 by engaging the notch 840 with different sets of protrusions 842.

[00186] The foregoing detailed description of the certain exemplary embodiments has been provided for the purpose of explaining the principles of the invention and its practical application, thereby enabling others skilled in the art to understand the invention 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 invention to the precise 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 examples to accomplish a more general goal that may be accomplished in another way.

[00187] 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 invention, and are not intended to limit the structure of the exemplary embodiments of the present invention 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 support;
   a lens connected to the support;
   a sheet connected to the support between the lens and the support having a plurality of LEDs, wherein a first LED is positioned in a first direction and a second LED is positioned in a second direction different from said first direction;
   a top cover connected to the support;
   a driver positioned in the support and electrically connected to the plurality of LEDs;
   an end bracket connected to the support; and
   an end cap connected to the support covering the end bracket.

2. The luminaire of claim 1, wherein
   the support includes a bottom, first and second side hooks extending from the bottom, and first and second arms extending from the first and second side hooks, respectively.

3. The luminaire of claim 1, wherein
   the lens includes an outer surface having a first set of prisms and an inner surface having a second set of prisms.

4. The luminaire of claim 3, wherein
   said first set of prisms include one or more rounded convex surfaces and said second set of prisms includes one or more rounded concave surfaces and one or more flat surfaces.

5. The luminaire of claim 1, wherein
the end bracket includes a top section, a front wall, first and second side walls, a first aperture, and a second aperture.

6. The luminaire of claim 1, further comprising
a second top cover connected to the support and a center bracket connecting the top cover and the second top cover.

7. A luminaire comprising:
a first support having an open first end;
a first lens connected to the first support;
a second support having an open second end;
a second lens connected to the second support; and
a joiner rail connected to the open first end of the first support and the open second end of the second support.

8. The luminaire of claim 7, further comprising
a joiner bracket connected to the joiner rail and an optical spacer connected to the joiner rail between the first and second lens.

9. The luminaire of claim 8, further comprising
a first cover connected to the first support and the joiner bracket and a second cover connected to the second support and the joiner bracket.

10. The luminaire of claim 8, wherein
the optical spacer includes a central region, an outer rim, and an outer flange.

11. The luminaire of claim 10, wherein
the outer flange includes one or more prisms.

12. A luminaire comprising:
    a support;
    a lens connected to the support;
    a light element positioned between the support and the lens;
    a tray connected to the support; and
    a control component received in the tray.

13. The luminaire of claim 12, wherein
    the support includes a slot slidably receiving the tray.

14. The luminaire of claim 12, wherein
    the tray includes an opening configured for a sensor module.

15. The luminaire of claim 12, wherein
    the tray includes a first opening configured for a first sensor module and a second opening configured for a second sensor module.

16. The luminaire of claim 15, wherein
    the first opening is curvilinear and the second opening is rectilinear.

17. The luminaire of claim 12, wherein
    the control component is one of a occupancy sensor and a wireless control component.

18. The luminaire of claim 12, further comprising
    a shield positioned between the lens and the tray.

19. The luminaire of claim 18, wherein
    the shield includes an opening configured for a sensor.

20.The luminaire of claim 19,

wherein the opening is curvilinear or rectilinear.

21. A luminaire comprising:

a support;

a lens connected to the support;

a flexible sheet connected to the light rail between the lens and the light rail having a plurality of LEDs, wherein a first LED is positioned in a first direction and a second LED is positioned in a second direction different from said first direction;

a driver electrically connected to the LEDs;

a top cover connected to the support;

a side cover connected to the support; and

an end cap connected to the support.

22. The luminaire of claim 21, wherein

the lens includes a first set of prisms positioned in a first direction and a second set of prisms positioned in a second direction.

23. The luminaire of claim 22, wherein

the prisms include a rounded surface.

24. The luminaire of claim 21, wherein

the lens includes a bottom section having an outer surface and an inner surface, a top section having an outer surface and an inner surface, and a cylindrical groove having an outer surface and an inner surface.

25. The luminaire of claim 24, wherein

the outer surface of the bottom section has a first set of prisms, the inner surface of the top section has a second set of prisms, and the inner surface of the cylindrical groove has a third set of prisms.

26. The luminaire of claim 25, wherein
the second LED is positioned underneath the cylindrical groove.

27. The luminaire of claim 21, wherein
the lens includes a bottom section having an outer surface with a first set of prisms, a top section having an inner surface with a second set of prisms, and a flange connected to the support.

28. A luminaire comprising:
a light rail having an open first end;
a lens having an open first end connected to the light rail;
a flexible sheet connected to the light rail between the lens and the light rail having a plurality of LEDs; and
an end cap extending into the light rail and the lens to enclose the first end of the light rail and the first end of said lens.

29. The luminaire of claim 28, wherein
the light rail has a first hook bounding a first hook channel and the end cap has a first mounting post extending into the first hook channel.

30. The luminaire of claim 28, wherein
the end cap has a bottom flange extending into the lens.

31. The luminaire of claim 28, wherein
the end cap is translucent.

32. A luminaire comprising:
a first section having a first support;
a second section having a second support; and

an extending cover connected to the first and second sections.

33. The luminaire of claim 32, wherein
the first section includes a light emitter and the second section includes a sensor module.

34. The luminaire of claim 33, wherein
the sensor module includes a sensor cover having an aperture.

35. A luminaire comprising:
a first section having a first support;
a second section having a second support;
a connector plate connected to the first and second sections; and
a spacer positioned between the first and second sections.

36. The luminaire of claim 35, wherein
the first section includes a light emitter and the second section includes a light emitter.

37. The luminaire of claim 35, wherein
the connector plate includes a first end, a second end, a first flange, and a second flange.

38. The luminaire of claim 37, wherein
the first and second flanges engage the first and second supports.

39. The luminaire of claim 35, wherein
the connector plate includes a tine having an opening for receiving a set screw.

40. The luminaire of claim 35, wherein
the spacer includes a central region and a spacer channel that slidably engages the connector plate.

41. The luminaire of claim 40, wherein
the spacer includes an outer rim that mates with a lens of the first section.

42. A support for a luminaire comprising:
a first portion for connecting a light emitter;
a second portion for connecting a lens;
a third portion for connecting a driver;
a fourth portion for connecting a suspension assembly.

43. The support of claim 42, wherein
the first portion includes a bottom surface, the second portion includes a first channel, the third portion includes a center channel, and the fourth portion includes a second channel.

44. A support for a luminaire comprising:
a bottom portion;
a center channel;
a side hook surrounding a hook channel;
an arm extending from the side hook.

45. The support of claim 44, wherein
the arm includes a first protrusion, a second protrusion, and a third protrusion.

46. The support of claim 44, wherein
the bottom portion includes a notch on an outer surface and a pair of protrusions on an inner surface.

47. An end cap for a luminaire comprising;
an angled wall;
a top flange;
a bottom flange; and
a mounting post.

48. The end cap of claim 47, wherein
the mounting post is substantially V-shaped.

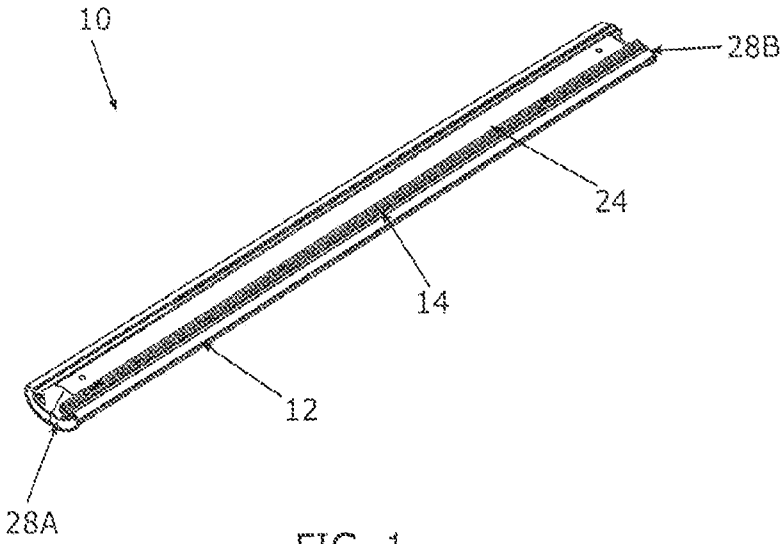


FIG. 1

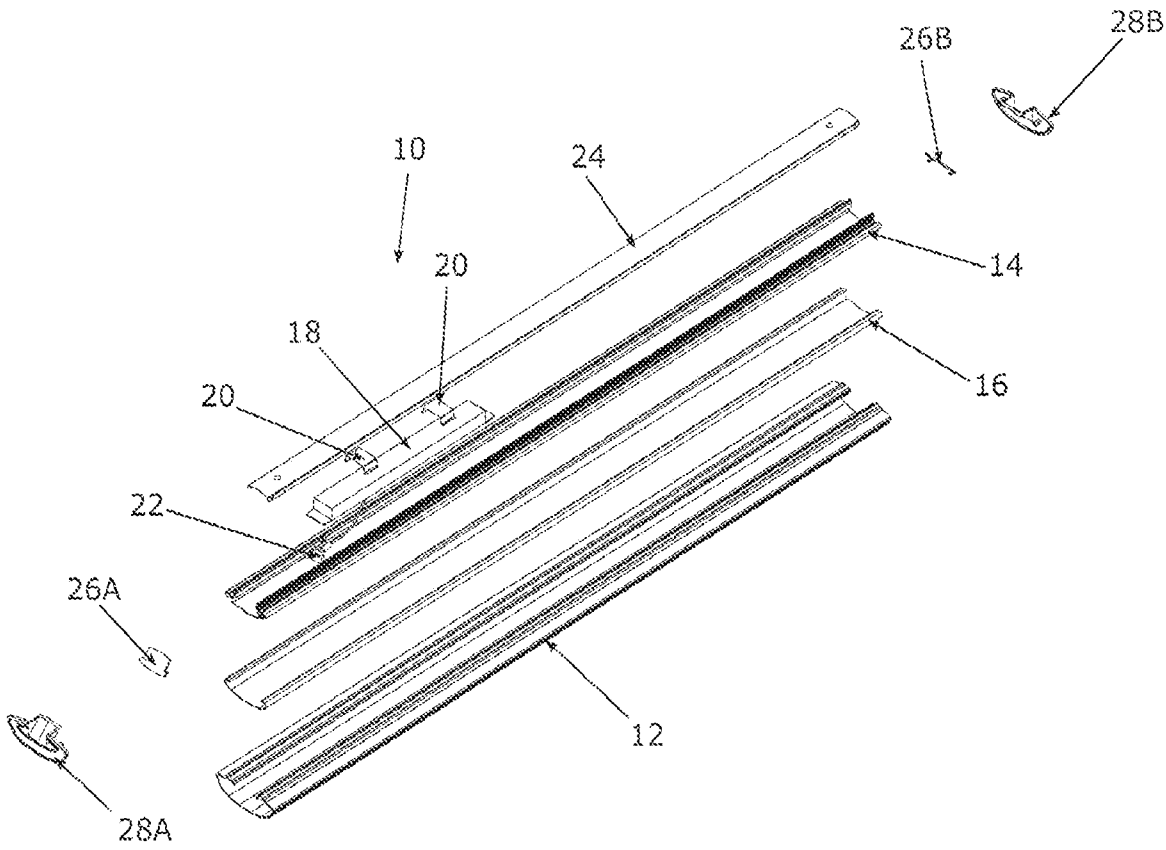


FIG. 2

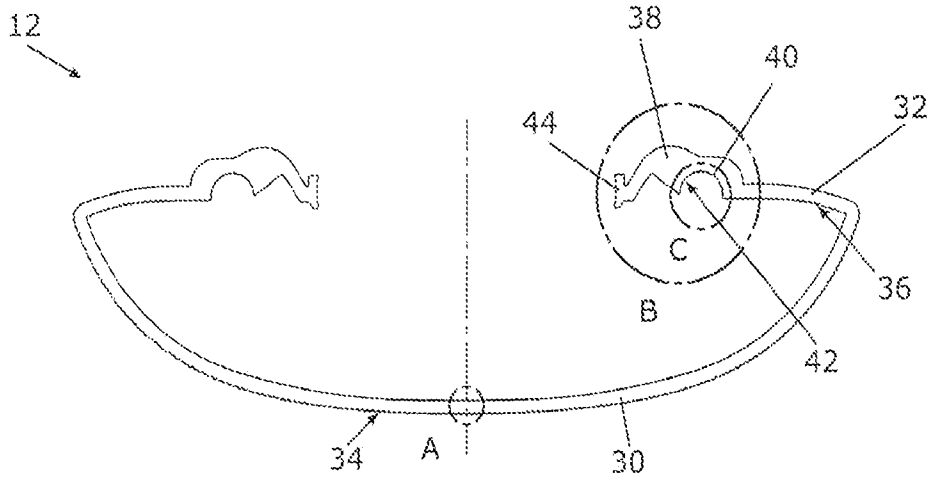


FIG. 3

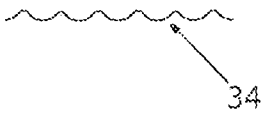


FIG. 3A

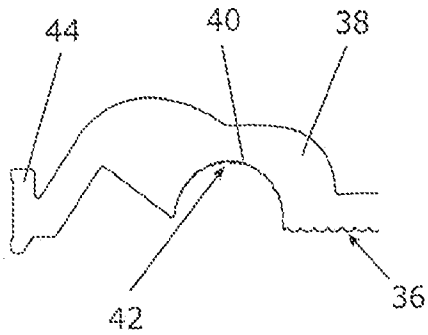


FIG. 3B

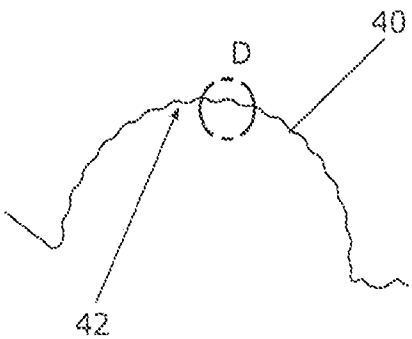


FIG. 3C

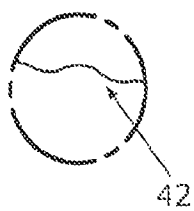


FIG. 3D

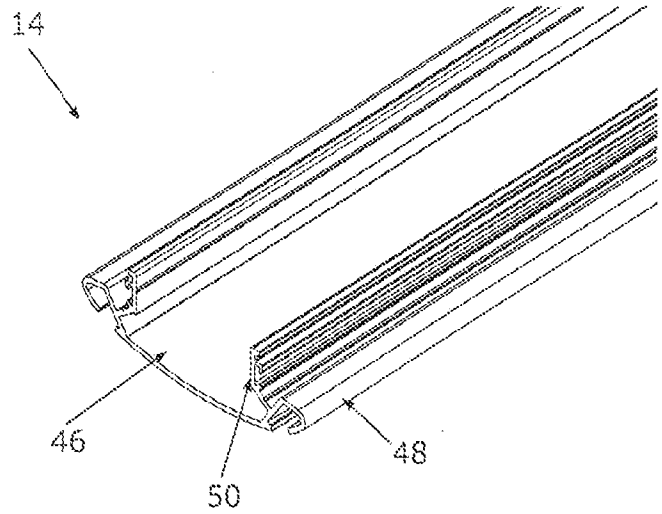


FIG. 4

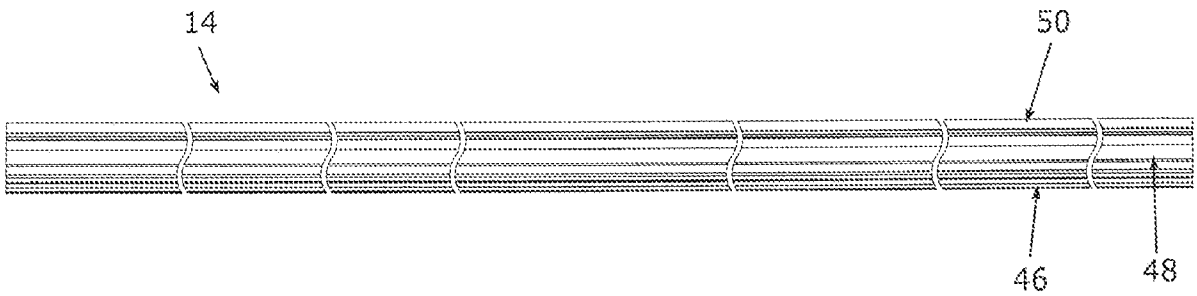


FIG. 5

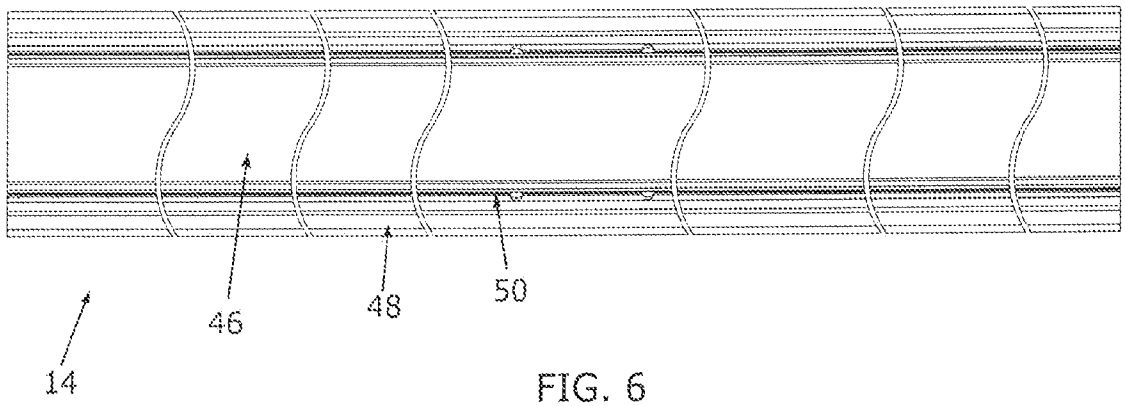


FIG. 6

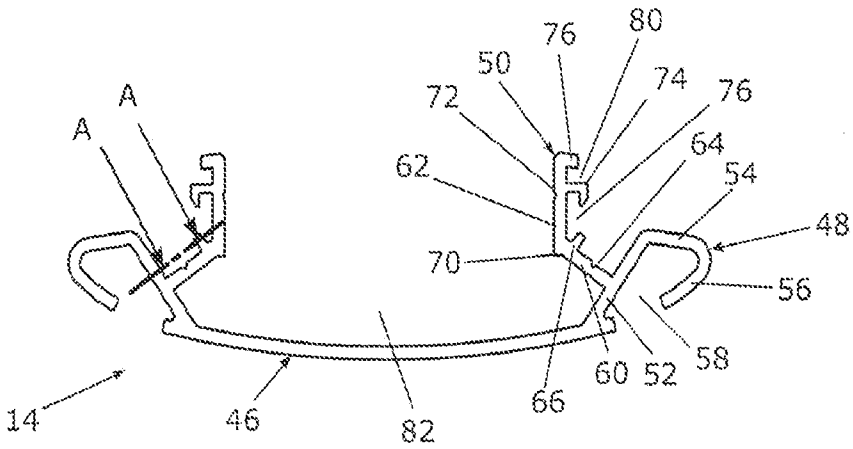


FIG. 7

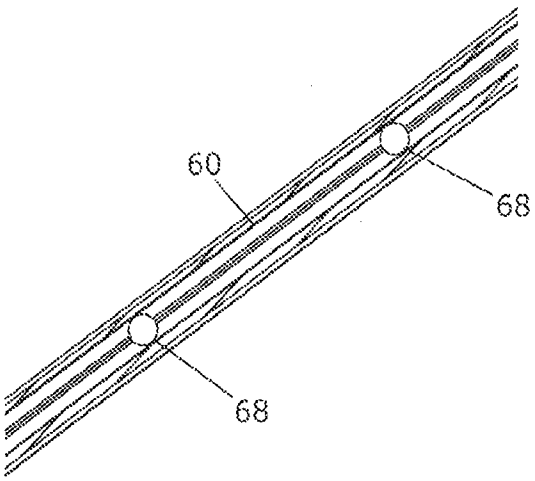


FIG. 7A

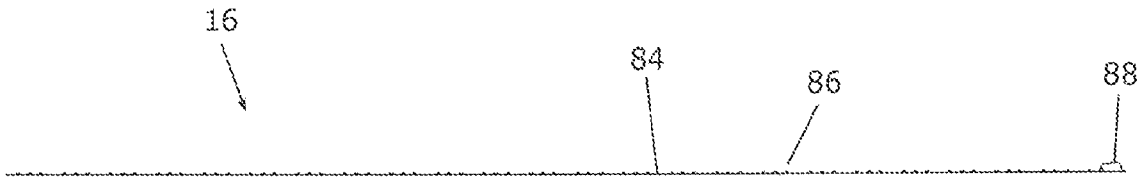


FIG. 8

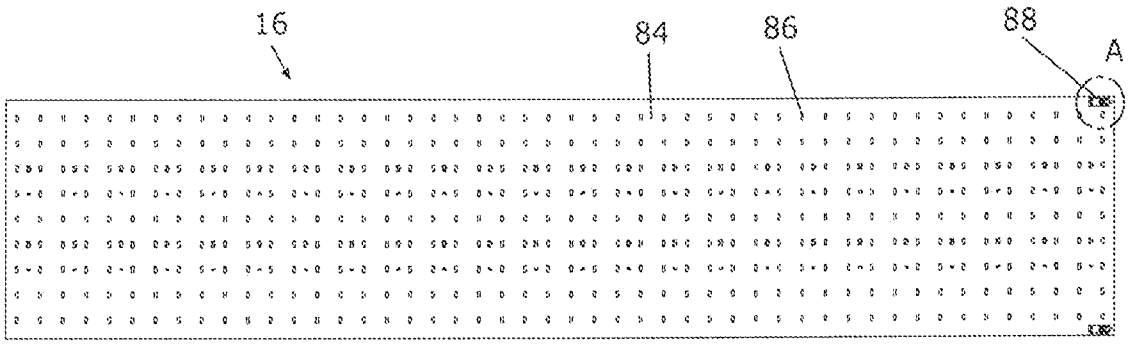


FIG. 9

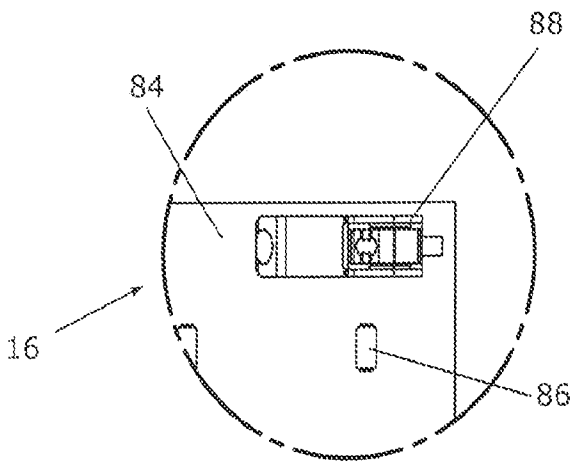


FIG. 9A

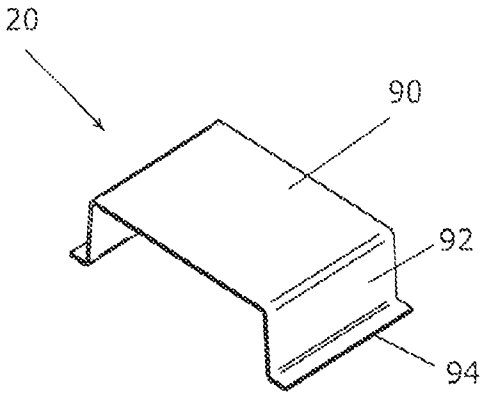


FIG. 10

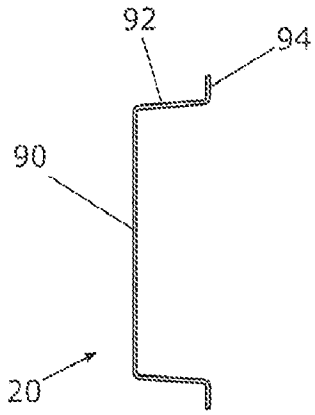


FIG. 11

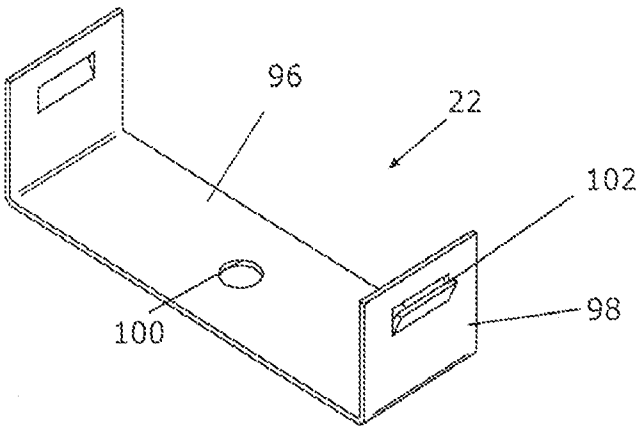


FIG. 12

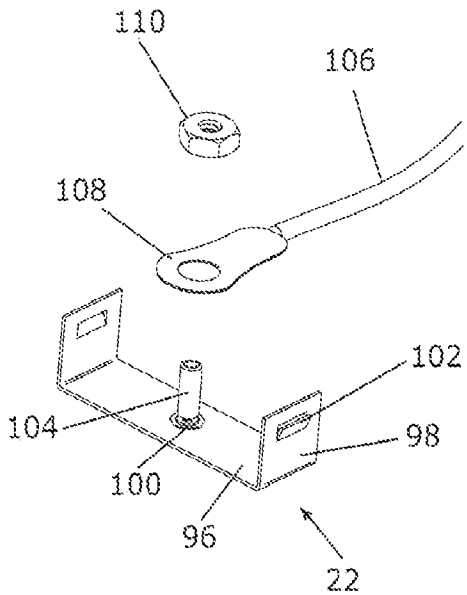


FIG. 13

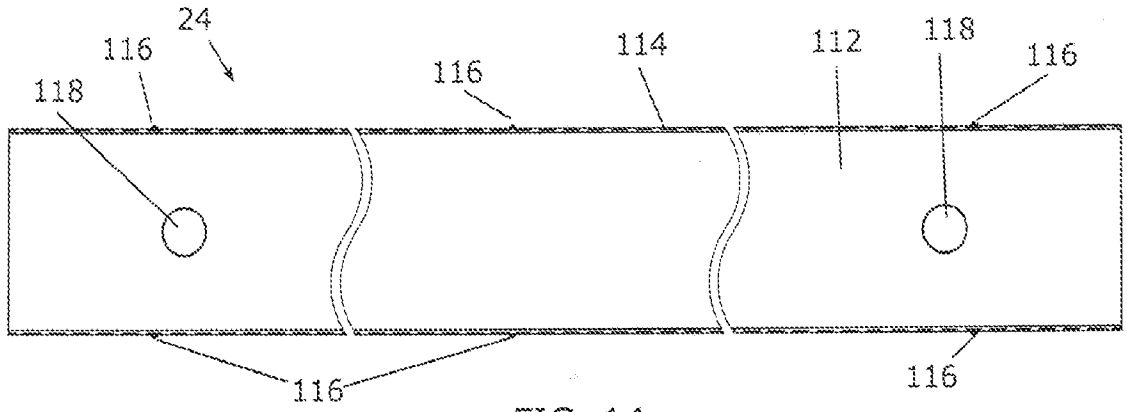


FIG. 14

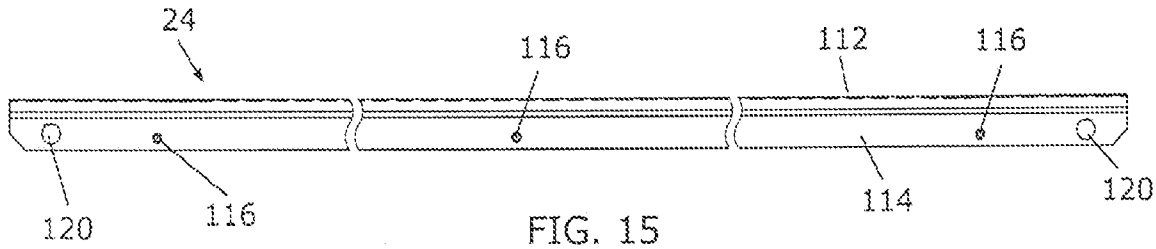


FIG. 15

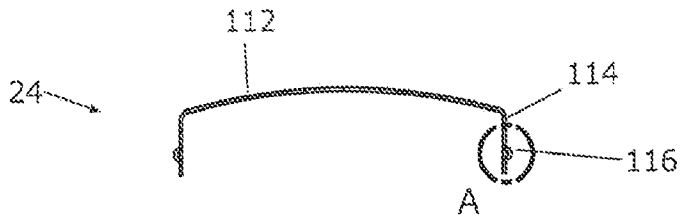


FIG. 16

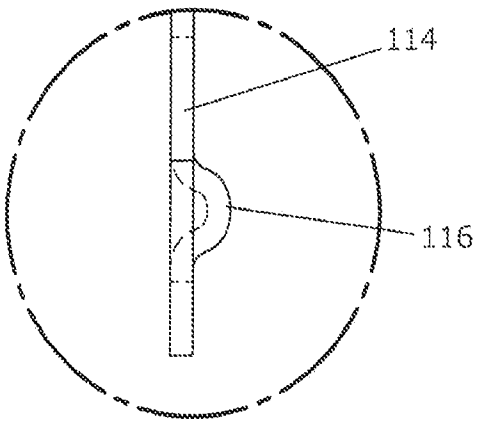


FIG. 16A

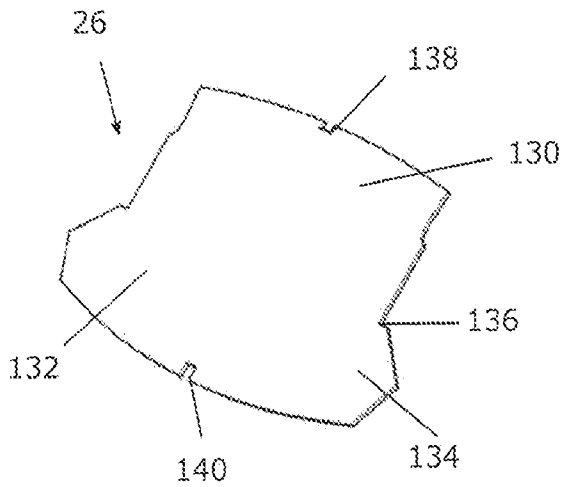


FIG. 17

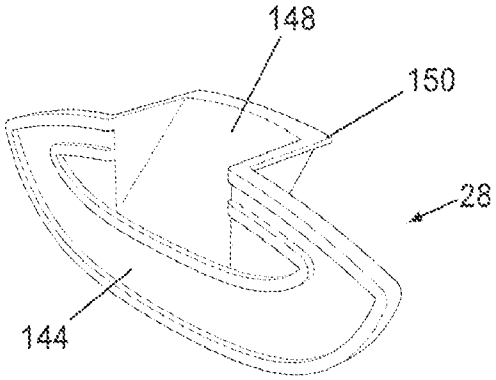


FIG. 18

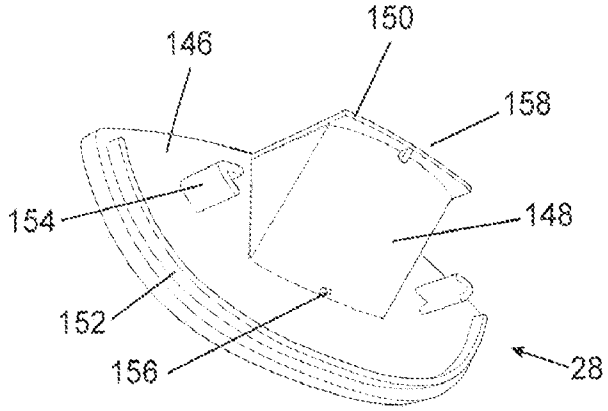


FIG. 19

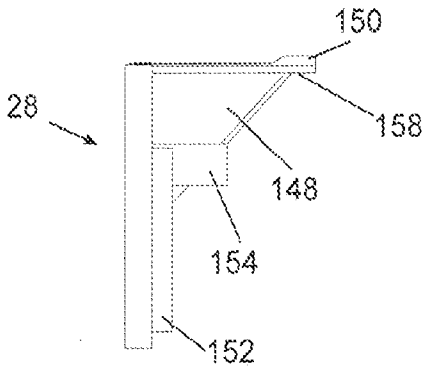


FIG. 20

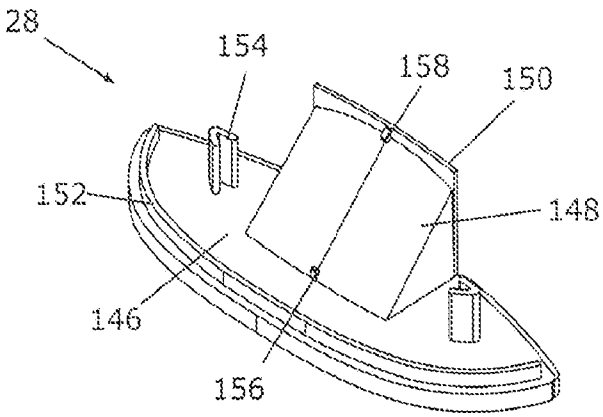


FIG. 21

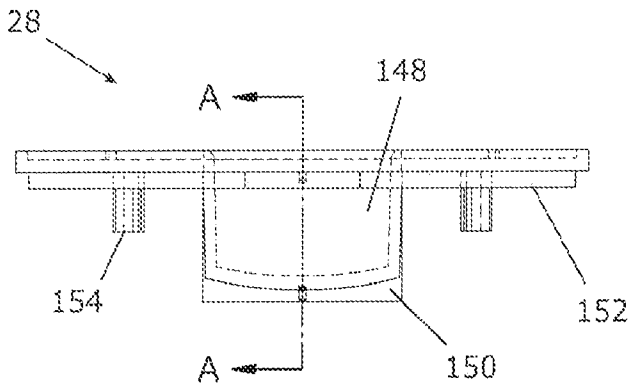


FIG. 22

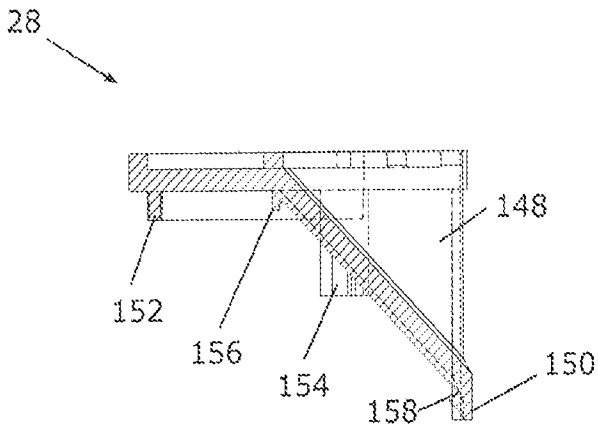


FIG. 22A

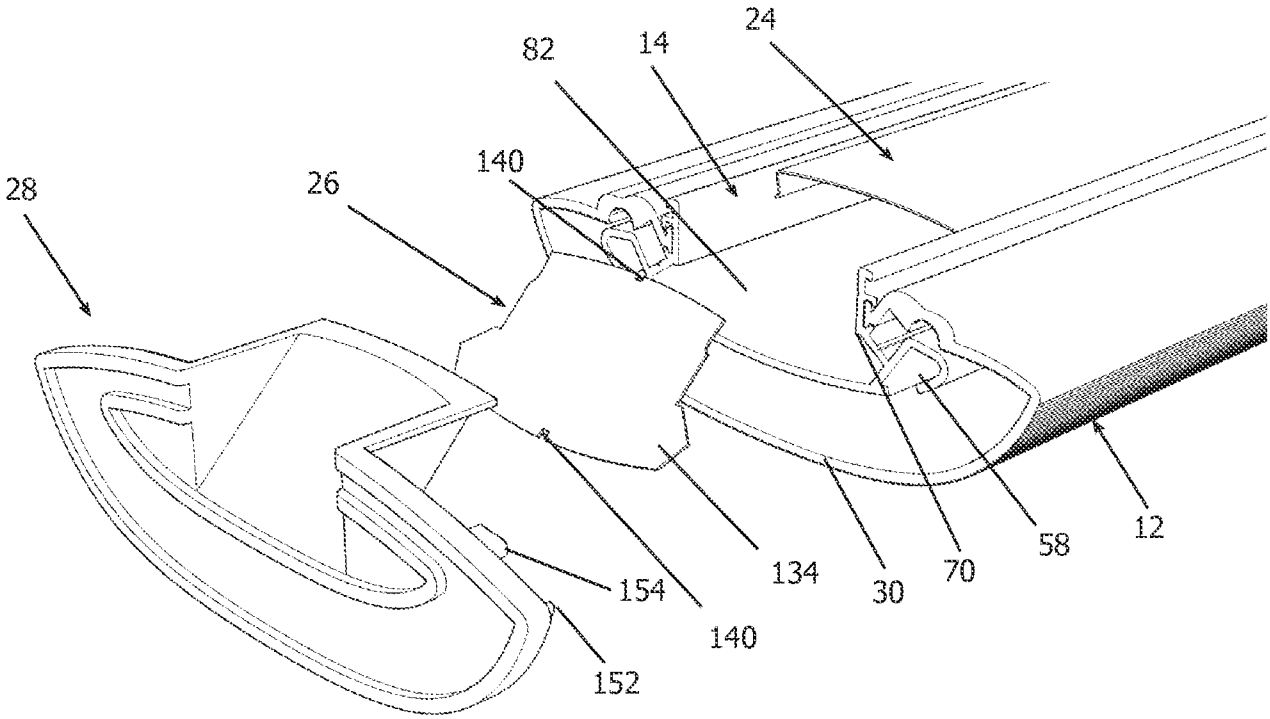


FIG. 23

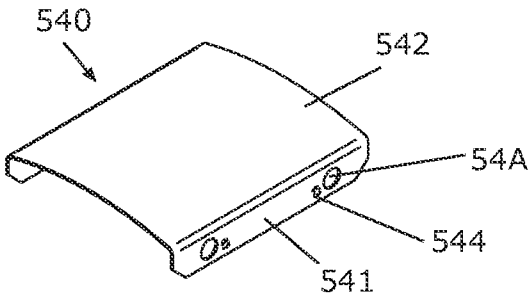


FIG. 21

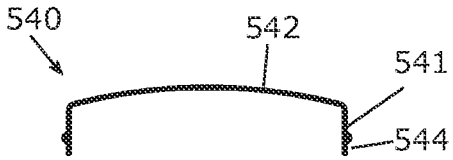


FIG. 28

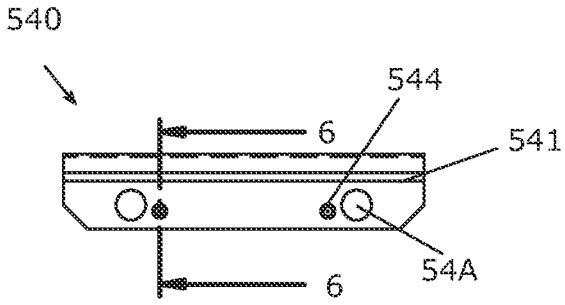


FIG. 24

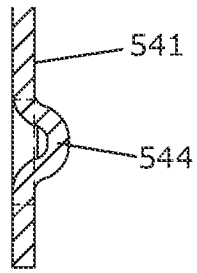


FIG. 246

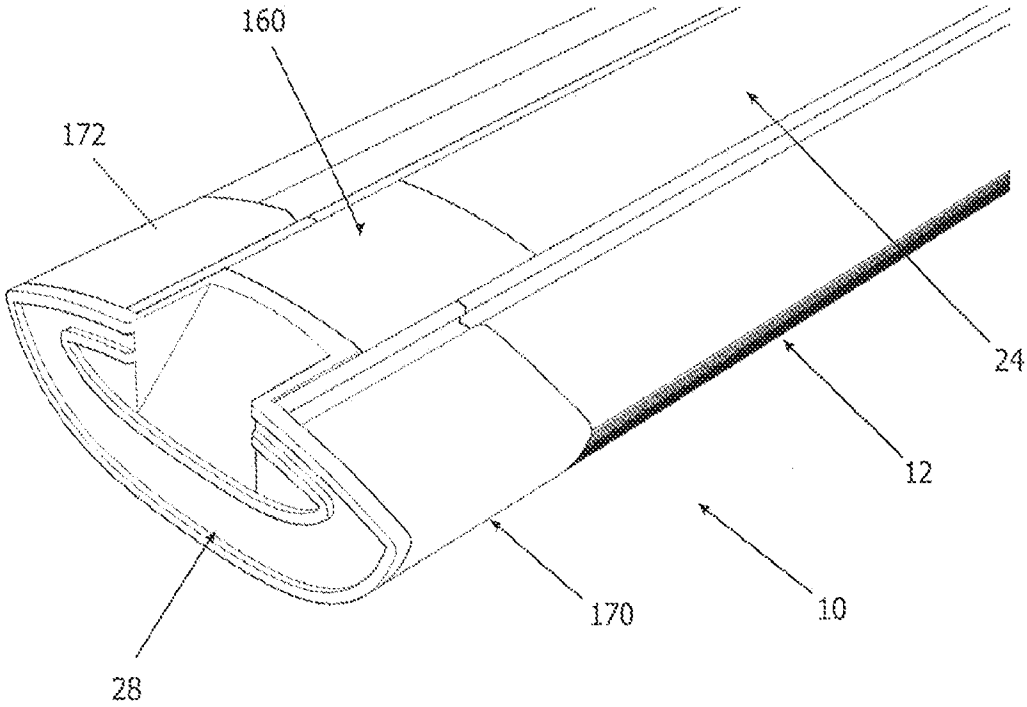


FIG. 27

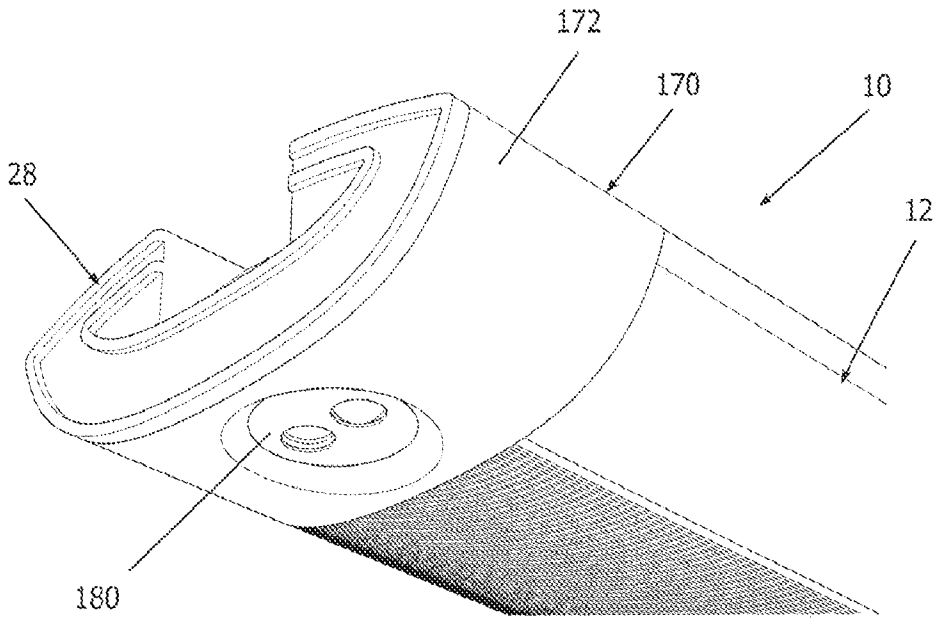


FIG. 28

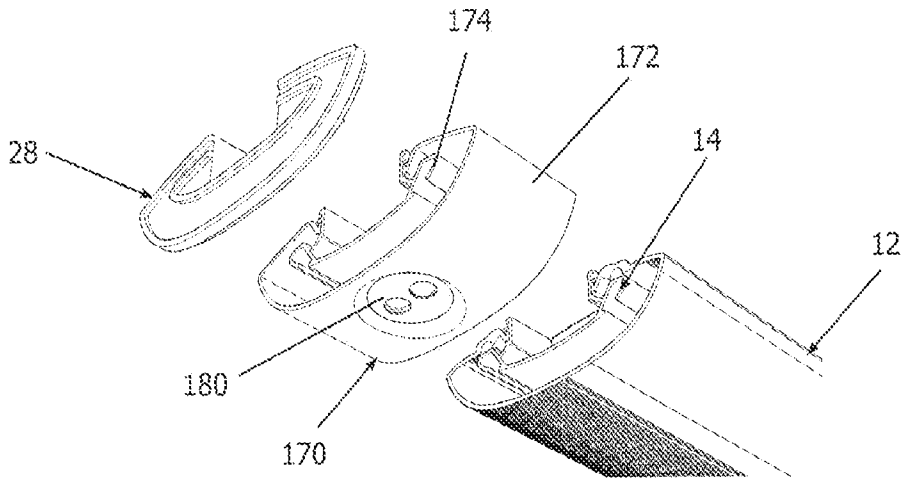


FIG. 29

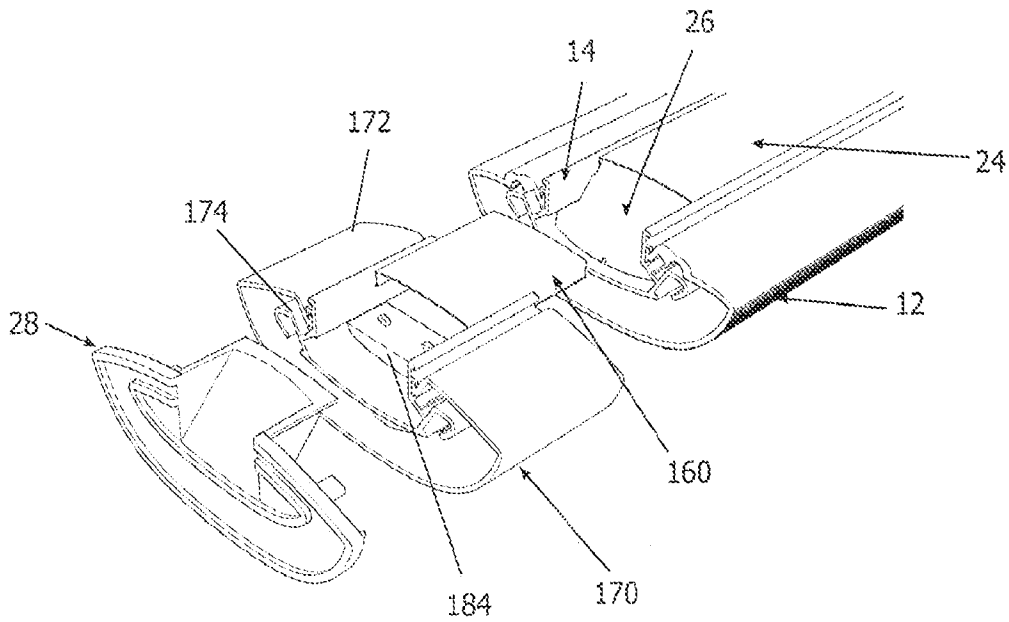


FIG. 30

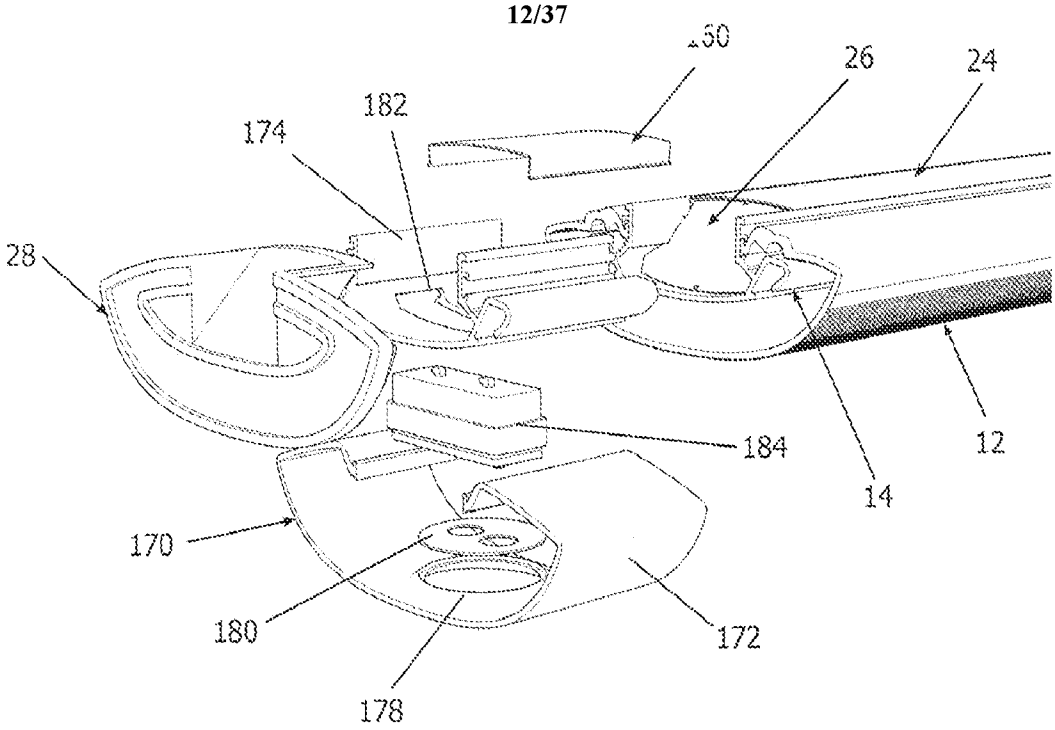


FIG. 31

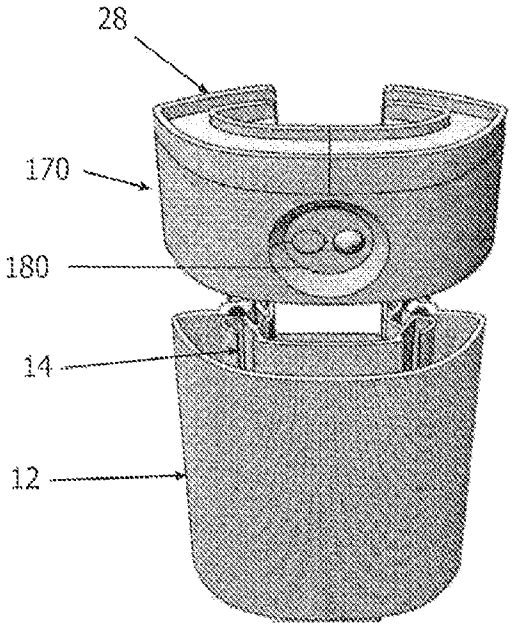


FIG. 32

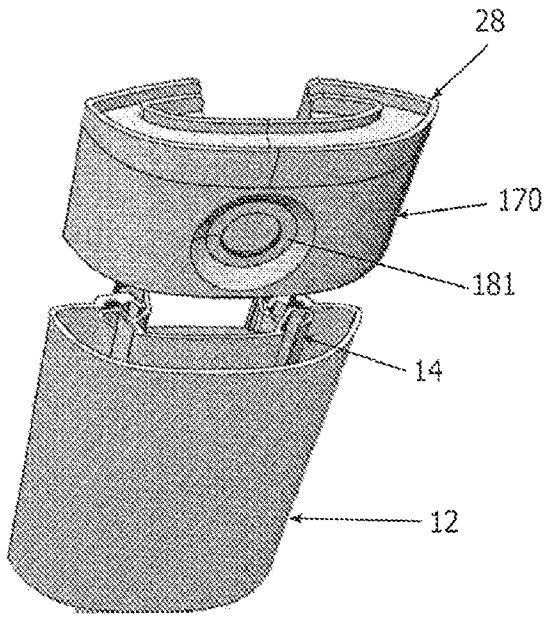


FIG. 33

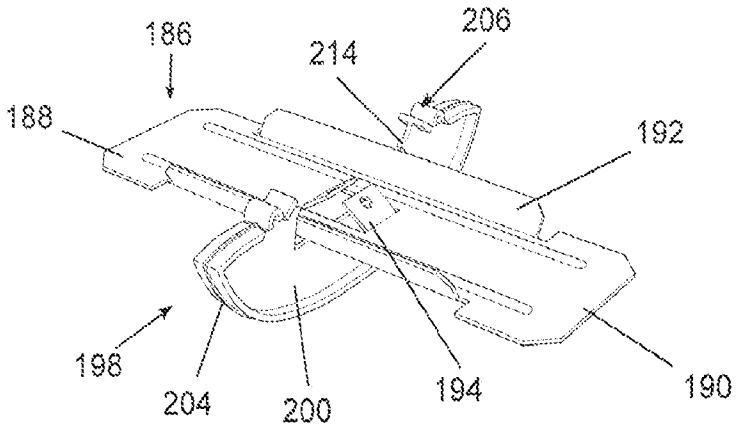


FIG. 34

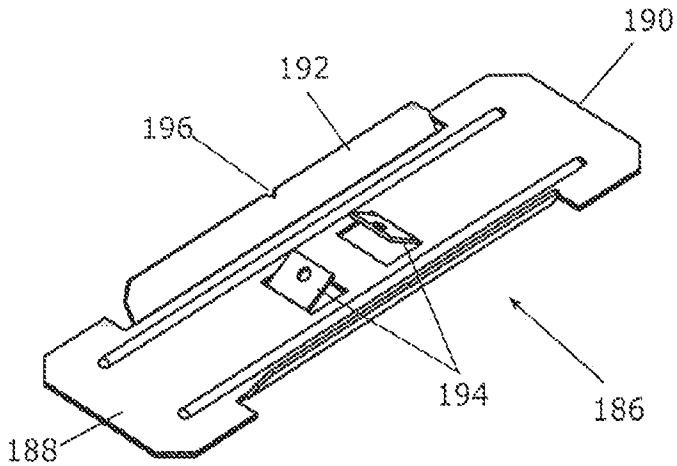


FIG. 35

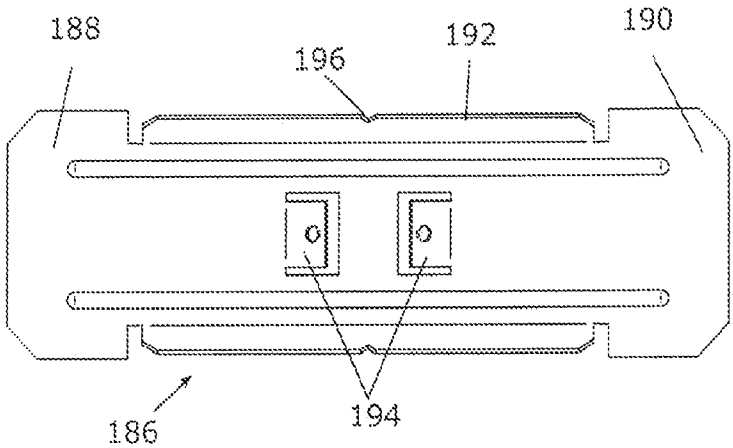


FIG. 36

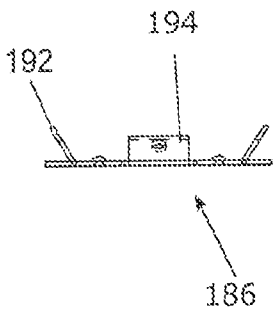


FIG. 37

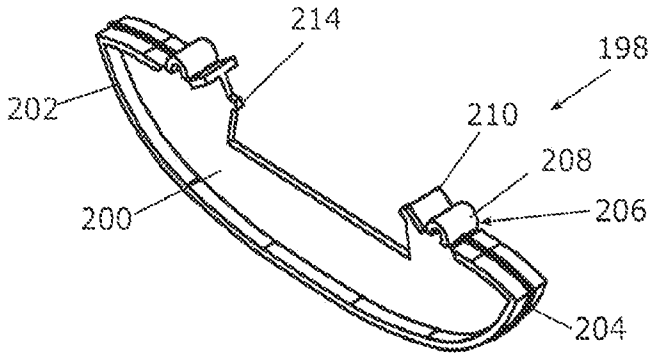


FIG. 38

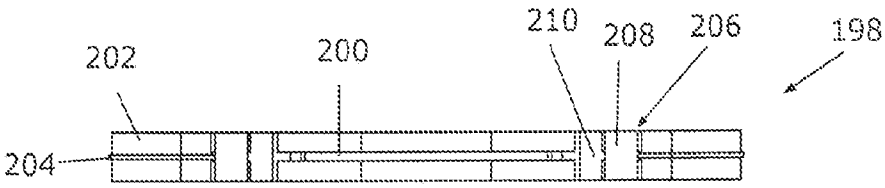


FIG. 39

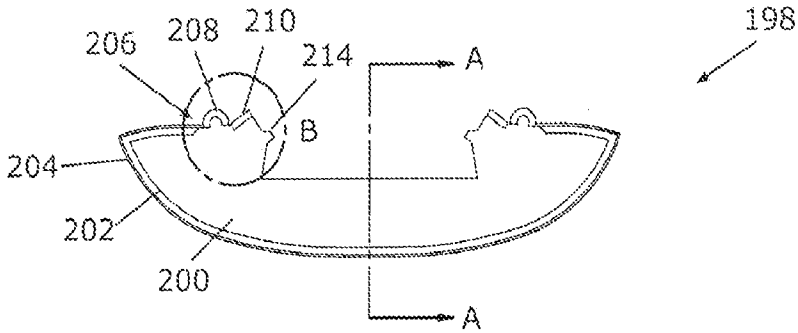


FIG. 40

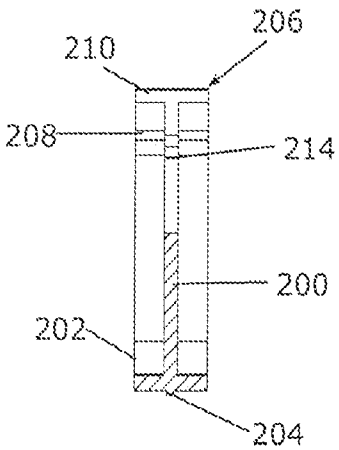


FIG. 40A

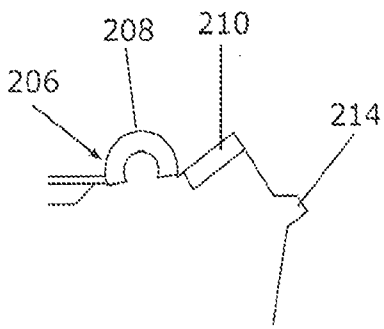


FIG. 40B

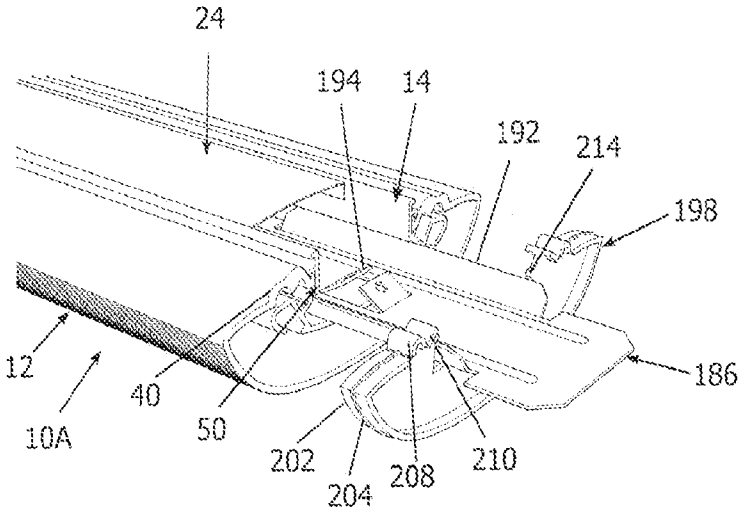


FIG. 41

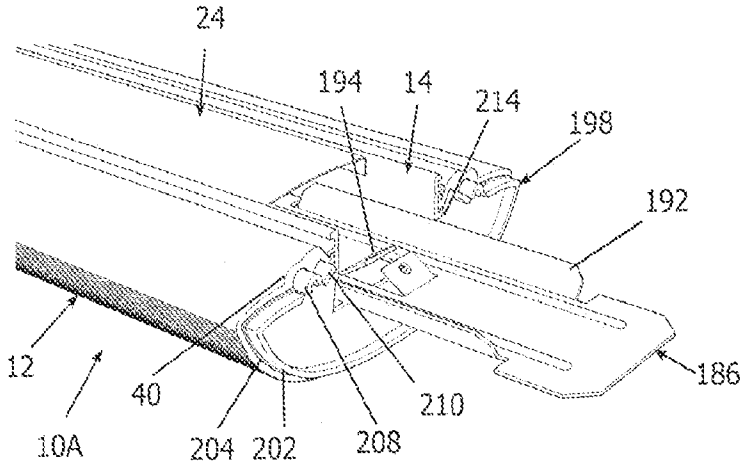


FIG. 42

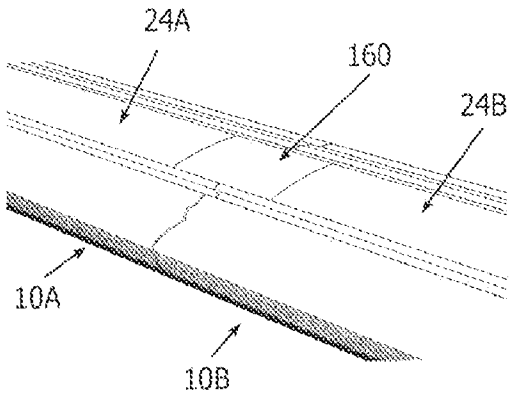


FIG. 43

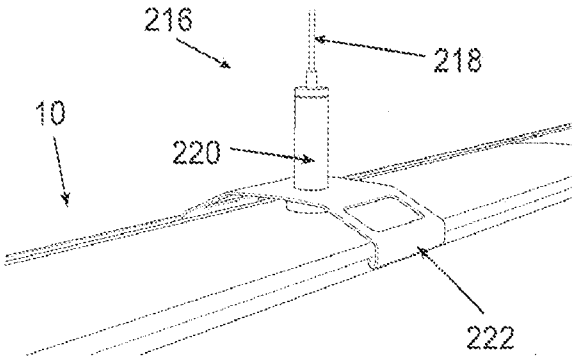


FIG. 44

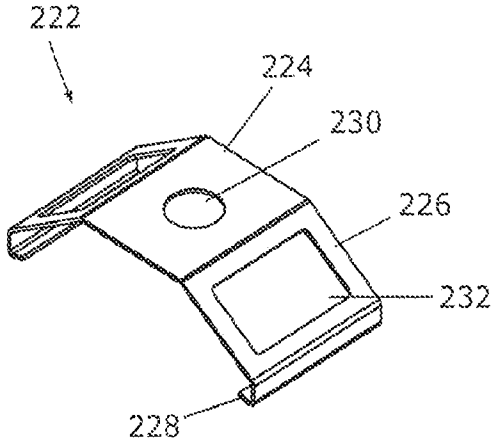


FIG. 45

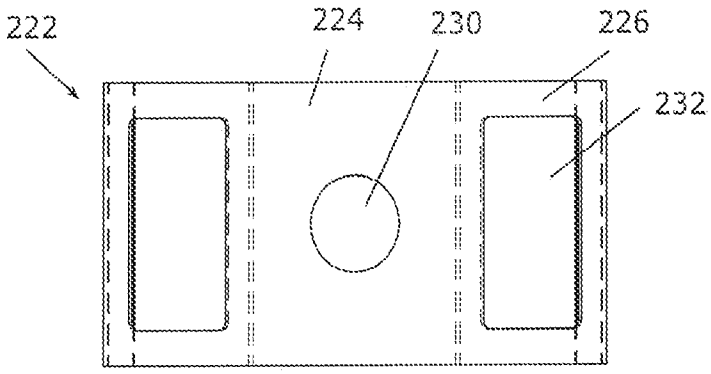


FIG. 46

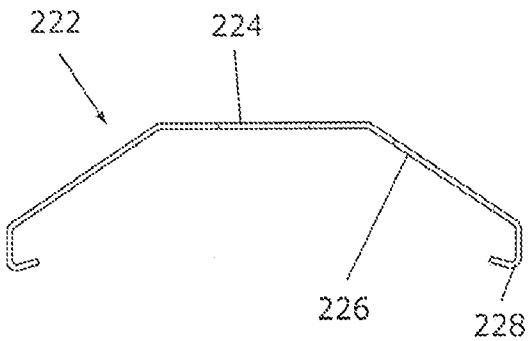


FIG. 47

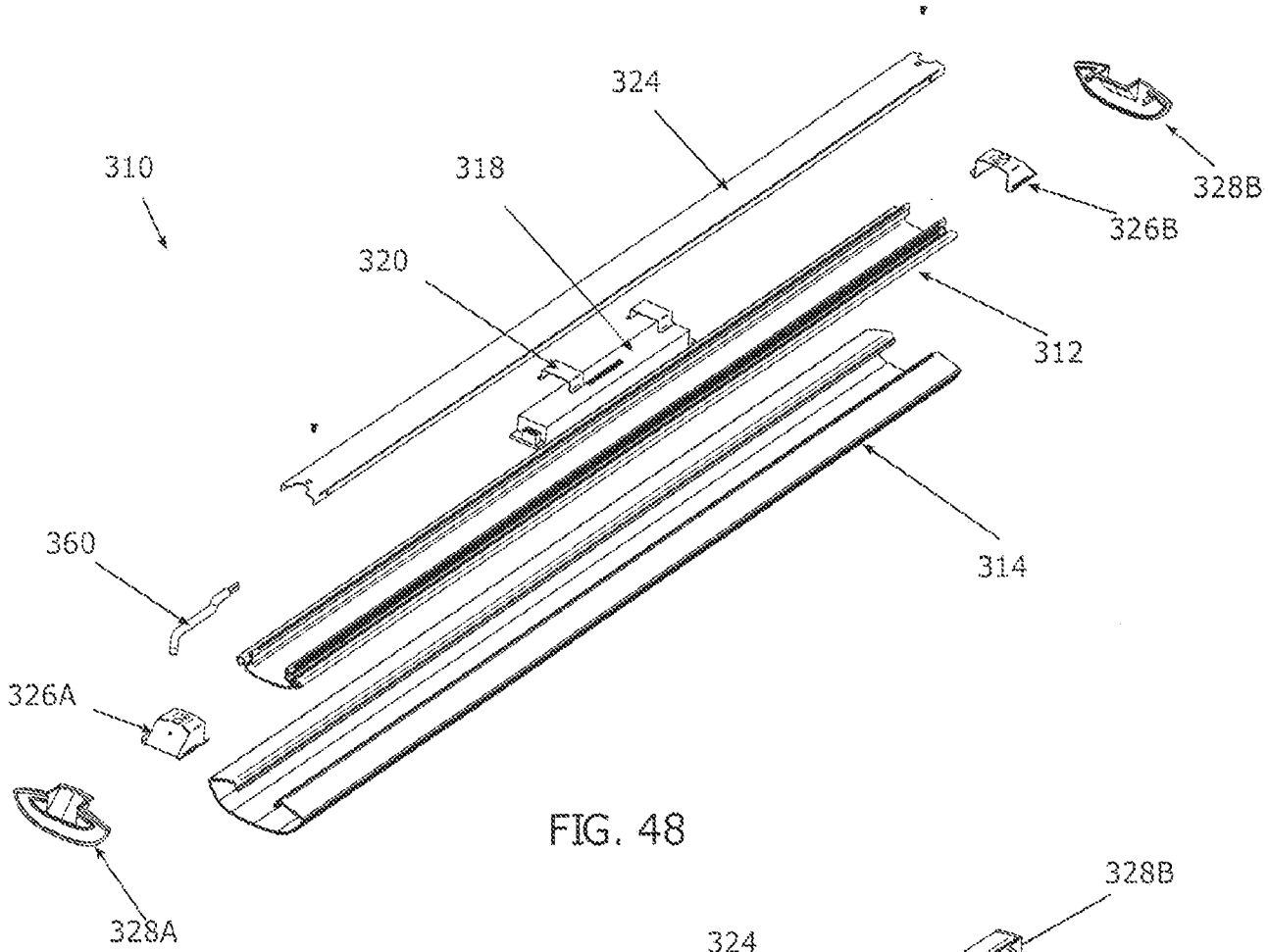

324
310
318
328B
326B
320
312
360
314
326A
328A

FIG. 48

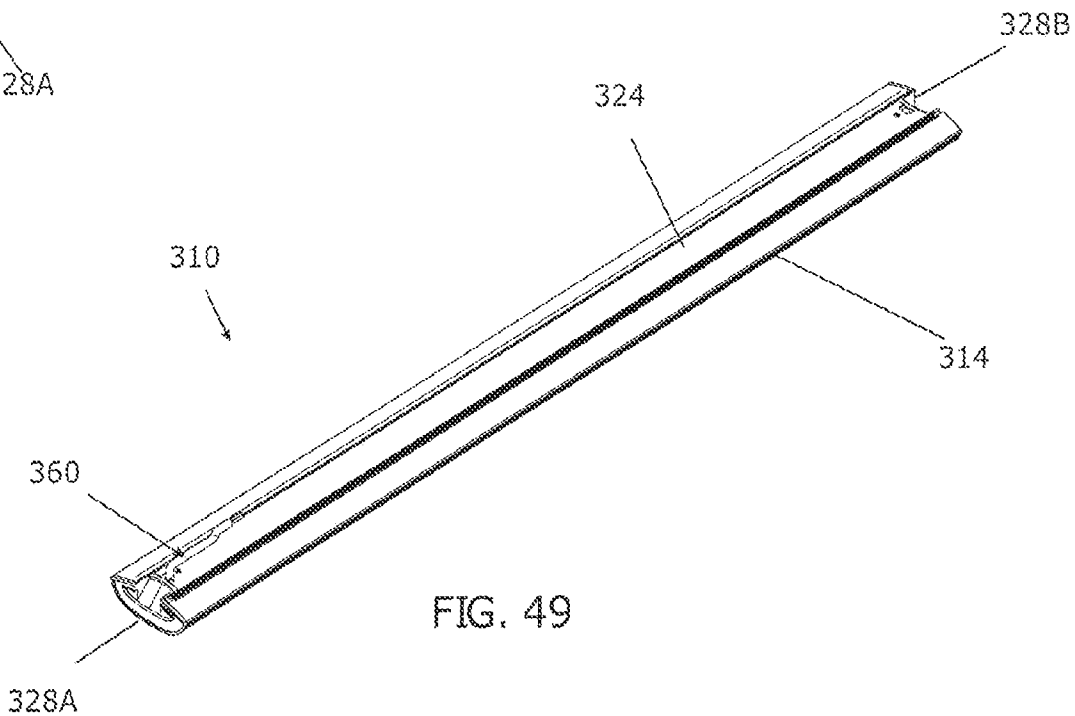

328B
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310
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360
328A

FIG. 49

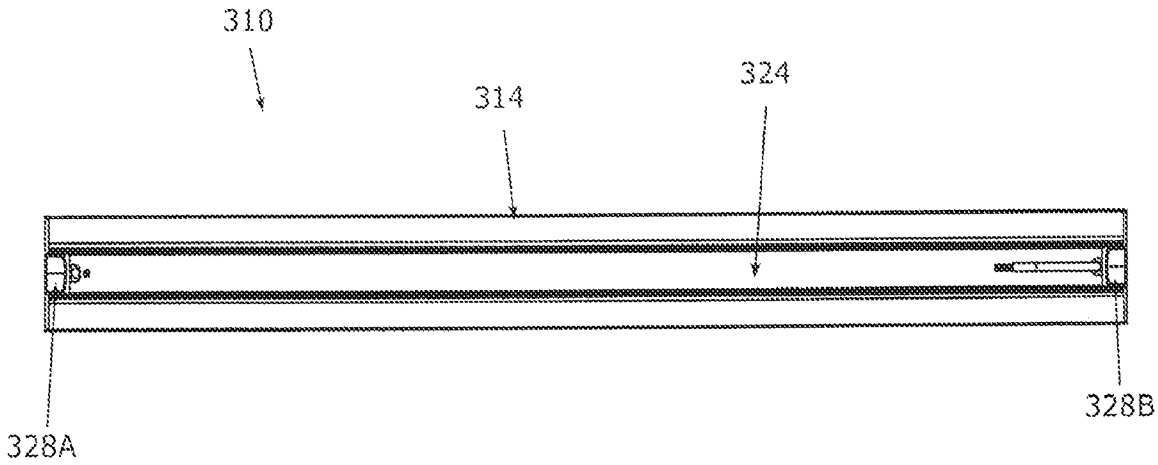


FIG. 50

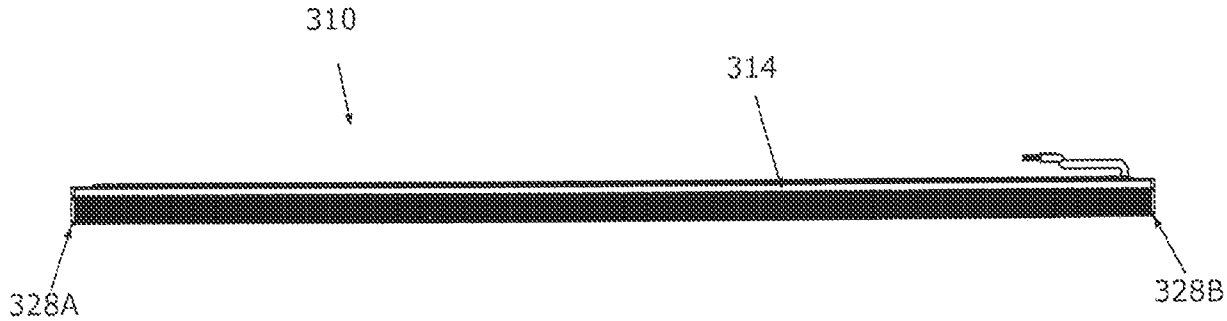


FIG. 51

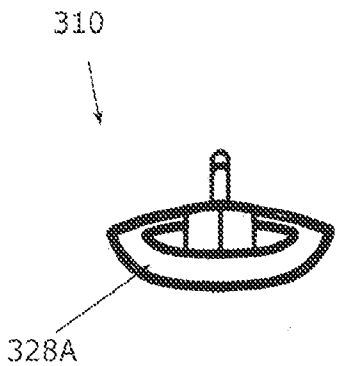


FIG. 52

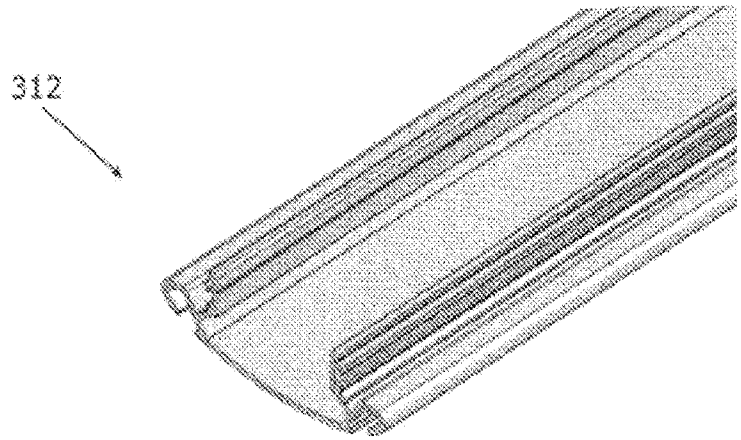


FIG. 53

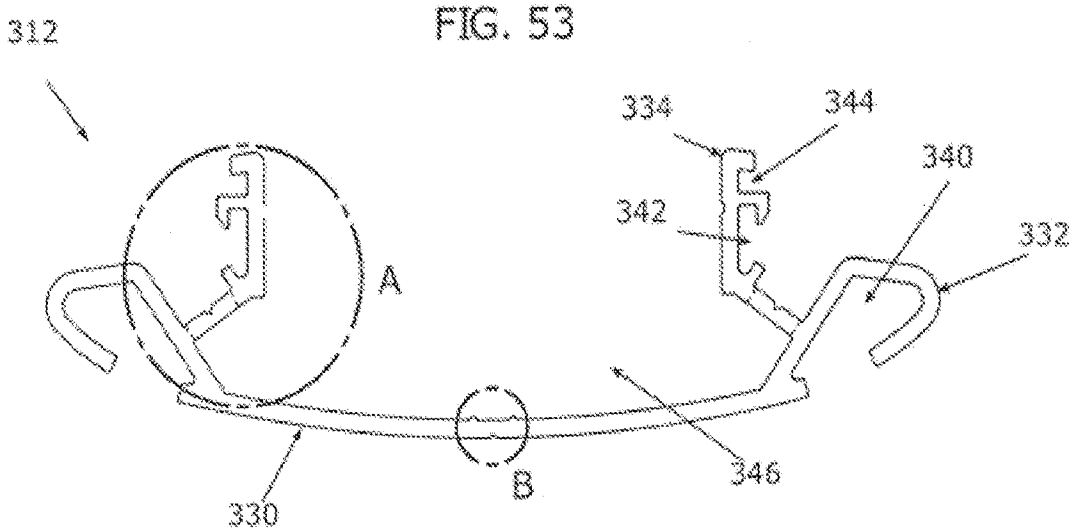


FIG. 54

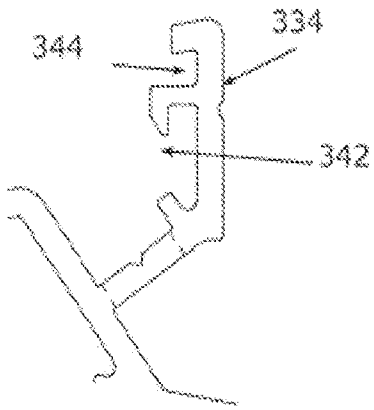


FIG. 54A

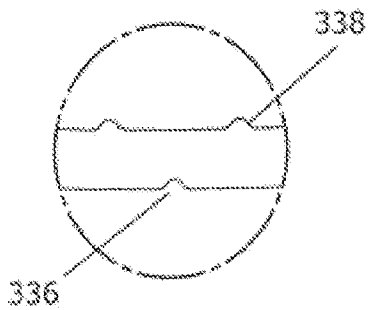


FIG. 54B

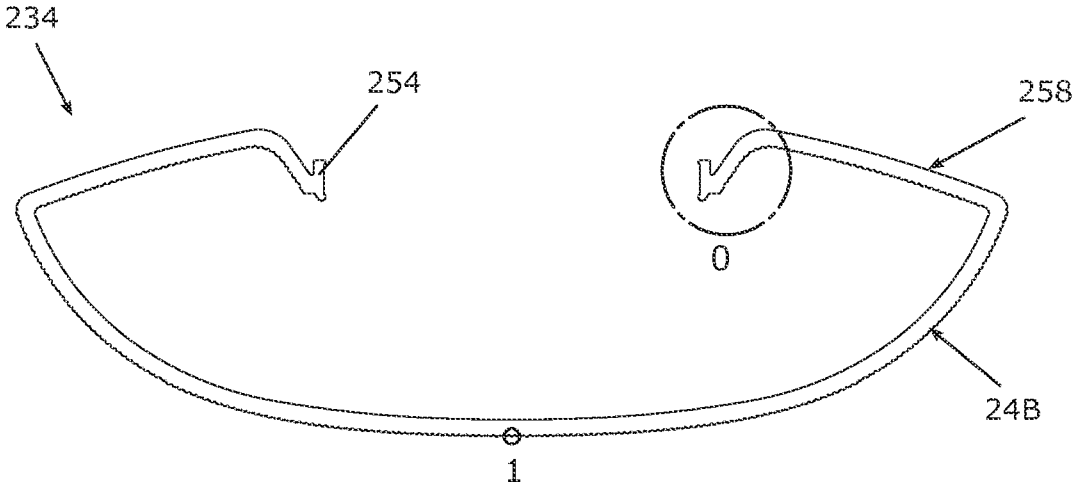


FIG. 55

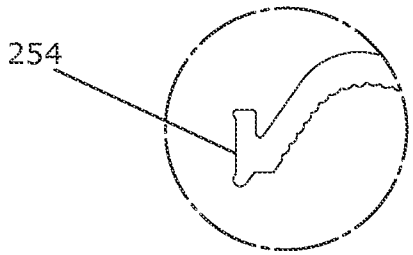


FIG. 550

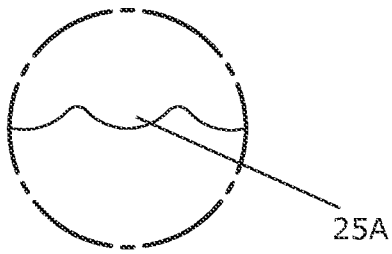


FIG. 551

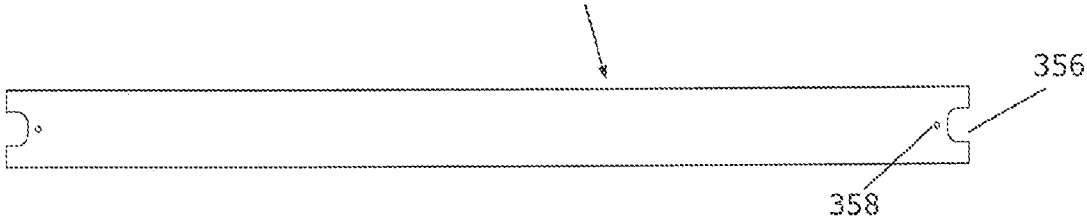


FIG. 56

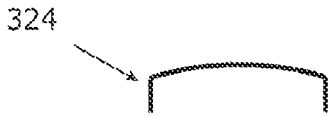


FIG. 57

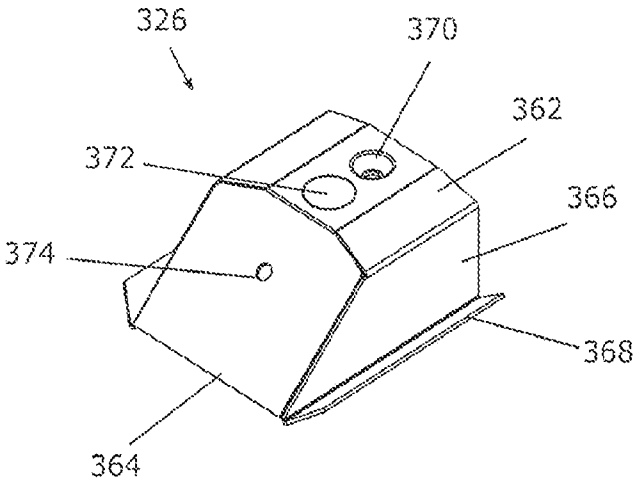


FIG. 58

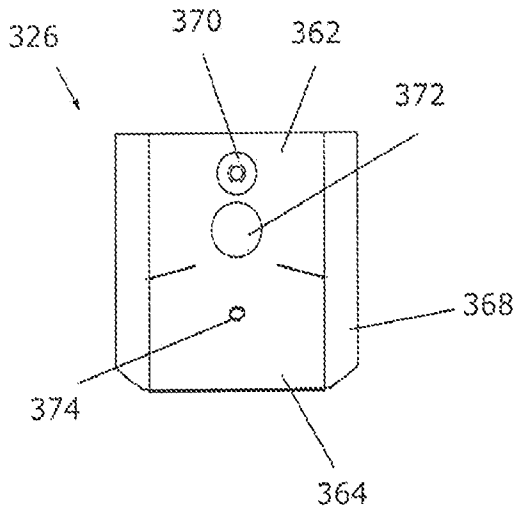


FIG. 59

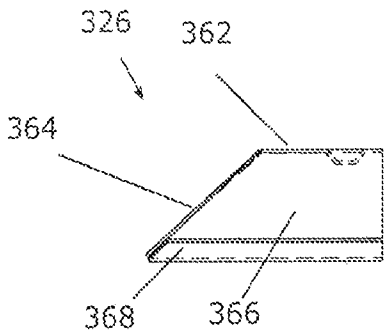


FIG. 60

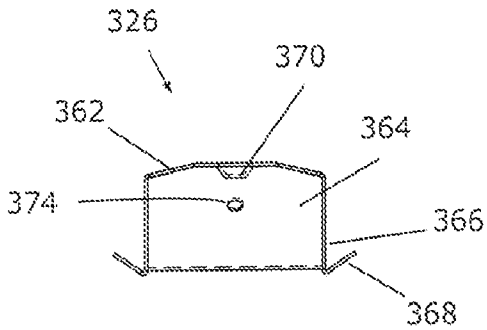


FIG. 61

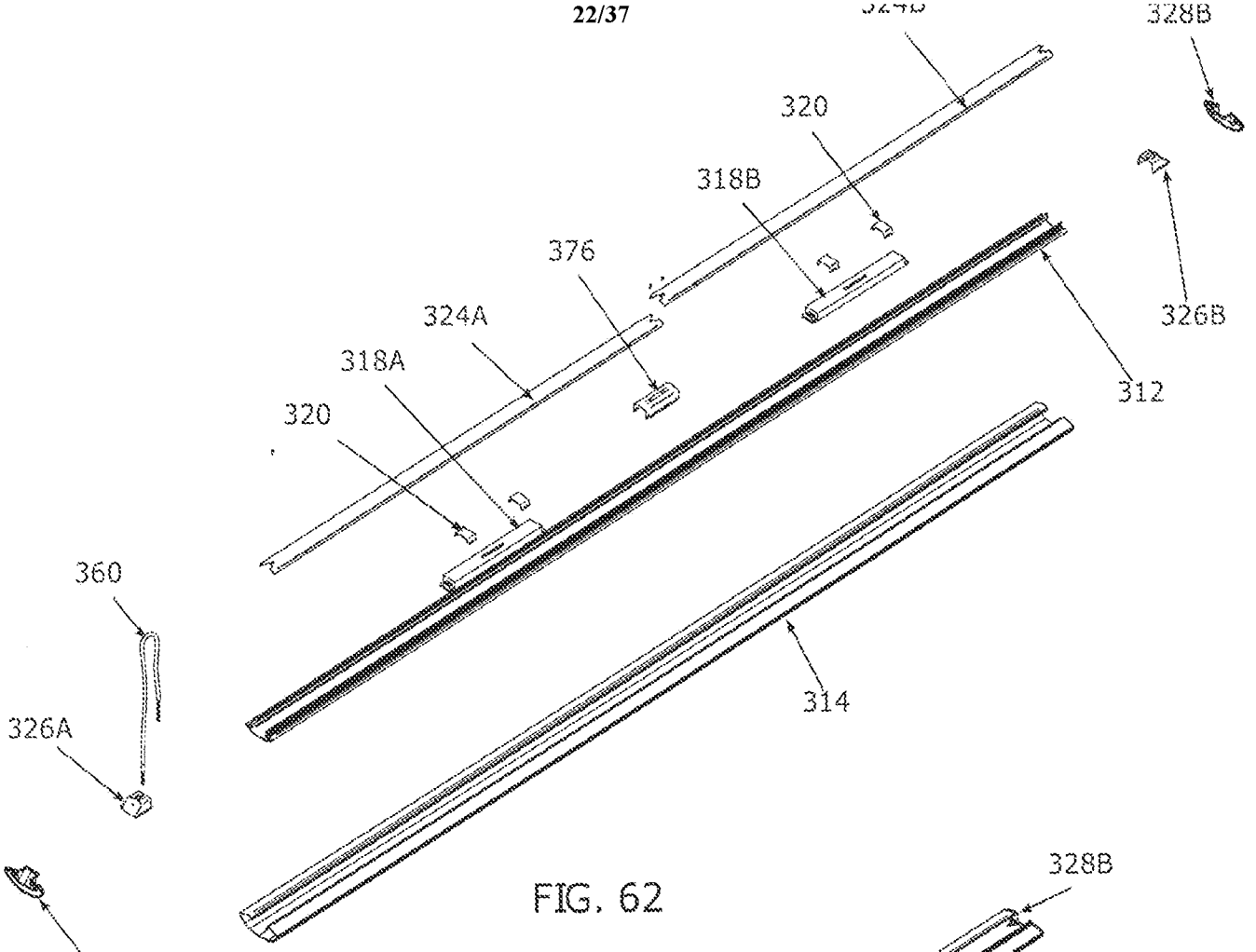

328B
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326A
328A

FIG. 62

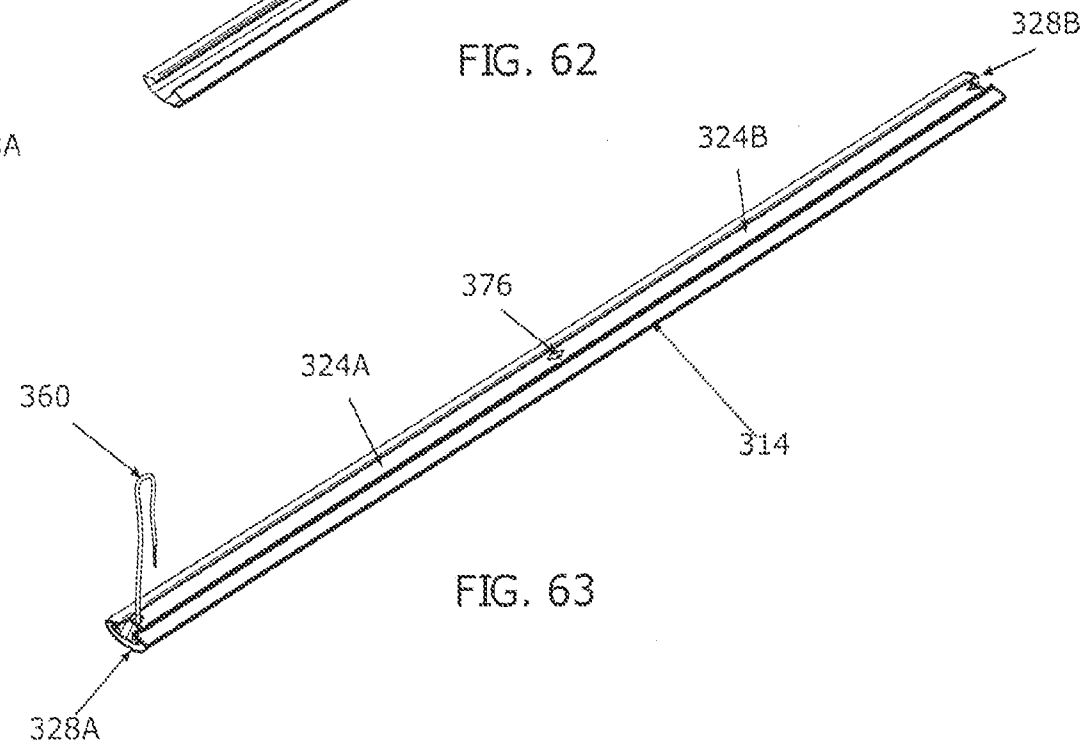

328B
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FIG. 63

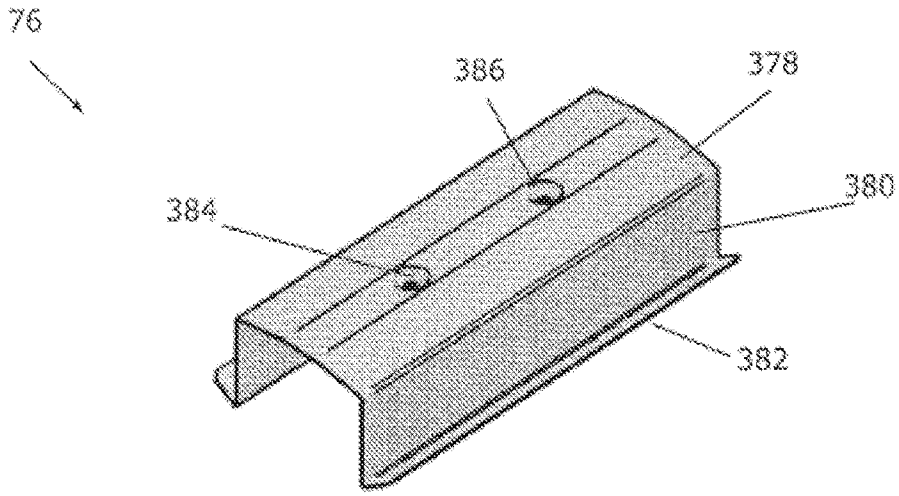


FIG. 64

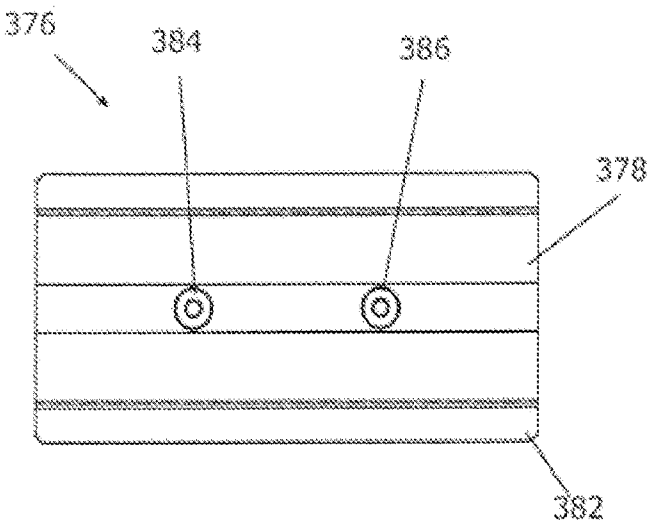


FIG. 65

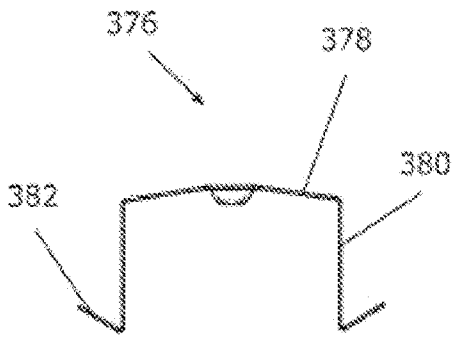


FIG. 66

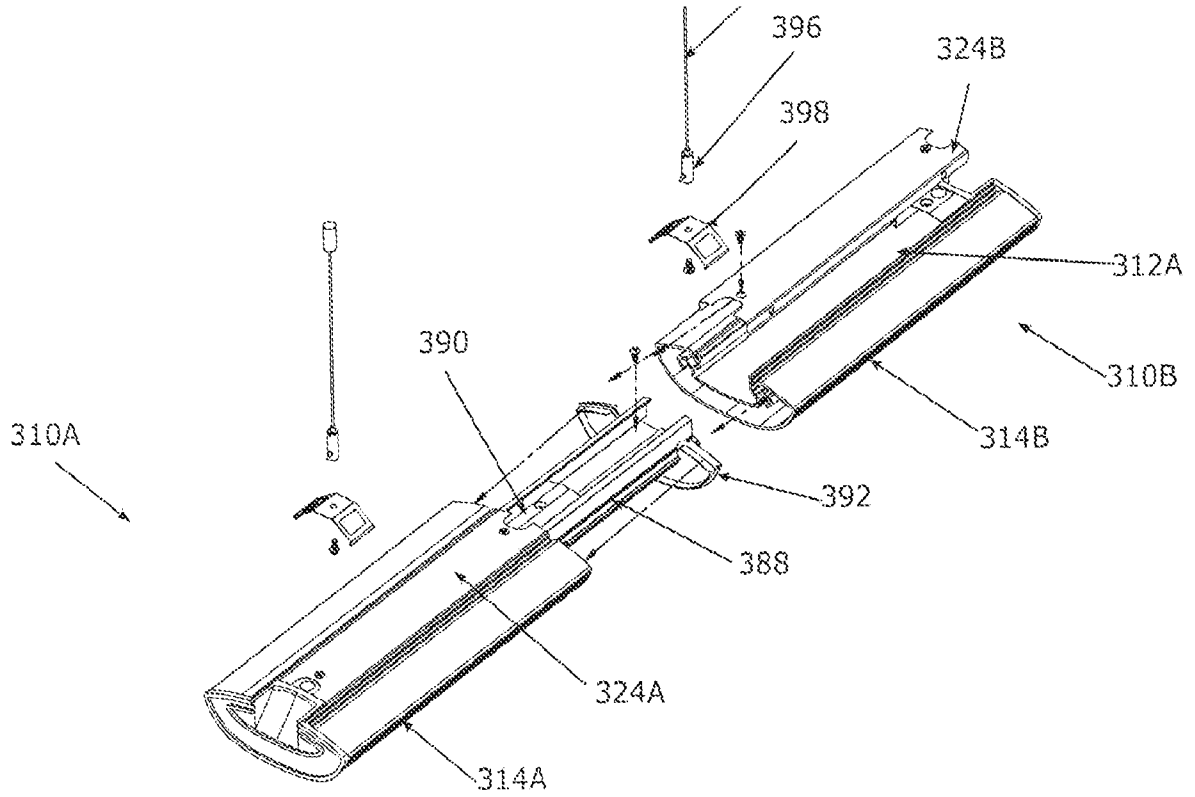

396
324B
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310B
310A
314B
392
388
324A
314A

FIG. 67

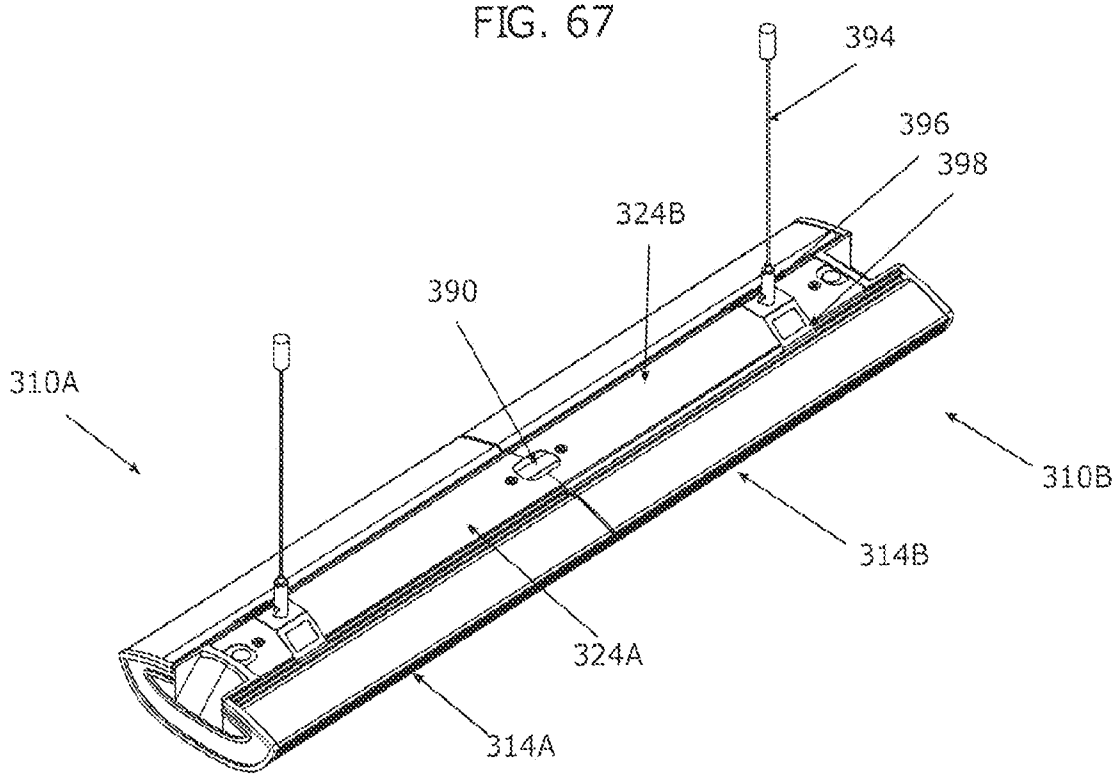

394
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310A
310B
314B
324A
314A

FIG. 68

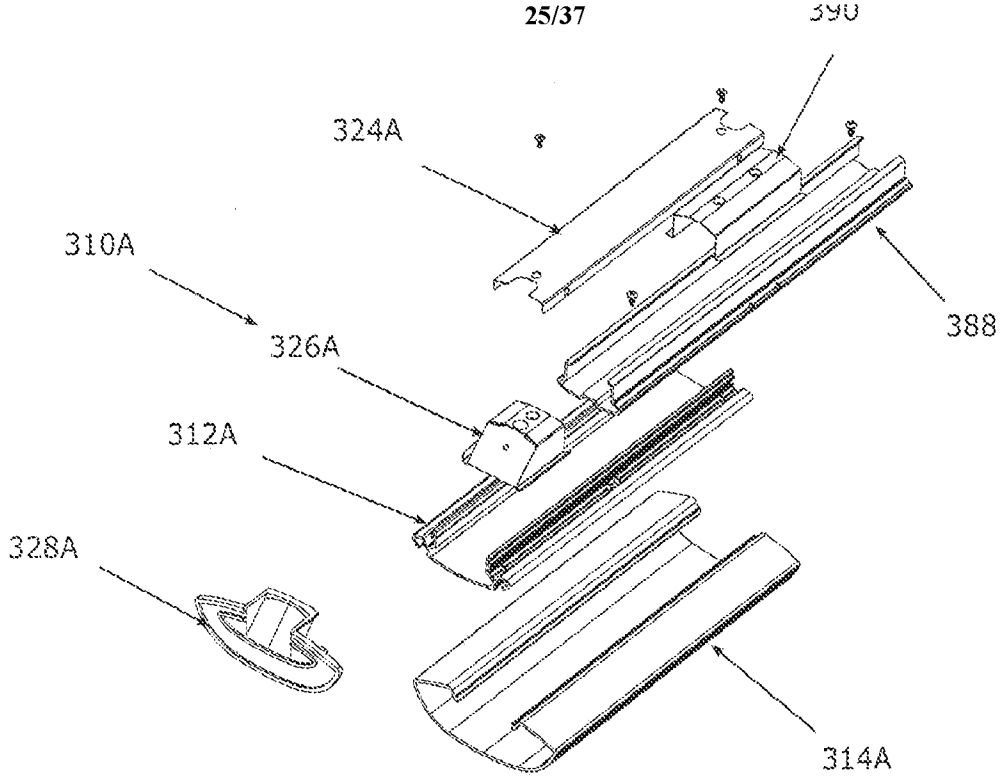


FIG. 69

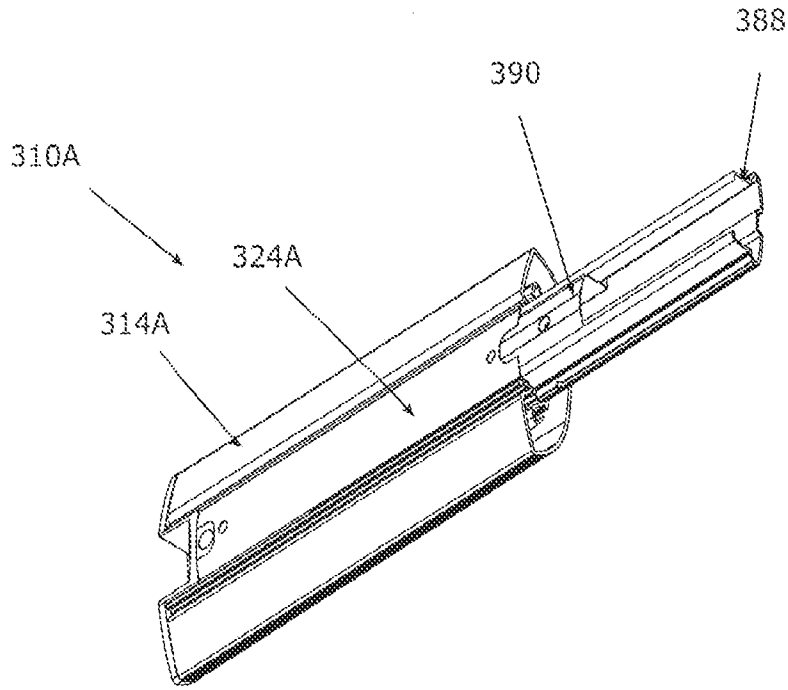


FIG. 70

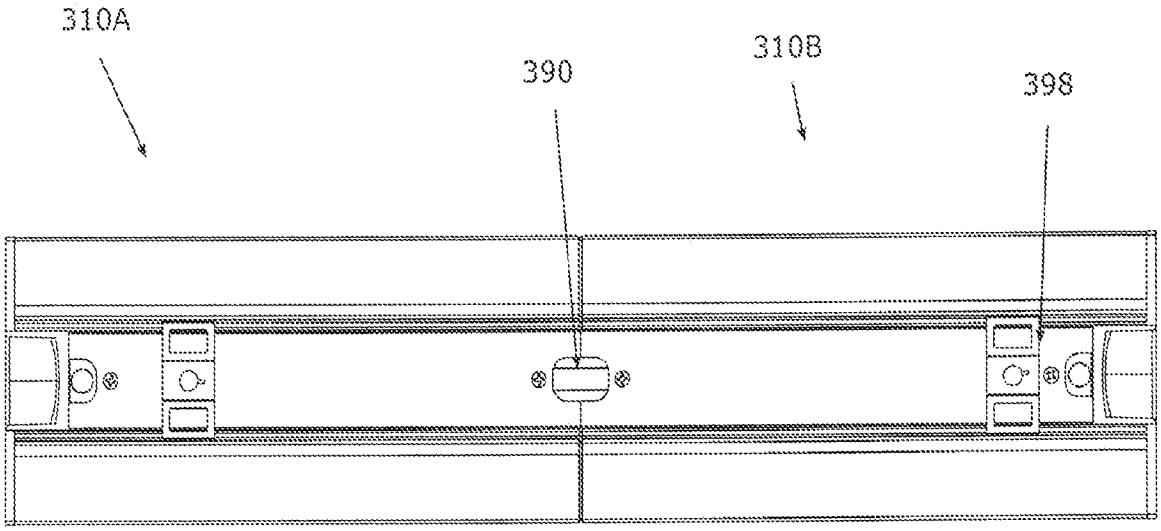


FIG. 71

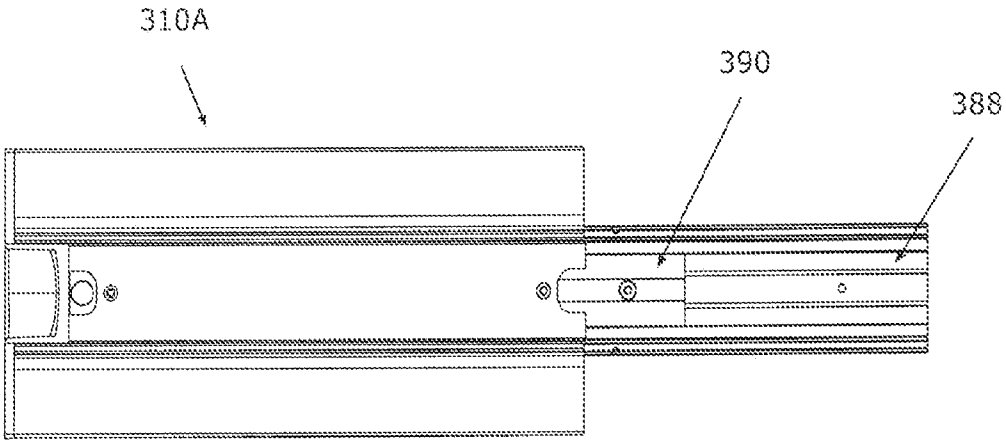


FIG. 72

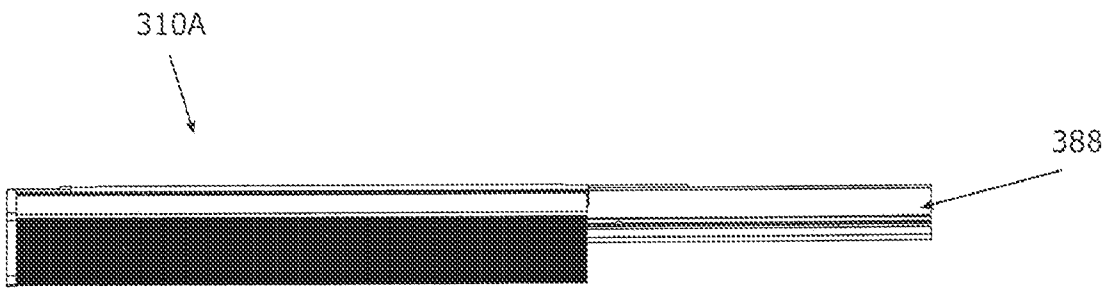


FIG. 73

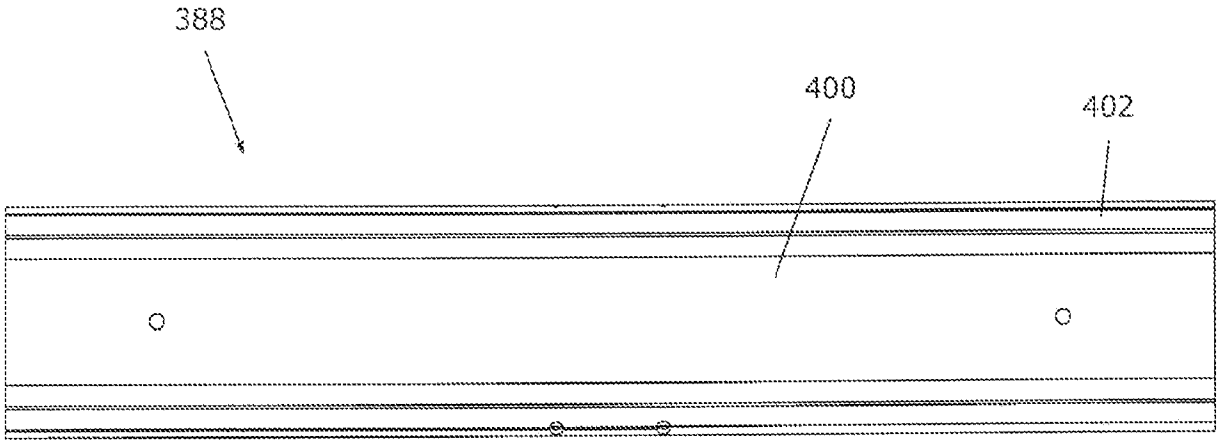


FIG. 74

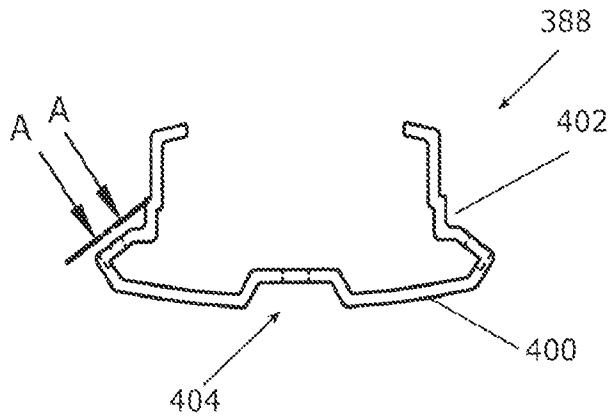


FIG. 75

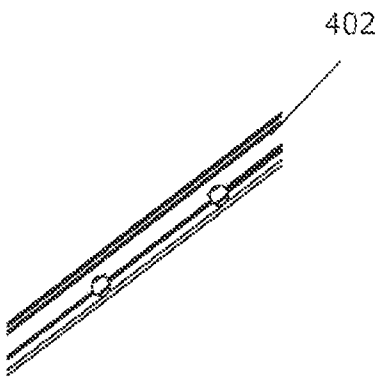


FIG. 75A

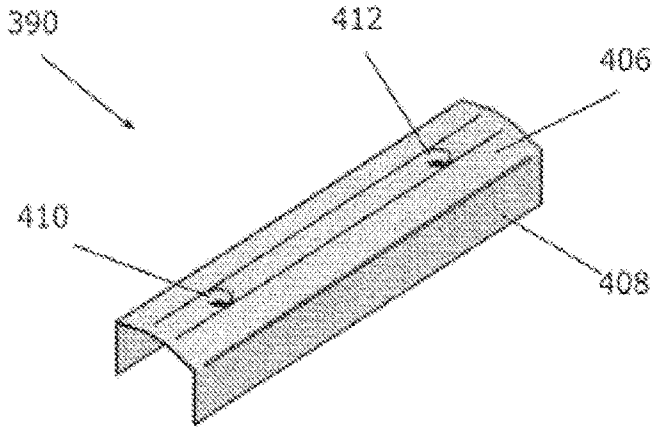


FIG. 76

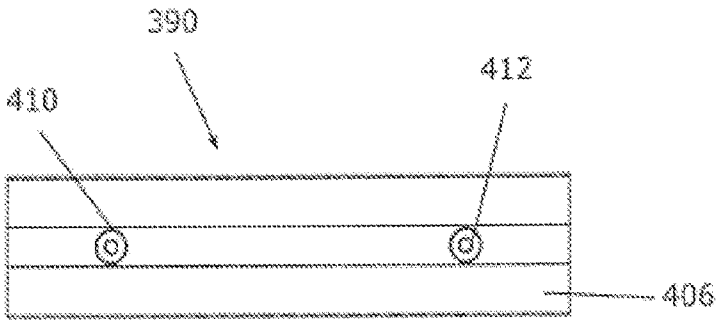


FIG. 77

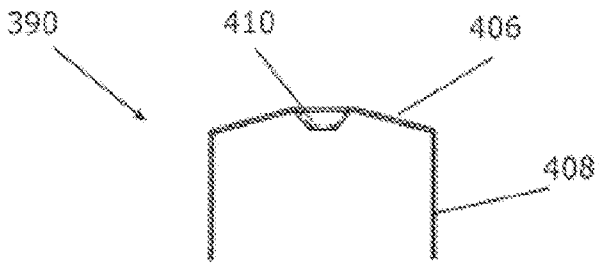


FIG. 78

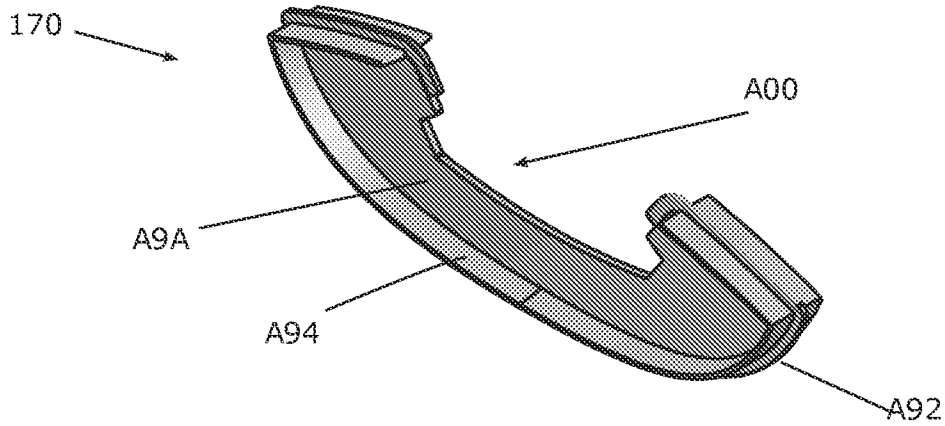


FIG. 67

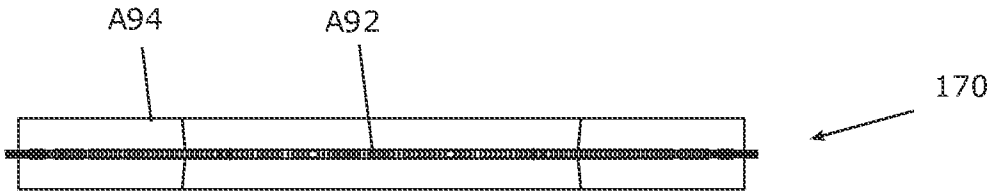


FIG. 2B

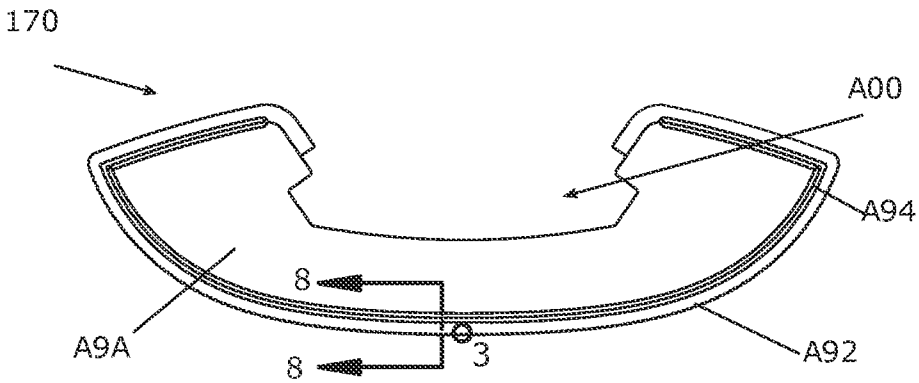


FIG. 29

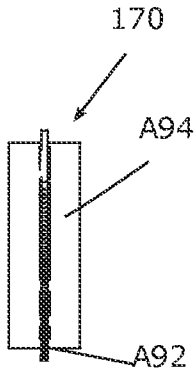


FIG. 20

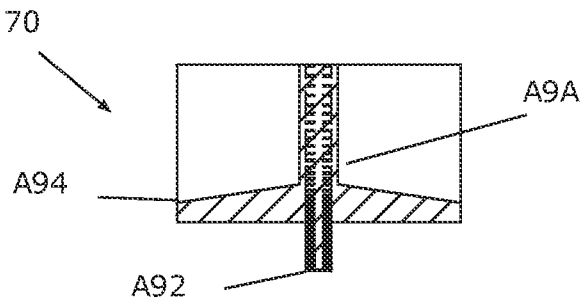


FIG. 298

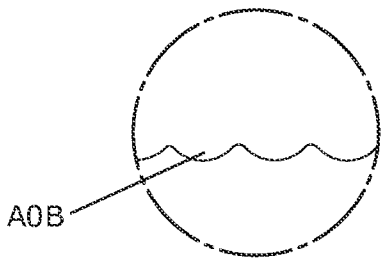


FIG. 293

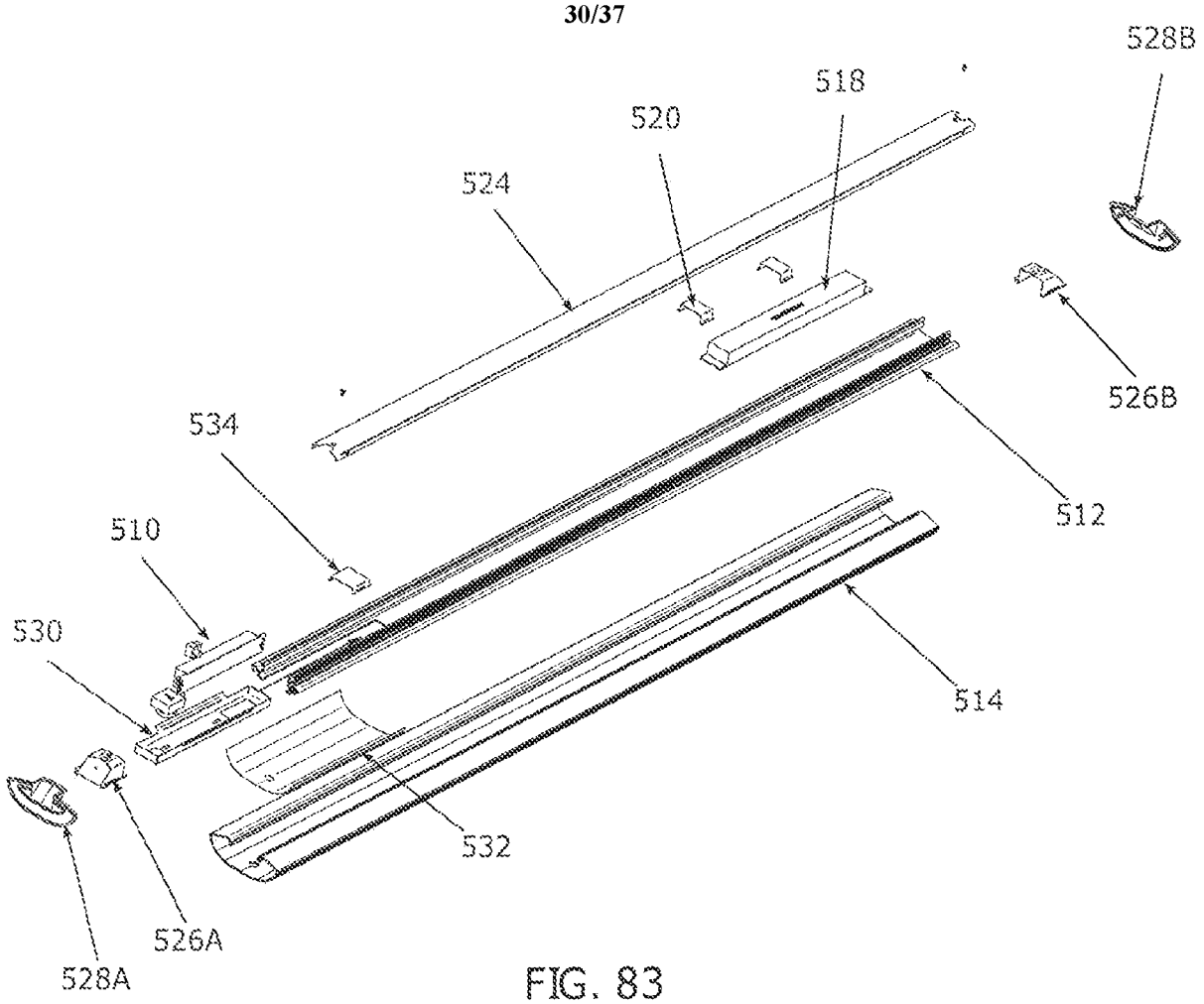


FIG. 83

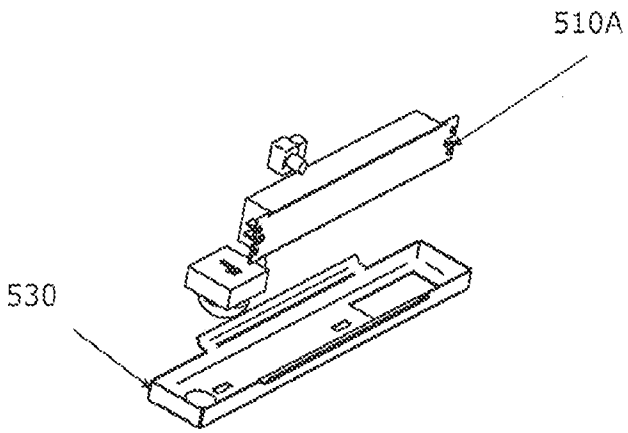


FIG. 84

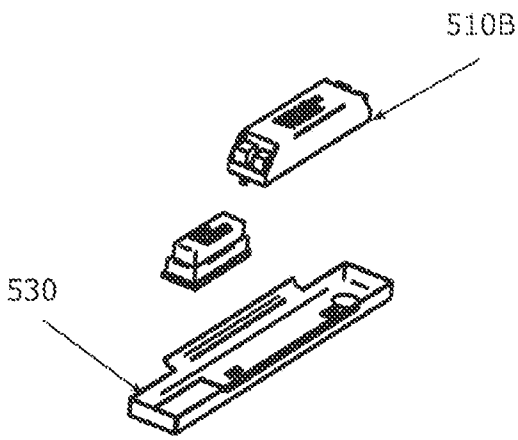


FIG. 85

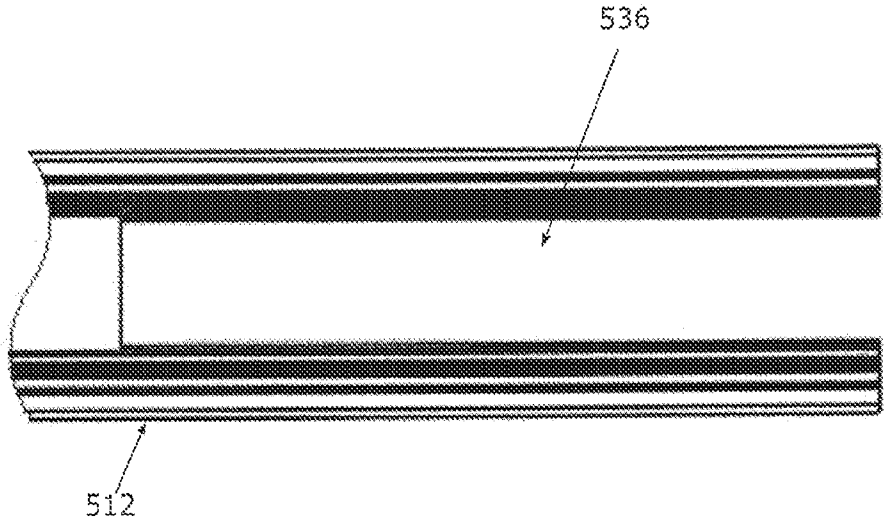


FIG. 86

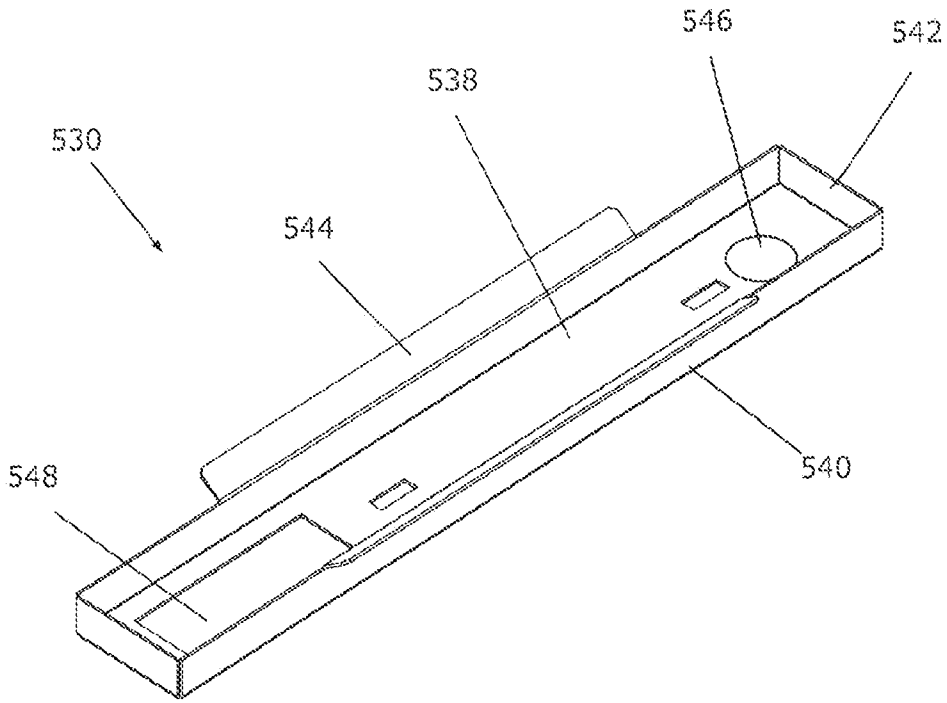


FIG. 87

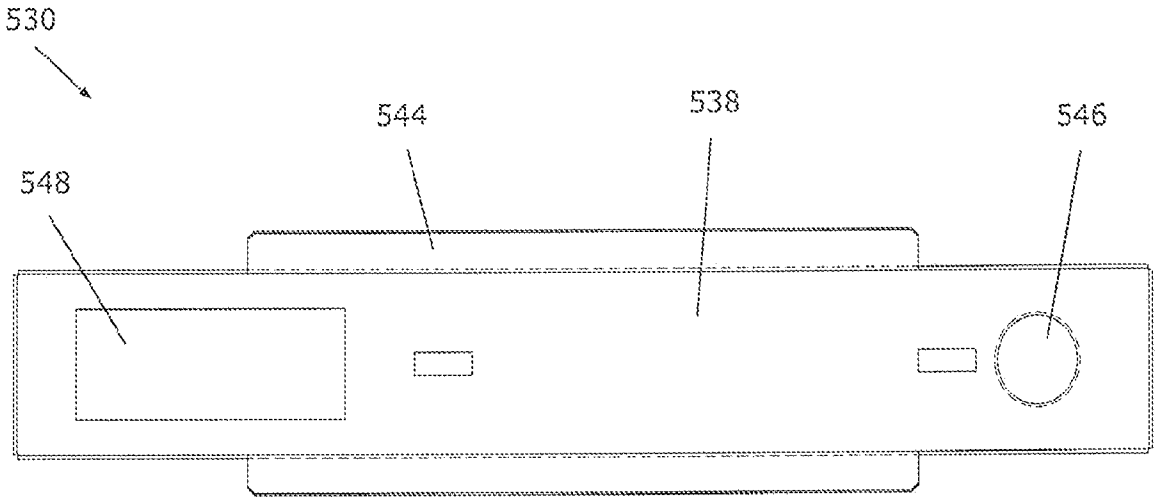


FIG. 88

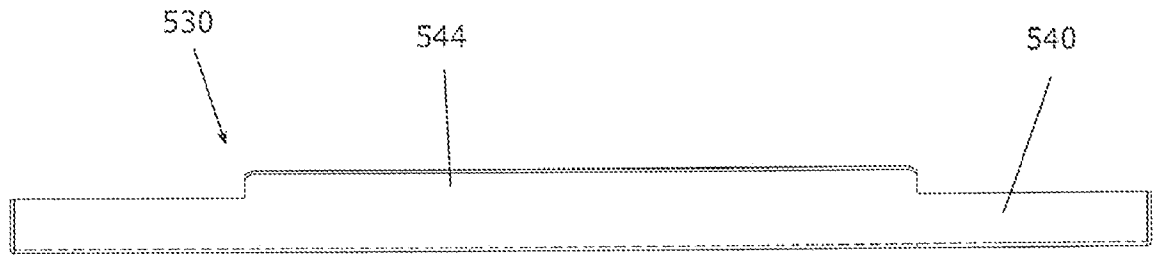


FIG. 89

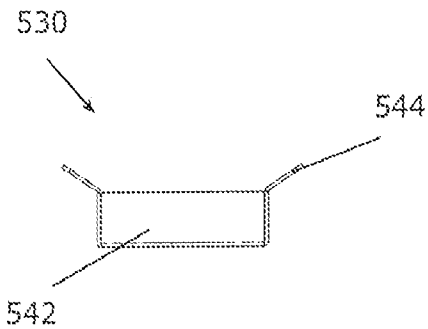


FIG. 90

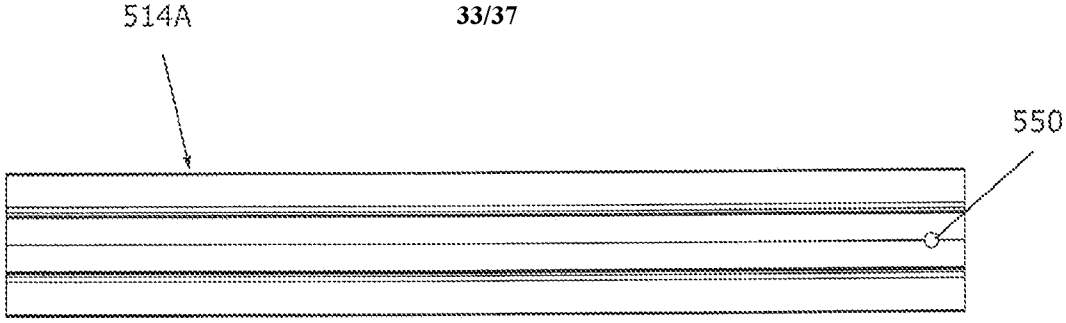


FIG. 91

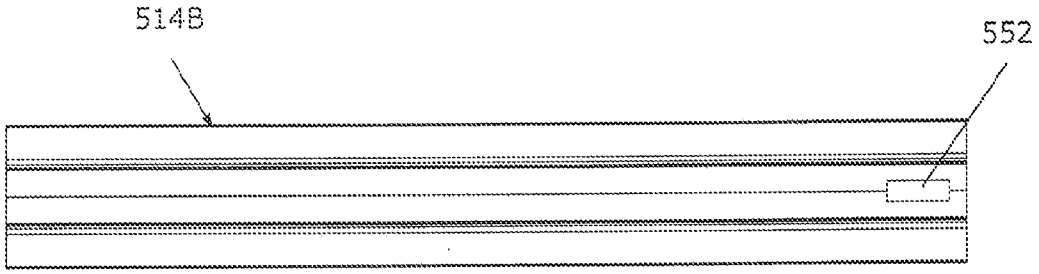


FIG. 92

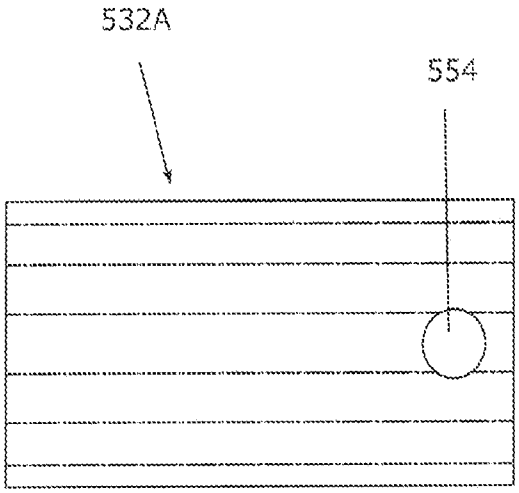


FIG. 93

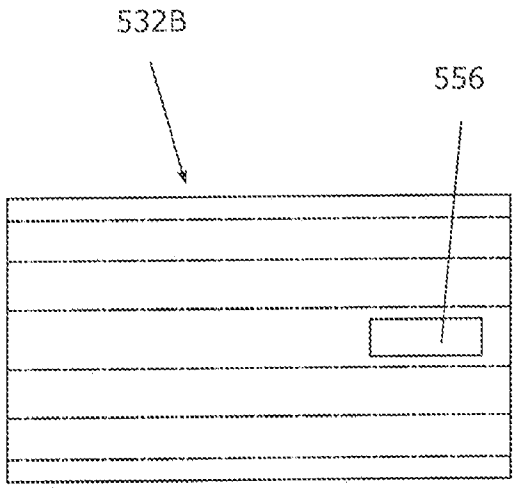


FIG. 94

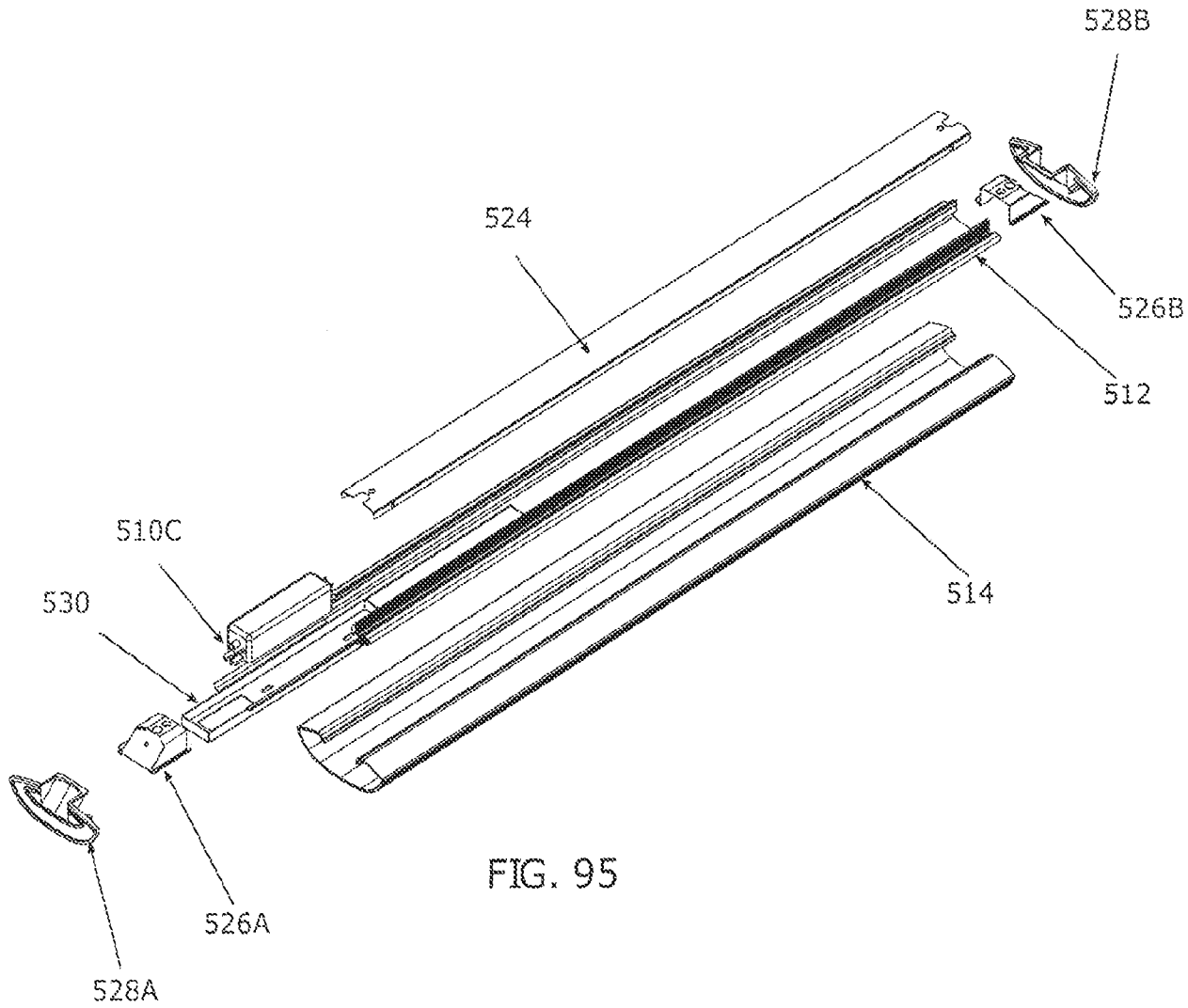


FIG. 95

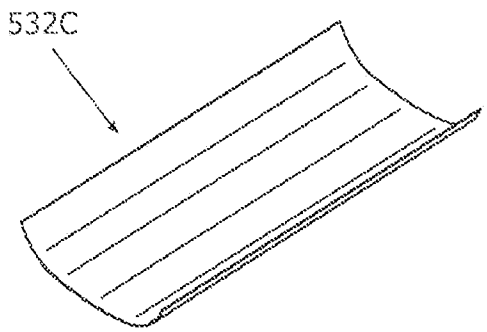


FIG. 96

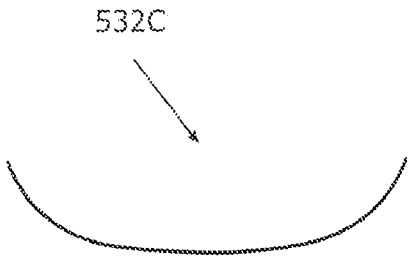


FIG. 97

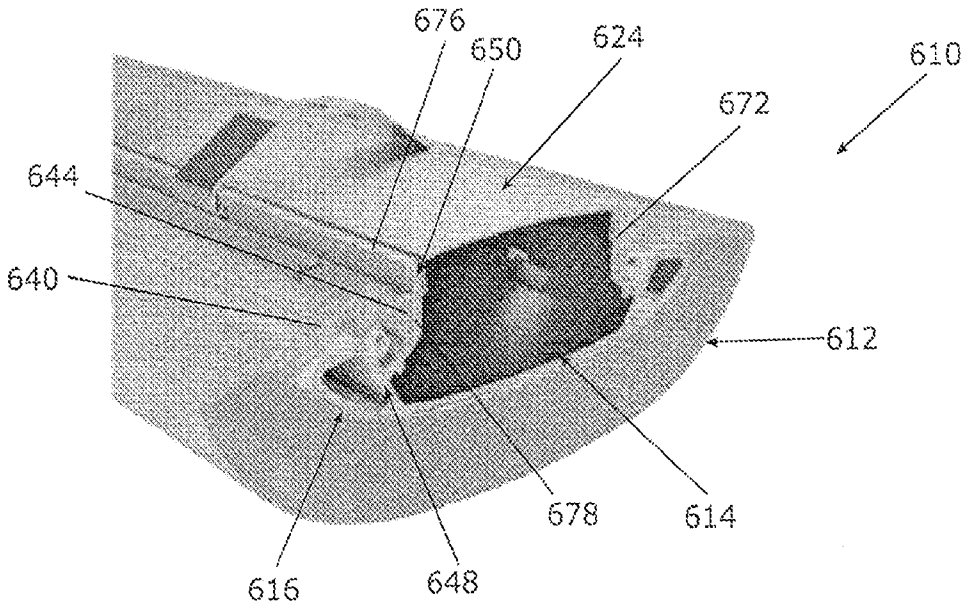

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FIG. 98

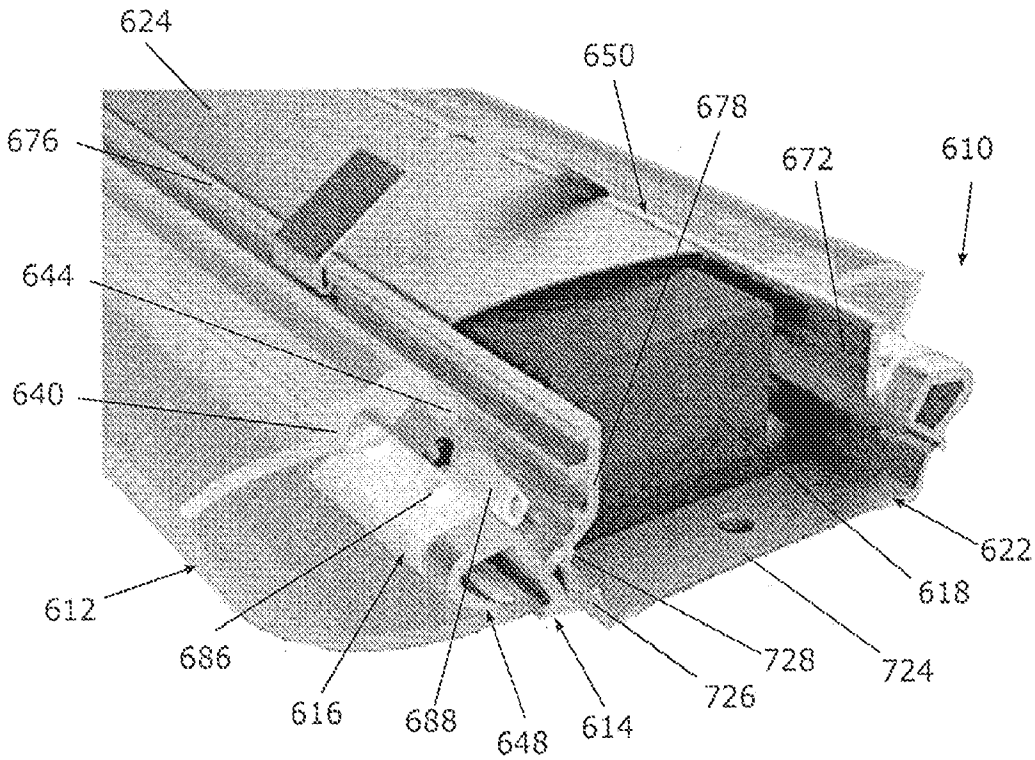

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FIG. 99

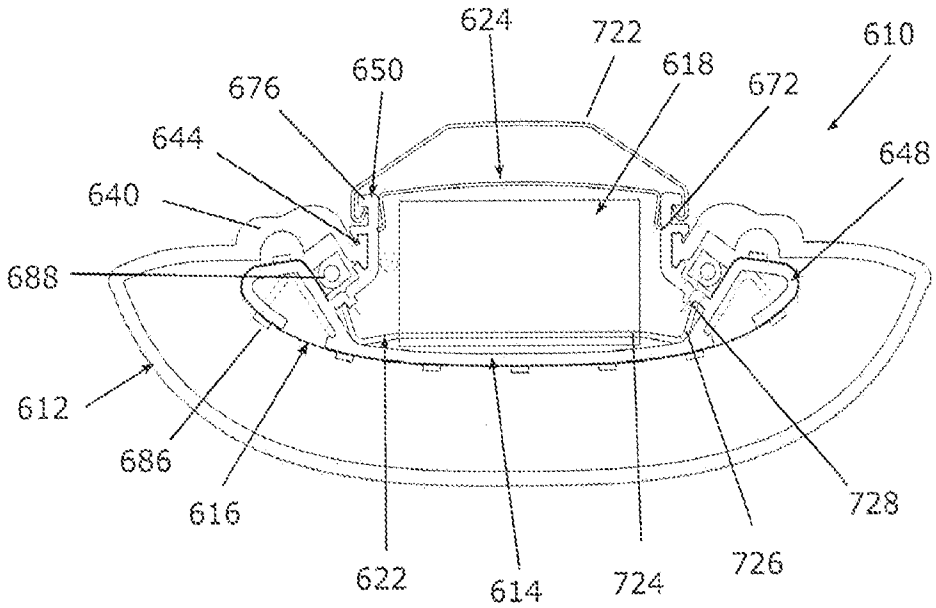


FIG. 100

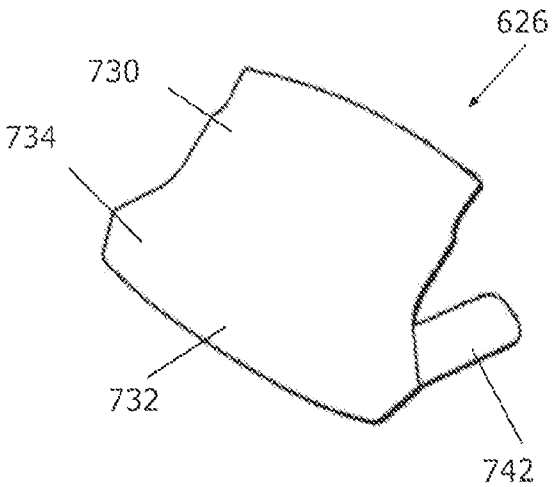


FIG. 101

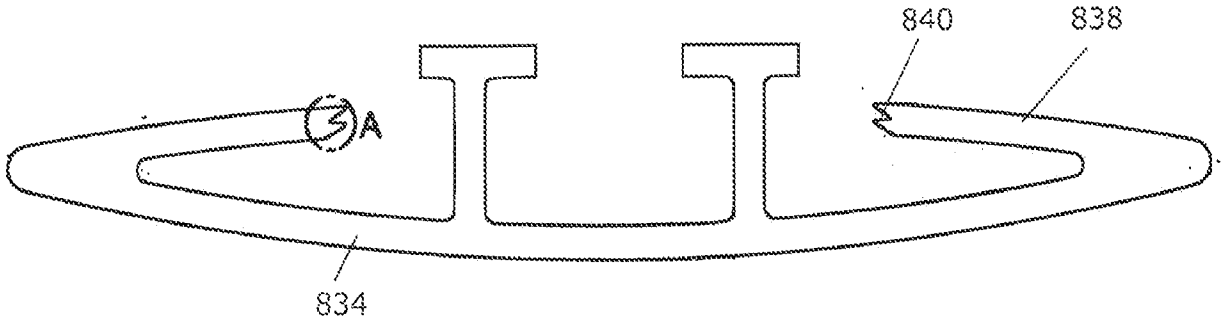


FIG. 102

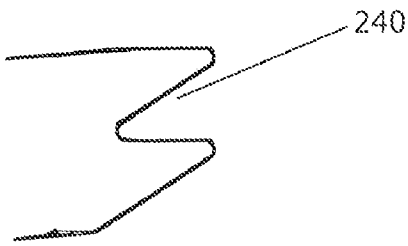


FIG. 102A

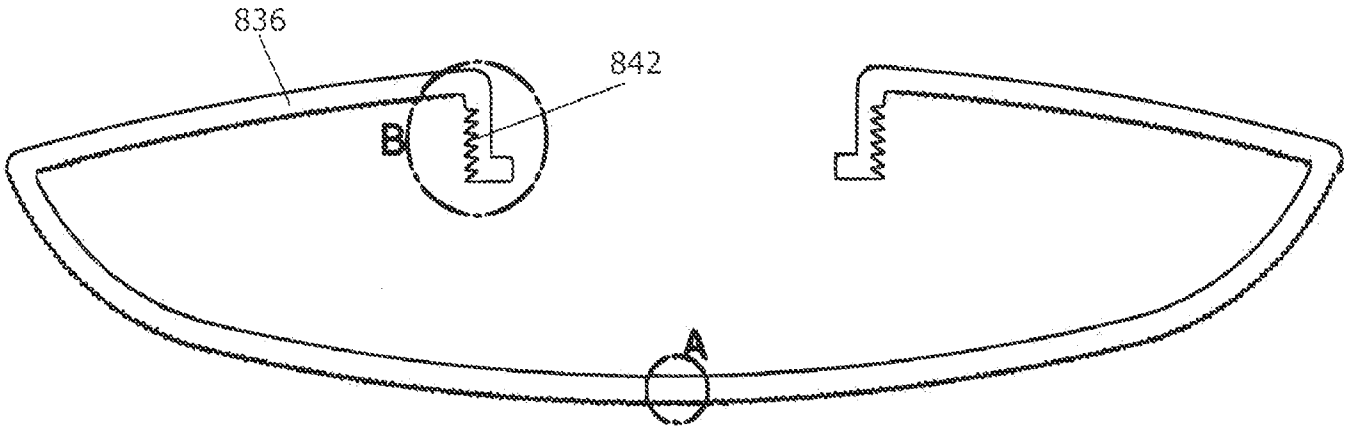


FIG. 103

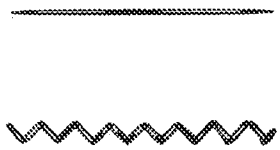


FIG. 103A

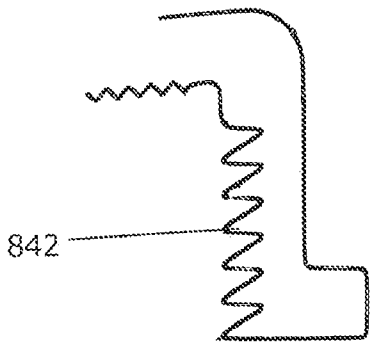


FIG. 103B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 15/32121

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - F21S 8/04, F21V 21/02 (2015.01)
CPC - F21V 21/025; F21S 8/03, 8/04
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): F21S 8/04, F21V 21/02 (2015.01)
CPC: F21V 21/025; F21S 8/03, 8/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC: F21V 17/00, 21/00, 21/02, 21.025; F21S 8/00, 8/02, 8/03, 8/04, 8/046, 8/06; IPC(8): F21S 8/04, F21V 21/02 (2015.01)
USPC: 362/145, 147, 235, 249.02, 404, 408

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Patbase; Google Patents; Google Scholar; Google Web
Search Terms Used: Luminaire, lamp, light, LED, light emitting diode, endcap, bracket, support, wall, board, PCB, substrate, sheet, cover, cap, ballast, reflect, refract, prism, direction, angle, flexible, concave, convex, inner, outer

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y ---- A	US 2011/0285314 A1 (CARNEY et al.) 24 November 2011 (24.11.2011), para [0049], [0053]-[0054],[0056]-[0058], [0060], Fig. 2, 3	1-6, 21-23, 27-31 ---------- 24-26
Y --- A	US 8,414,154 B2 (DAU et al.) 09 April 2013 (09.04.2013), Abstract, col 4, ln 31-48	1-6, 21-23, 27 ---------- 24-26
Y	US 2009/0284988 A1 (SNAGEL et al.) 19 November 2009 (19.11.2009), ara [0024], [0026], [0033], Figs. 1-2	28-31
Y	US 8,092,041 B2 (FOWLER, JR. et al.) 10 January 2012 (10.01.2012), col 4, ln 26-36, col 5, ln 23-47, col 6, ln 1-31, Figs. 2, 9, 15-19	2, 5
Y	US 8,092,040 B2 (WU et al.) 10 January 2012 (10.01.2012), col 8, ln 28-40	31
Y ------ A	US 4,262,326 A (LEWIN) 14 April 1981 (14.04.1981), col 4, ln 36-65, col 7, ln 61- col 8, ln 19, Fig. 4, 12, 13	3, 4, 22, 23, 27 ---------- 24-26
Y	US 8,232,724 B2 (MOSTOLLER et al.) 31 July 2012 (31.07.2012), col 5, ln 45- col 6, ln 2, col 8, ln 60- col 9, ln 12 Fig. 5, 12-14	28-31

☐ 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	Date of mailing of the international search report
28 September 2015 (28.09.2015)	28 OCT 2015
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 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 15/32121

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 1-6 and 21-31 directed to a luminaire comprising a sheet having a plurality of LEDs positioned in different directions.

Group II: Claims 7-11 and 32-41 directed to a luminaire having first and second support and a first end and a second end connected by a joiner rail.

Group III: Claims 12-20 directed to a luminiare having a tray and a control component received in the tray.

Group IV: Claims 42-43 directed to a support for a luminaire having portions connecting individual components.

---See continuation sheet---

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.:
1-6, 21-31

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 15/32121

Continuation of Box III -- Observations where unity of invention is lacking

Group V: Claims 44-46 directed to a support for a luminaire having a hook channel.

Group VI: Claims 47-48 directed to an end cap for a luminaire.

The inventions listed as Groups I-VI 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 special technical features for the following reasons:

Group I includes the special technical feature of a sheet connected to the support between the lens and the support having a plurality of LEDs, wherein a first LED is positioned in a first direction and a second LED is positioned in a second direction different from said first direction; a top cover connected to the support; a driver positioned in the support and electrically connected to the plurality of LEDs; an end bracket connected to the support; and an end cap connected to the support covering the end bracket, not found in the other groups.

Group II includes the special technical feature of a second support having an open second end; a second lens connected to the second support; and a joiner rail connected to the open first end of the first support and the open second end of the second support, not found in the other groups.

Group III includes the special technical feature of a tray connected to the support; and a control component received in the tray as, not found in the other groups.

Group IV includes the special technical feature of a support having a first, second, thrid and fourth portions, not found in the other groups.

Group V includes the special technical feature of a support having a center channel, a side hook surrounding a hook element and an arm extending from the side hook not found in the other groups.

Group VI includes the special technical feature of an end cap comprising an angled wall, a top flange, a bottom flange and a mounting post not found in the other groups.

The only techical feature shared by Groups I-VI that would otherwise unify the groups, is the technical feature a luminaire. However, this shared technical feature does not represent a contribution over prior art, because the shared technical feature is disclosed by US 2011/0285314 A1 to Carney et al. (hereinafter Carney). Carney discloses a luminaire (105) (Fig. 2 and para [0049]).

The only additional technical features shared by Groups I-III that would otherwise unify the groups, is the technical feature of luminaire and a support and a lens connected to the support. However, this shared technical feature does not represent a contribution over prior art, because the shared technical feature is disclosed by Carney, which discloses a support and a lens (210) connected to the support (235) (Fig. 2 and para [0056]-[0057]).

The only additional technical feature shared by Groups I and III that would otherwise unify the groups, is the technical feature of a light element between the support and the lens. However, this shared technical feature does not represent a contribution over prior art, because the shared technical feature is disclosed by Carney, which discloses a light element (220) between the support (235) and the lens (210) (Fig. 2 and para [0056]-[0057]).

The only feature shared by Groups I and IV that would otherwise unify the groups, is the technical feature of luminaire, a light emitter, a lens, and a driver. However, this shared technical feature does not represent a contribution over prior art, because the shared technical feature is disclosed by Carney, which discloses a luminaire having a light emitter (222), a lens (210) and a driver (Fig. 2 and para [0054] disclosing LEDs and driver, [0056]-[0057] discosing lens).

The only additional technical feature shared by Groups III and IV that would otherwise unify the groups, is the technical feature of luminaire, a light emitter, and a lens. However, this shared technical feature does not represent a contribution over prior art, because the shared technical feature is disclosed by Carney, which discloses a luminaire having a light emitter (222), and a lens (210) (Fig. 2 and para [0054] disclosing LEDs and para [0056]-[0057] disclosing lens).

The only additonal technical feature shared by Groups IV and V that would otherwise unify the groups, is the technical feature of a support for a luminaire having a portion. However, this shared technical feature does not represent a contribution over prior art, because the shared technical feature is disclosed by Carney, which discloses a support for a luminaire having a portion (205, 235, 260) (Fig. 2 and para [0057] and [0059]).

As the shared technical features were known in the art at the time of the invention, these cannot be considered special technical features that would otherwise unify the groups.

Therefore, Groups I through VI lack unity under PCT Rule 13.