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(54) **LIGHTING MODULE, METHOD FOR MANUFACTURING THE SAME AND LUMINOUS SIGNAGE DEVICE COMPRISING SUCH LIGHTING MODULE**

BELEUCHTUNGSMODUL, VERFAHREN ZUR HERSTELLUNG DAVON UND LEUCHTENDE BESCHILDERUNGSVORRICHTUNG MIT SOLCH EINEM BELEUCHTUNGSMODUL

MODULE D'ÉCLAIRAGE, SON PROCÉDÉ DE FABRICATION ET DISPOSITIF DE SIGNALISATION LUMINEUSE COMPRENANT UN TEL MODULE D'ÉCLAIRAGE

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Description

Technical Field

[0001] The present description refers to lighting devices.

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

[0003] The invention relates to luminous signage devices including lighting modules.

[0004] The invention also relates to a method for producing signage devices.

Technological Background

[0005] The use of LED lighting modules has increasingly spread over the last few years. The LED lighting modules have been used in various applications, for example general lighting, automotive lighting, luminous signage etc. The various applications pose different requirements, and the need is felt of a universal LED module being adapted to meet the requirements in a variety of different applications.

[0006] In the field of luminous signage there may be the need of illuminating letters or symbols for advertising or information purposes. In the luminous signage devices requiring an integrated illumination, the lighting modules may be enclosed within a block of acrylic material, wherein three sides of the block may be coated with a reflective material in order to provide a uniform light radiation distribution on the letters or symbols of the luminous signage device.

[0007] In order to obtain a good uniformity of the light radiation, two systems are available in the state of the art: one may envisage the arrangement of a plurality of lighting modules below the light emission surface of the signage device, while the other may include the use of a complex system in order to produce multiple reflections and mix the light radiation inside the luminous signage device.

[0008] The existing solutions may envisage the use of LED modules mounted on a planar printed circuit board. In such cases, the possibility of obtaining a wide radiation pattern (e.g. a batwings distribution) may be obtained by means of lenses or reflectors. The uniformity of the light radiation on the emission surface may be achieved by means of one or more of the following solutions:

- reducing the pitch between two consecutive lighting modules;
- increasing the distance between the lighting modules and the light emission surface;
- using lenses or reflectors in order to widen the light radiation pattern.

[0009] US2013062631-A1 discloses a light emitting module includes a carrier unit, a substrate unit, and a light emitting unit. The substrate unit includes a plurality of substrate portions and a plurality of bending portions. The substrate portions can be disposed on different planes after bending the bending portions.

[0010] GB2485745-A discloses an LED device for three-dimensional illumination.

[0011] US2016178166-A1 discloses an LED module including a plurality of light-emitting diodes disposed only on a lateral surface of a right cone, a right pyramid, a truncated right cone, or a truncated right pyramid.

[0012] US2012238045-A1 discloses a flexible layered structure which can be easily bent to form a LED substrate for shining light in more than one direction.

[0013] DE10350913-A1 discloses a flexible circuit board having diode regions laminated on a support.

[0014] EP2295849-A1 discloses a vehicle including a parabolic reflector and a lighting device that is equipped with a folded substrate forming a pyramid whose side faces are provided with LEDs. EP 2722589 A2 discloses a luminous signage device according to the preamble of claim 1.

Object and Summary

[0015] One or more embodiments aim at providing a luminous signage device including a lighting module offering a better light distribution uniformity.

[0016] According to the invention, said object is achieved thanks to a luminous signage device having the features set forth in the claims that follow.

[0017] The invention also relates to a method for producing a luminous signage device including one or more lighting modules.

[0018] The claims are an integral part of the technical teaching provided herein with reference to the embodiments.

Brief Description of the Figures

[0019] One or more embodiments will now be described, by way of non-limiting example only, with reference to the annexed Figures, wherein:

- Figures 1-4 show a method for producing a lighting module,
- Figures 5 and 6 are perspective views, from different angles, of a lighting module,
- Figures 7 and 8 are side views of an embodiment of a connector device for a lighting module,
- Figure 9 is a perspective view showing an alternative configuration of a printed circuit board for producing a lighting module, and
- Figures 10 and 11 are perspective views of a luminous signage device.

[0020] It will be appreciated that, for clarity and simplicity of illustration, the various Figures may not be drawn to the same scale.

Detailed Description

[0021] In the following description, various specific details are given to provide a thorough understanding of various exemplary embodiments. The embodiments may be practiced without one or several specific details, or with other methods, components, materials, etc. In other instances, well-known structures, materials or operations are not shown or described in detail in order to avoid obscuring various aspects of the embodiments.

[0022] Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the possible appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring exactly to the same embodiment. Furthermore, particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

[0023] The headings provided herein are for convenience only, and therefore do not interpret the extent of protection or scope of the embodiments.

[0024] In Figure 1, reference 10 denotes a planar printed circuit board. The printed circuit board 10 may have a first surface 12, on which a plurality of electrically powered light radiation sources 14 may be fixed.

[0025] The electrically powered light radiation sources 14 may be solid-state light radiation sources, such as LED sources. The light radiation sources 14 may have respective light emission surfaces 16, parallel to the first surface 12 of printed circuit board 10. The light radiation sources 14 may be top emission LEDs.

[0026] The printed circuit board 10 may include three or more rigid portions 18, which are mutually connected by means of flexible portions 20. The rigid portions 18 may have a square or rectangular shape. The printed circuit board 10 may be L-shaped, as shown in Figures 1 and 2.

[0027] The light radiation sources 14 may be fixed onto respective rigid portions 18 of the printed circuit board 10. Connector devices 22 may be fixed onto a rigid portion 18 devoid of light radiation sources 14. The printed circuit board 10 may also host electrical driving components (not shown) for driving and controlling the light radiation sources 14. The light radiation sources 14, the electrical connectors 22 and the electronic driving components may be attached to the printed circuit board 10 by soldering, according to techniques known in the field of production of LED lighting devices.

[0028] As shown in Figures 3 and 4, in one or more embodiments the printed circuit board 10 may be folded into a three-dimensional structure 24, having three or more planar faces 26 formed by respective rigid portions 18 of the printed circuit board 10. The planar faces 26 of the three-dimensional structure 24 may extend around a main axis A. The rigid portion 18 carrying the connector devices 22 may be orthogonal to the main axis A. The flexible portions 20 of the printed circuit board 10 may form rounded corners between the planar faces 26 of the three-dimensional structure 24.

[0029] With reference to Figure 3, in one or more embodiments the three-dimensional structure 24 may be folded around a rigid support 28 located within the three-dimensional structure 24. The three-dimensional structure 24 may be attached to the rigid support 28 e.g. by gluing. The rigid support 28 may have the shape of a three-dimensional solid figure having a polygonal shape, e.g. triangular, square, pentagonal etc. Specifically, in one or more embodiments, the three-dimensional structure 24 may have a cubic or parallelepiped shape, having four faces 26 oriented at 90° one with respect to the other.

[0030] With reference to Figure 4, in one or more embodiments the three-dimensional structure 24 may be encapsulated into a polymeric material 30, which may form an encapsulating layer coating the printed circuit board 10, the light radiation sources 14 and other electronic components. The polymeric material 30 may be a material adapted to protect the light radiation sources 14 and other electronic components. The layer of polymeric material 30 may be formed by conventional moulding techniques.

[0031] In Figures 5 and 6, reference 32 denotes a finished lighting module which may be obtained by means of the

method described in the foregoing. The lighting module 32 may include a planar printed circuit board 10, which is folded into a three-dimensional structure 24 having three or more planar faces 26 extending around a main axis A.

[0032] In one or more embodiments, the lighting module 32 may include three or more electrically powered light radiation sources 14, fixed to respective faces 26 of the three-dimensional structure 24. The light radiation sources 24 may have respective emission surfaces 16 facing outwards of the three-dimensional structure 24. The light radiation sources may be angularly equidistant from each other in a plane orthogonal to the main axis A, along an angle of 360°. The angular distance between the light radiation sources 14 may amount to 360°/n, wherein n is the number of faces 26 of the three-dimensional structure 24 parallel to main axis A.

[0033] The faces 26 of the three-dimensional structure may be formed by respective rigid portions 18 of the printed circuit board 10, which are connected to each other by means of flexible portions 20.

[0034] The three-dimensional structure 24 may be fixed to a rigid support 28 located within the three-dimensional structure 24. The three-dimensional structure 24 may include a base 34 orthogonal to the main axis A and carrying connector devices 22.

[0035] In one or more embodiments, the three-dimensional structure 24 may be encapsulated into a polymeric material 30.

[0036] With reference to Figures 7 and 8, in one or more embodiments the connector devices 22 may be IDCs (Insulation-Displacement Connectors) provided with cutting edges 36, between which an insulated cable 38 may be inserted. As shown in Figures 7 and 8, when the cable 38 is inserted between the cutting edges 36 of contacts 22, the edges 36 cut the insulating coating of cable 38 and establish an electrical connection with the conductive portion of cable 38.

[0037] In one or more embodiments, the lighting module 32 may be devoid of light radiation sources on a surface orthogonal to main axis A opposed to base 34.

[0038] In one or more embodiments, the three-dimensional structure (24) may include three or more planar faces 26 in a plane containing said main axis (A) and carrying respective electrically-powered light radiation sources (14) equidistant from each other. For example, in one or more embodiments the lighting module 32 may have a face orthogonal to axis A and opposite base 34 carrying a light radiation source 14. In one or more embodiments, this arrangement may be obtained starting from a T-shaped planar printed circuit board, as shown in Figure 9, which may then be folded so as to form a three-dimensional structure having two opposite faces orthogonal to main axis A.

[0039] With reference to Figures 10 and 11, one or more embodiments may concern a luminous signage device 40. The signage device 40 may be a component of a lighted sign and may have the shape e.g. of a letter or a symbol. The signage device 40 may include a casing 42 having a cavity 44. In one or more embodiments, the signage device 40 may include a light emitting wall 46, which may close one side of the cavity 44.

[0040] In one or more embodiments, the cavity 44 of the signage device 40 may host one or more lighting modules 32, arranged with the main axis A orthogonal to the light emitting wall 46. In one or more embodiments, the cavity 44 may have a side wall 48, and the lighting modules 32 may be received within cavity 44 with the faces 26 of the three-dimensional structure 24 facing side wall 48.

[0041] In one or more embodiments, casing 42 may have a reflective side wall 50. The reflective side wall 50 may be the outer surface of casing 42. The cavity 44 may also have a bottom wall opposed to the light emitting wall 46. In one or more embodiments, also the bottom wall of cavity 44 may be reflective.

[0042] In one or more embodiments, the lighting modules 32 may emit light radiation having a distribution over 360° around the respective main axes A. The light radiation emitted by the lighting modules 32 may be parallel to the light emitting wall 46 of the luminous signage device 40. The light radiation generated by the lighting modules 32 may be reflected by the reflective outer surface 50 and by the bottom wall of cavity 44. The reflected light radiation may illuminate the light emitting wall 46 of the signage device 40 with a uniform distribution. This distribution may avoid or reduce light spots and/or dark areas on the light emitting wall 46. In one or more embodiments, the light radiation generated by the lighting modules 32 may therefore be mainly directed onto the reflective walls of cavity 44, without directly illuminating the light emitting wall 46 of the signage device 40.

[0043] In one or more embodiments, the lighting modules 32 may be fixed in the casing 42 of the signage device 40 by means of an additional encapsulating layer. In one or more embodiments, the lighting modules 32 may be glued to the casing 42 or to the light emitting wall 46 of the signage device 40.

[0044] One or more embodiments may offer one or more of the following advantages:

- possibility of a wider spacing between two consecutive LED modules 32,
- possibility of using common top emission LEDs, instead of more expensive side emission LEDs,
- possibility of distributing the light radiation over 360°,

- possibility of changing the distance between the lighting modules 32,
- possibility of varying the length of the cables, in order to avoid floating cables which may originate shadows.

[0045] One or more embodiments may therefore refer to a lighting module including:

- a planar printed circuit board (e.g. 10) folded into a three-dimensional structure (e.g. 24) having three or more planar faces (e.g. 26) extending around a main axis (e.g. A),
- three or more electrically powered light radiation sources (e.g. 14) fixed to respective faces (e.g. 26) of said three-dimensional structure (e.g. 24) and having respective light emission surfaces (e.g. 16) facing outwards of said three-dimensional structure (e.g. 24),

wherein the light radiation sources (e.g. 14) may be angularly equidistant from each other in a plane orthogonal to said main axis (e.g. A) along an angle of 360°.

[0046] In one or more embodiments, the three-dimensional structure (e.g. 24) may include three or more faces (e.g. 26) in a plane containing said main axis (e.g. A) and carrying respective electrically powered light radiation sources (e. g. 14) equidistant from each other.

[0047] According to the invention, the printed circuit board (e.g. 10) includes three or more rigid portions (e.g. 18) forming said faces (e.g. 26) and connected together by flexible portions (e.g. 20).

[0048] In one or more embodiments, the three-dimensional structure (e.g. 24) may be fixed to a rigid support (e.g. 28) located within the three-dimensional structure (e.g. 24).

[0049] In one or more embodiments, the three-dimensional structure (e.g. 24) may include a base (e.g. 34) orthogonal to the main axis (e.g. A) and carrying connector devices (e.g. 22).

[0050] In one or more embodiments, the three-dimensional structure (e.g. 24) may include an upper face (e.g. 26) perpendicular to the main axis (e.g. A) and carrying a respective electrically powered light radiation source (e.g. 14).

[0051] In one or more embodiments, the three-dimensional structure (e.g. 24) may be encapsulated in a polymeric material (e.g. 30).

[0052] In one or more embodiments, the light radiation sources (e.g. 14) may be top emission LEDs.

[0053] One or more embodiments may concern a method for producing a lighting module (e.g. 32), including:

- providing a planar printed circuit board (e.g. 10) carrying three or more electrically powered light radiation sources (e.g. 14),
- folding said planar printed circuit board (e.g. 10) into a three-dimensional structure (e.g. 24) having three or more planar faces (e.g. 26) extending around a main axis (e.g. A),

  wherein said light radiation sources (e.g. 14) are fixed to respective faces (e.g. 26) and have respective emission surfaces (e.g. 16) facing outwards of said three-dimensional structure (e.g. 24), and
  wherein in said three-dimensional structure (e.g. 24) said light radiation sources (e.g. 14) may be angularly equidistant from each other in a plane orthogonal to the main axis (e.g. A) along an angle of 360°.

[0054] In one or more embodiments, the method may include attaching the three-dimensional structure (e.g. 24) to a rigid support (e.g. 28) located within said three-dimensional structure (e.g. 24).

[0055] In one or more embodiments, the method may include encapsulating said three-dimensional structure (e.g. 24) into a polymeric material (e.g. 32).

[0056] One or more embodiments may concern a luminous signage device (e.g. 40) including a casing (e.g. 42) having a cavity (e.g. 44) and a light emitting wall (e.g. 46) that covers one side of said cavity (e.g. 44), including one or more lighting modules (e.g. 32) arranged in said cavity (e.g. 44), with said main axis (e.g. A) orthogonal to said light emitting wall (e.g. 46) .

[0057] According to the invention, the casing (e.g. 42) has a reflective side wall (e.g. 50).

[0058] According to the invention, said emitting surfaces (e.g. 16) of said light radiation sources (e.g. 14) are directed towards a side wall (e.g. 48) of the cavity (e.g. 44) of the casing (e.g. 42).

[0059] Without prejudice to the basic principle, the implementation details and the embodiments may vary, even appreciably, with respect to what has been described herein by way of non-limiting example only, without departing from the extent of protection.

[0060] Said extent of protection is defined by the annexed claims.

LIST OF REFERENCE SIGNS

[0061]

printed circuit board	10
first surface	12

light radiation sources	14
light emission surfaces	16
rigid portions	18
flexible portions	20
connector devices	22
three-dimensional structure	24
planar faces	26
main axis	A
rigid support	28
polymeric material	30
finished lighting module	32
base	34
cutting edges	36
insulated cable	38
luminous signage device	40
casing	42
cavity	44
light emitting wall	46
side wall	48
reflective sidewall	50

Claims

1. A luminous signage device (40) comprising:

- a casing (42) having a cavity (44), at least one reflective sidewall (50), and a light emitting wall (46) that covers one side of said cavity (44),
- at least one lighting module (32) comprising:
- a planar printed circuit (10) folded into a three-dimensional structure (24) having three or more planar faces (26) extending around a main axis (A),
- three or more electrically powered light radiation sources (14) fixed to respective faces (26) of said three-dimensional structure (24) and having respective light emitting surfaces (16) facing outwards of said three-dimensional structure (24),

wherein the light radiation sources (14) are angularly equidistant from each other in a plane orthogonal to said main axis (A) along an angle of 360°,
said at least one lighting module (32) being disposed in said cavity (44) with said main axis (A) orthogonal to said light emitting wall (46) and with said emitting surfaces (16) of said light radiation sources (14) directed toward said side wall (50), **characterized in that**
said printed circuit board (10) comprises three or more rigid portions (18) forming said faces (26) and connected together by flexible portions (20).

2. A luminous signage device (40) according to claim 1, wherein said three-dimensional structure (24) comprises three or more planar faces (26) in a plane containing said main axis (A) and carrying respective electrically powered light radiation sources (14) equidistant from each other.

3. A luminous signage device (40) according to any one of the preceding claims, wherein said three-dimensional structure (24) is fixed to a rigid support (28) located within the three-dimensional structure (24) .

4. A luminous signage device (40) module according to any one of the preceding claims, wherein said three-dimensional structure (24) comprises a base (34) orthogonal to said main axis (A) and carrying connector devices (22).

5. A luminous signage device (40) according to any one of the preceding claims, wherein said three-dimensional structure (24) comprises an upper face (26) perpendicular to said main axis (A) and carrying a respective electrically powered source of light radiation (14).

6. A luminous signage device (40) according to any one of the preceding claims, wherein said three-dimensional

structure (24) is encapsulated in a polymeric material (30).

7. A luminous signage device (40) according to any one of the preceding claims, wherein said light radiation sources (14) are top emission LED.

8. A method for producing a luminous signage device (40), comprising:

- producing at least one lighting module (32) by:
- providing a planar printed circuit board (10) carrying three or more electrically powered light radiation sources (14),
- folding said planar printed circuit board (10) in a three-dimensional structure (24) having three or more planar faces (26) extending around a main axis (A),

wherein said light radiation sources (14) are fixed to respective faces (26) and have respective emission surfaces (16) facing outwards of said three-dimensional structure (24),
wherein in said three-dimensional structure (24) said light radiation sources (14) are angularly equidistant from each other in a plane orthogonal to said main axis (A) along an angle of 360 °,
wherein said printed circuit board (10) comprises three or more rigid portions (18) forming said faces (26) and connected together by flexible portions (20),

- providing a casing (42) having a cavity (44), at least one reflective sidewall (50), and a light emitting wall (46) that covers one side of said cavity (44), and
- disposing said at least one lighting module (32) in said cavity (44) with said main axis (A) orthogonal to said light emitting wall (46) and with said emitting surfaces (16) of said light radiation sources (14) directed toward said side wall (50).

9. A method according to claim 8, comprising attaching said three-dimensional structure (24) to a rigid support (28) located within said three-dimensional structure (24).

10. A method according to claim 8 or claim 9, comprising encapsulating said three-dimensional structure (24) in a polymeric material (32).

Patentansprüche

1. Beleuchtete Beschilderungsvorrichtung (40), umfassend:

ein Gehäuse (42) mit einem Hohlraum (44), mindestens einer reflektierenden Seitenwand (50) und einer Licht emittierenden Wand (46), die eine Seite des Hohlraums (44) bedeckt,

- mindestens ein Beleuchtungsmodul (32), umfassend:
- eine planare gedruckte Schaltung (10), die in eine dreidimensionale Struktur (24) mit drei oder mehr planaren Flächen (26), die sich um eine Hauptachse (A) erstrecken, gefaltet ist,
- drei oder mehr elektrisch betriebene Lichtstrahlungsquellen (14), die an jeweiligen Flächen (26) der dreidimensionalen Struktur (24) befestigt sind und jeweilige Licht emittierende Oberflächen (16) aufweisen, die von der dreidimensionalen Struktur (24) nach außen gewandt sind,

wobei die Lichtstrahlungsquellen (14) in einer Ebene orthogonal zu der Hauptachse (A) entlang eines Winkels von 360° winkelmäßig äquidistant voneinander sind, wobei das mindestens eine Beleuchtungsmodul (32) in dem Hohlraum (44) angeordnet ist, wobei die Hauptachse (A) orthogonal zu der Licht emittierenden Wand (46) ist und die emittierenden Oberflächen (16) der Lichtstrahlungsquellen (14) zu der Seitenwand (50) hin gerichtet sind,
dadurch gekennzeichnet, dass die gedruckte Schaltungsplatine (10) drei oder mehr starre Abschnitte (18) umfasst, die die Flächen (26) bilden und durch flexible Abschnitte (20) miteinander verbunden sind.

2. Beleuchtete Beschilderungsvorrichtung (40) nach Anspruch 1, wobei die dreidimensionale Struktur (24) drei oder mehr planare Flächen (26) in einer Ebene umfasst, die die Hauptachse (A) enthält und jeweilige elektrisch betriebene Lichtstrahlungsquellen (14) äquidistant voneinander trägt.

3. Beleuchtete Beschilderungsvorrichtung (40) nach einem der vorhergehenden Ansprüche, wobei die dreidimensionale Struktur (24) an einem starren Träger (28) befestigt ist, der sich innerhalb der dreidimensionalen Struktur (24) befindet.

4. Beleuchtete Beschilderungsvorrichtung (40) nach einem der vorhergehenden Ansprüche, wobei die dreidimensionale Struktur (24) eine Basis (34) umfasst, die orthogonal zu der Hauptachse (A) ist und Verbindervorrichtungen (22) trägt.

5. Beleuchtete Beschilderungsvorrichtung (40) nach einem der vorhergehenden Ansprüche, wobei die dreidimensionale Struktur (24) eine obere Fläche (26) umfasst, die senkrecht zu der Hauptachse (A) ist und eine jeweilige elektrisch betriebene Quelle von Lichtstrahlung (14) trägt.

6. Beleuchtete Beschilderungsvorrichtung (40) nach einem der vorhergehenden Ansprüche, wobei die dreidimensionale Struktur (24) in einem Polymermaterial (30) eingekapselt ist.

7. Beleuchtete Beschilderungsvorrichtung (40) nach einem der vorhergehenden Ansprüche, wobei die Quellen (14) für Lichtstrahlung Top-Emission-LED sind.

8. Verfahren zum Herstellen einer beleuchteten Beschilderungsvorrichtung (40), umfassend:

- Herstellen mindestens eines Beleuchtungsmoduls (32) durch:
- Bereitstellen einer planaren gedruckten Schaltungsplatine (10), die drei oder mehr elektrisch betriebene Lichtstrahlungsquellen (14) trägt,
- Falten der planaren gedruckten Schaltungsplatine (10) in eine dreidimensionalen Struktur (24) mit drei oder mehr planaren Flächen (26), die sich um eine Hauptachse (A) erstrecken,

  wobei die Lichtstrahlungsquellen (14) an jeweiligen Flächen (26) befestigt sind und jeweilige Emissionsoberflächen (16) aufweisen, die von der dreidimensionalen Struktur (24) nach außen gewandt sind,
  wobei in der dreidimensionalen Struktur (24) die Lichtstrahlungsquellen (14) in einer Ebene orthogonal zu der Hauptachse (A) entlang eines Winkels von 360° winkelmäßig äquidistant voneinander sind,
  wobei die gedruckte Schaltungsplatine (10) drei oder mehr starre Abschnitte (18) umfasst, die die Flächen (26) bilden und durch flexible Abschnitte (20) miteinander verbunden sind,

- Bereitstellen eines Gehäuses (42) mit einem Hohlraum (44), mindestens einer reflektierenden Seitenwand (50) und einer Licht emittierenden Wand (46), die eine Seite des Hohlraums (44) bedeckt, und
- Anordnen des mindestens einen Beleuchtungsmoduls (32) in dem Hohlraum (44), wobei die Hauptachse (A) orthogonal zu der Licht emittierenden Wand (46) ist und die emittierenden Oberflächen (16) der Lichtstrahlungsquellen (14) zu der Seitenwand (50) hin gerichtet sind.

9. Verfahren nach Anspruch 8, umfassend Befestigen der dreidimensionalen Struktur (24) an einem starren Träger (28), der sich innerhalb der dreidimensionalen Struktur (24) befindet.

10. Verfahren nach Anspruch 8 oder Anspruch 9, umfassend Einkapseln der dreidimensionalen Struktur (24) in einem Polymermaterial (32).

Revendications

1. Un dispositif de signalétique lumineuse (40) comprenant :

- un boîtier (42) ayant une cavité (44), au moins une paroi latérale réfléchissante (50), et une paroi émettrice de lumière (46) qui recouvre un côté de ladite cavité (44),
- au moins un module d'éclairage (32) comprenant :
- un circuit imprimé plan (10) replié en une structure tridimensionnelle (24) avec trois ou plus faces planes (26) s'étendant autour d'un axe principal (A),
- trois ou plus sources de rayonnement lumineux alimentées électriquement (14) fixées à des faces respectives (26) de ladite structure tridimensionnelle (24) et ayant des surfaces émettrices de lumière respectives (16) tournées vers l'extérieur de ladite structure tridimensionnelle (24),

dans lequel les sources de rayonnement lumineux (14) sont angulairement équidistantes les unes des autres dans un plan perpendiculaire audit axe principal (A) suivant un angle de 360°, ledit au moins un module d'éclairage (32) étant disposé dans ladite cavité (44) avec ledit axe principal (A) perpendiculaire à ladite paroi émettrice de lumière (46) et avec lesdites surfaces émettrices (16) desdites sources de rayonnement lumineux (14) dirigées vers ladite paroi latérale (50), **caractérisé en ce que** ladite carte de circuit imprimé (10) comprend trois ou plus parties rigides (18) formant lesdites faces (26) et reliées ensemble par des parties flexibles (20).

2. Un dispositif de signalétique lumineuse (40) selon la revendication 1, dans lequel ladite structure tridimensionnelle (24) comprend trois ou plus faces planes (26) dans un plan contenant ledit axe principal (A) et portant des sources de rayonnement lumineux alimentées électriquement respectives (14) équidistantes les unes des autres.

3. Un dispositif de signalétique lumineuse (40) selon l'une des revendications précédentes, dans lequel ladite structure tridimensionnelle (24) est fixée à un support rigide (28) situé à l'intérieur de la structure tridimensionnelle (24).

4. Un module de dispositif de signalétique lumineuse (40) selon l'une des revendications précédentes, dans lequel ladite structure tridimensionnelle (24) comprend une base (34) perpendiculaire audit axe principal (A) et portant des dispositifs de connecteur (22).

5. Un dispositif de signalétique lumineuse (40) selon l'une des revendications précédentes, dans lequel ladite structure tridimensionnelle (24) comprend une face supérieure (26) perpendiculaire audit axe principal (A) et portant une source de rayonnement lumineux alimentée électriquement respective (14).

6. Un dispositif de signalétique lumineuse (40) selon l'une des revendications précédentes, dans lequel ladite structure tridimensionnelle (24) est encapsulée dans un matériau polymère (30).

7. Un dispositif de signalétique lumineuse (40) selon l'une des revendications précédentes, dans lequel lesdites sources de rayonnement lumineux (14) sont des LED à émission par le dessus.

8. Un procédé de production d'un dispositif de signalétique lumineuse (40), comprenant :

- la production d'au moins un module d'éclairage (32) par :
- l'obtention d'une carte de circuit imprimé plane (10) portant trois ou plus sources de rayonnement lumineux alimentées électriquement (14),
- le pliage de ladite carte de circuit imprimé plane (10) en une structure tridimensionnelle (24) avec trois ou plus faces planes (26) s'étendant autour d'un axe principal (A),

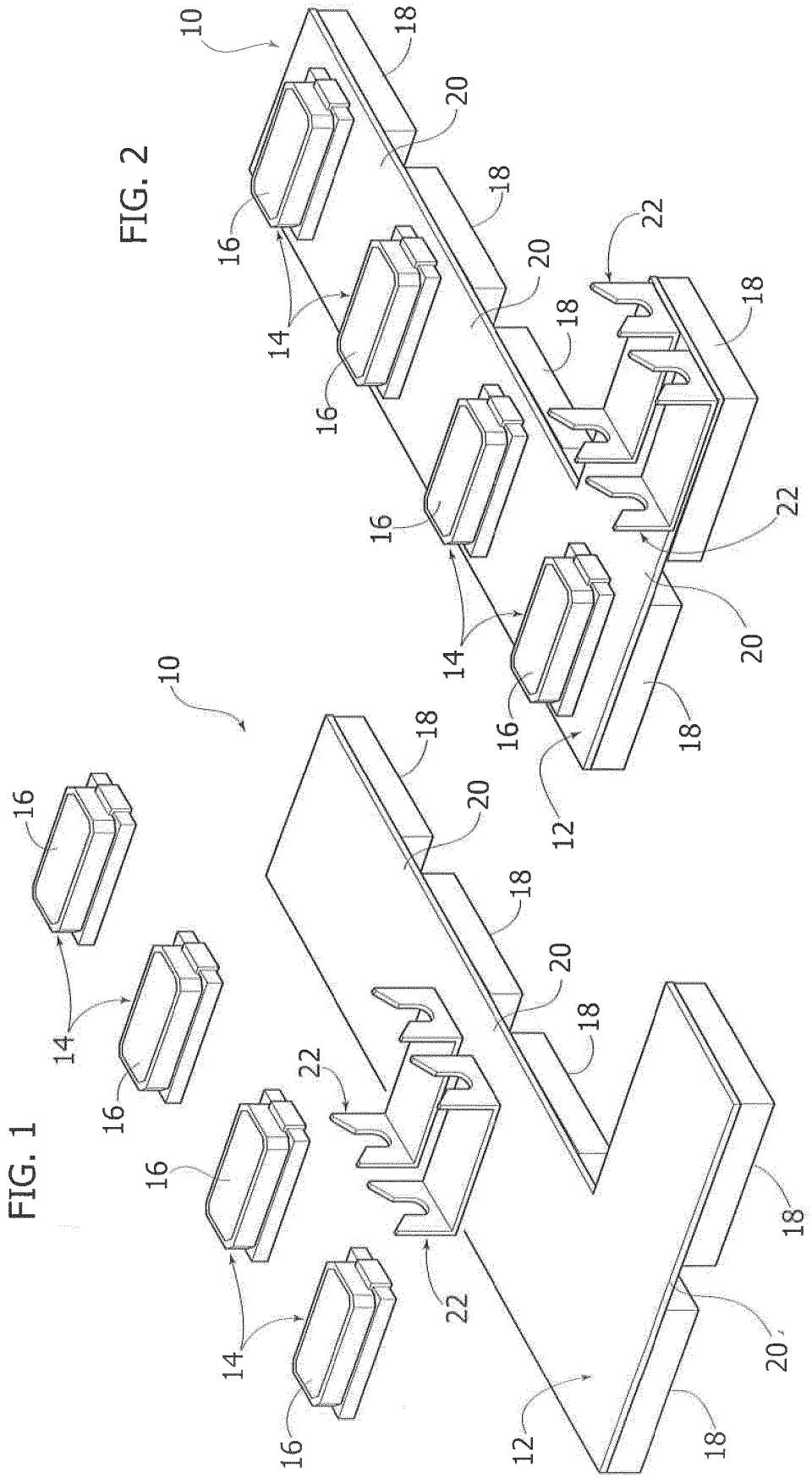
  dans lequel lesdites sources de rayonnement lumineux (14) sont fixées à des faces respectives (26) et ont des surfaces d'émission respectives (16) tournées vers l'extérieur de ladite structure tridimensionnelle (24), dans lequel, dans ladite structure tridimensionnelle (24), lesdites sources de rayonnement lumineux (14) sont angulairement équidistantes les unes des autres dans un plan perpendiculaire audit axe principal (A) selon un angle de 360°,
  dans lequel ladite carte de circuit imprimé (10) comprend trois ou plus parties rigides (18) formant lesdites faces (26) et reliées ensemble par des parties flexibles (20),

- l'obtention d'un boîtier (42) ayant une cavité (44), au moins une paroi latérale réfléchissante (50), et une paroi émettrice de lumière (46) qui couvre un côté de ladite cavité (44), et
- la mise en place dudit au moins un module d'éclairage (32) dans ladite cavité (44) avec ledit axe principal (A) perpendiculaire à ladite paroi émettrice de lumière (46) et avec lesdites surfaces émettrices de lumière (16) desdites sources de rayonnement lumineux (14) tournées vers ladite paroi latérale (50).

9. Un procédé selon la revendication 8, comprenant la solidarisation de ladite structure tridimensionnelle (24) à un support rigide (28) situé à l'intérieur de ladite structure tridimensionnelle (24).

10. Un procédé selon la revendication 8 ou la revendication 9, comprenant l'encapsulation de ladite structure tridimensionnelle (24) dans un matériau polymère (32).

FIG. 1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18

FIG. 2

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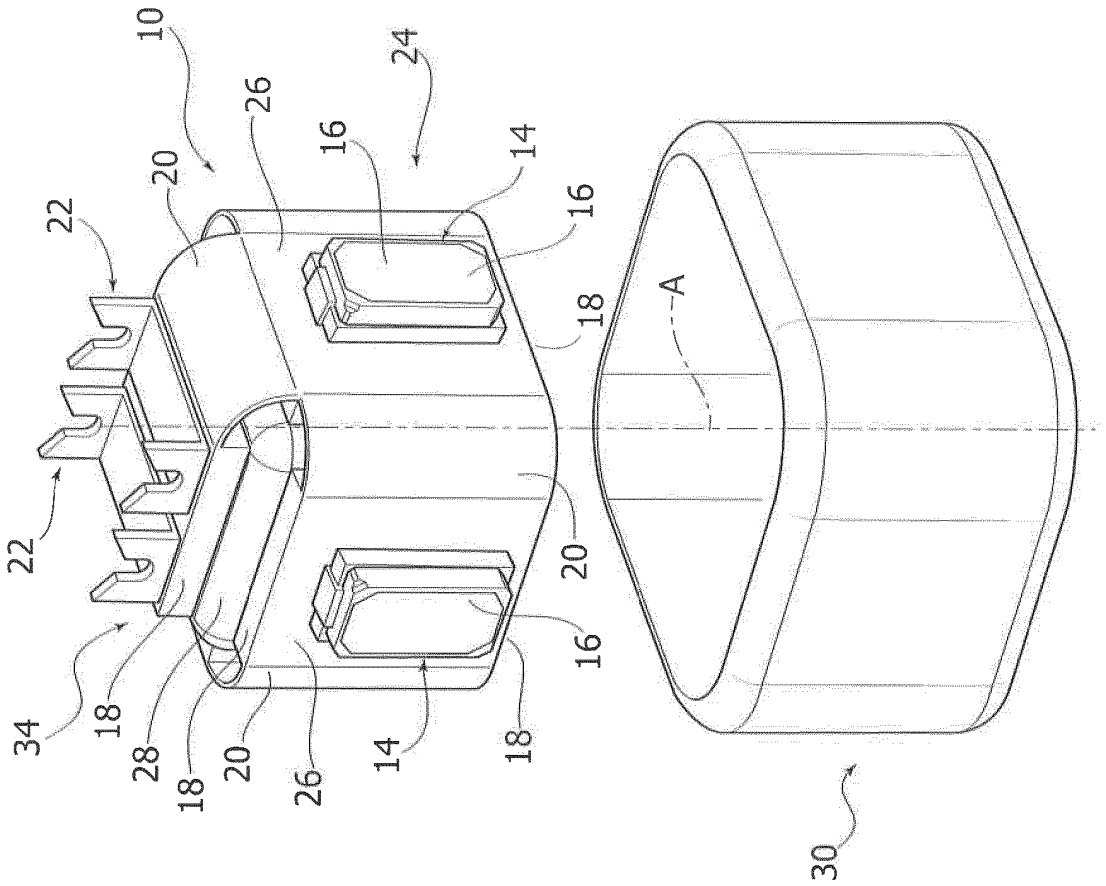
FIG. 4


10
26
24
16
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16
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A
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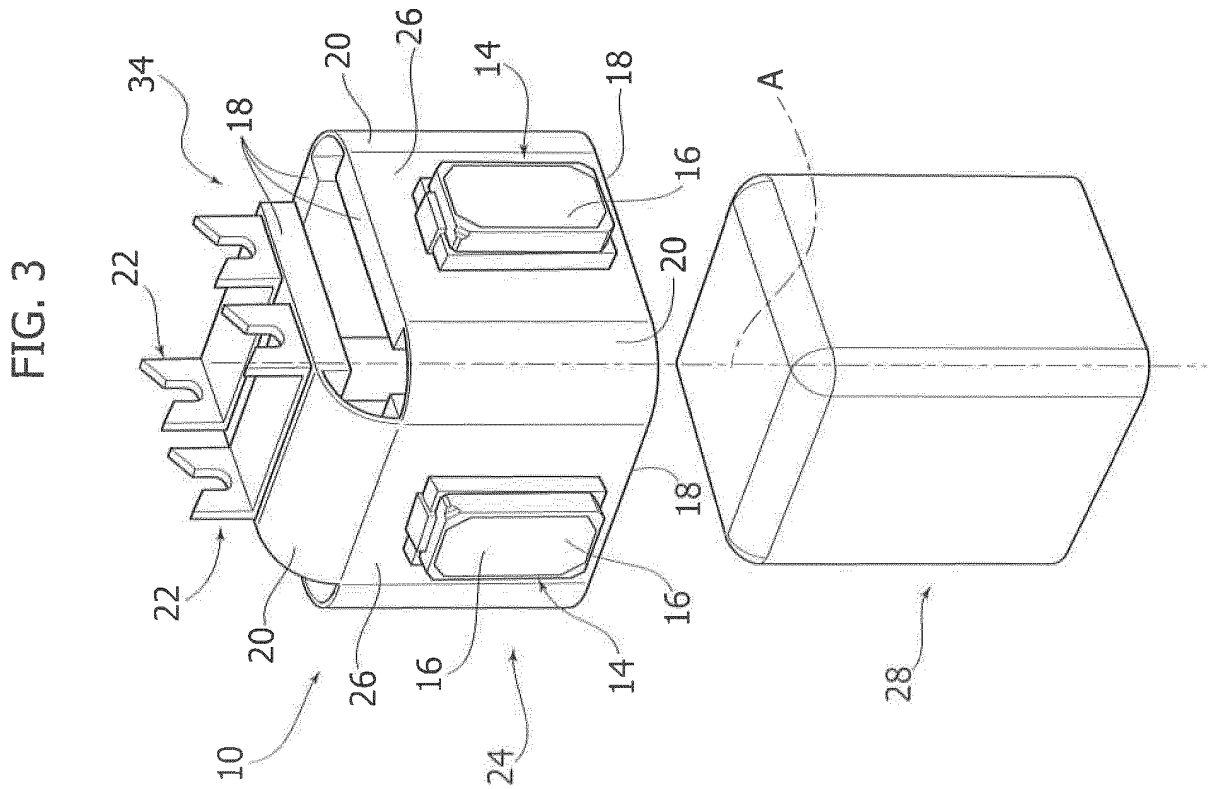
FIG. 3


34
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A
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26
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24
28

FIG. 6

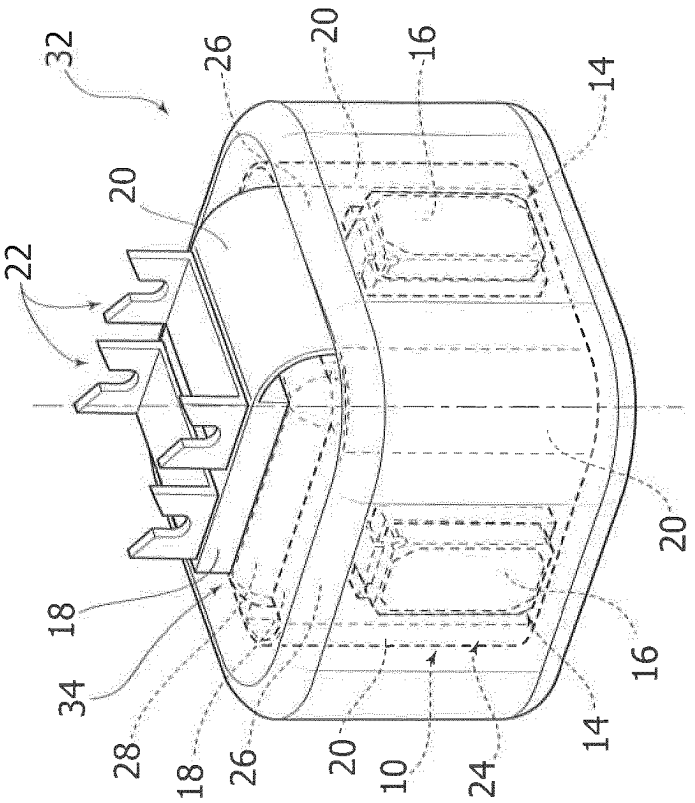
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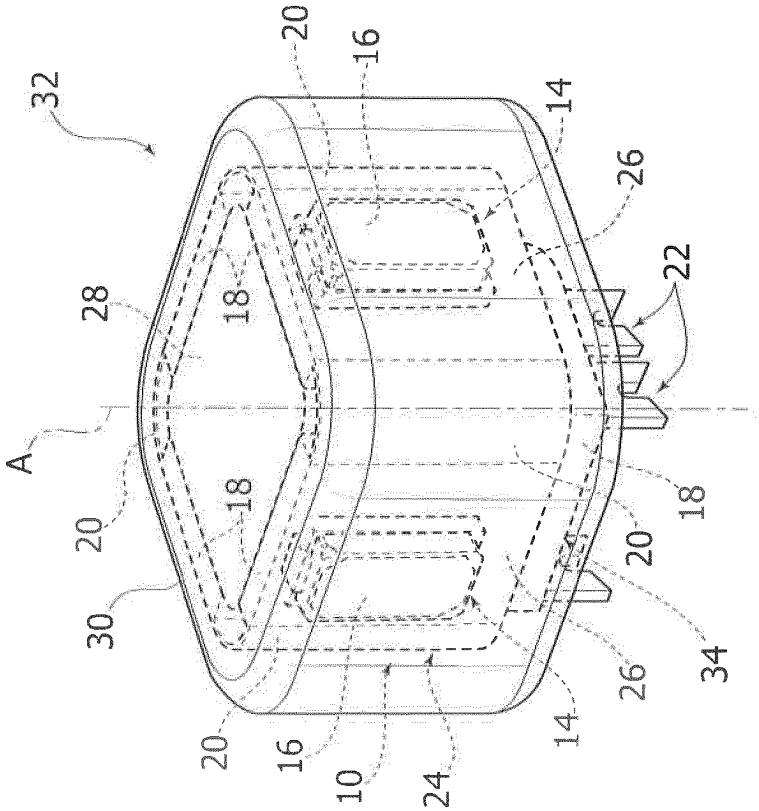
FIG. 5


32
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16
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A
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FIG. 7

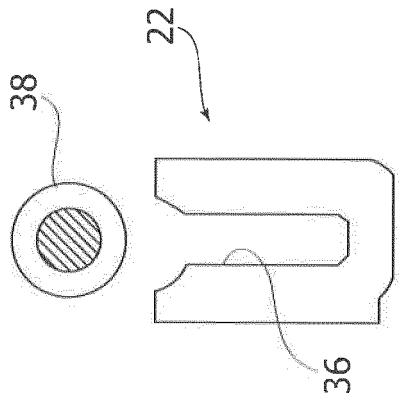


FIG. 8

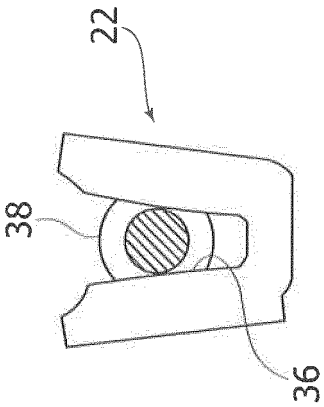
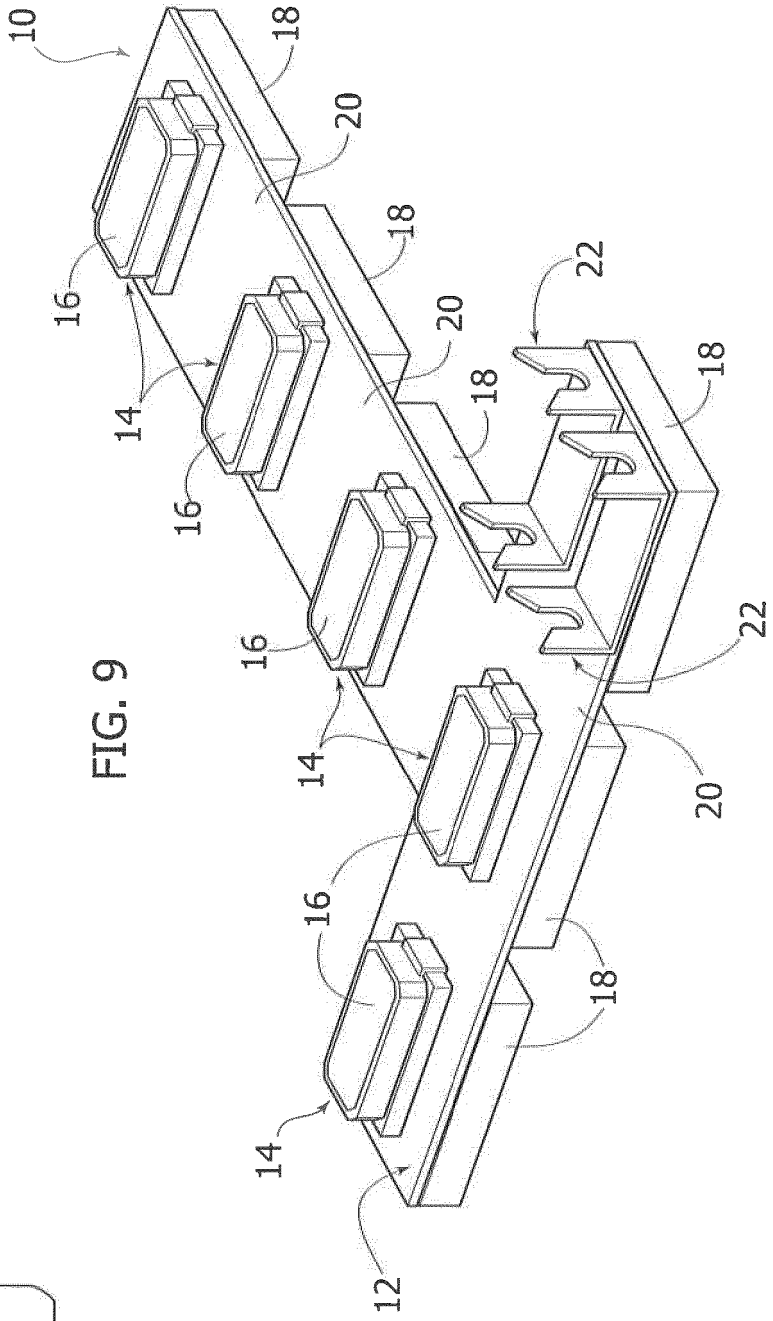


FIG. 9



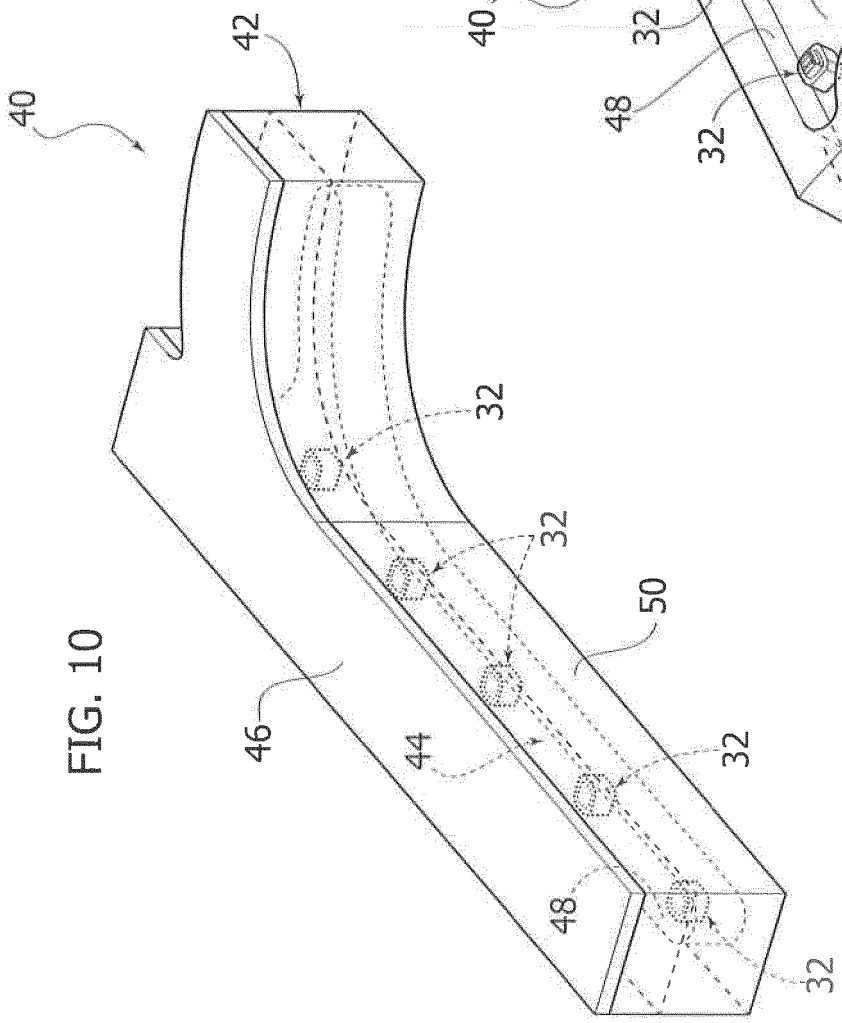


FIG. 10

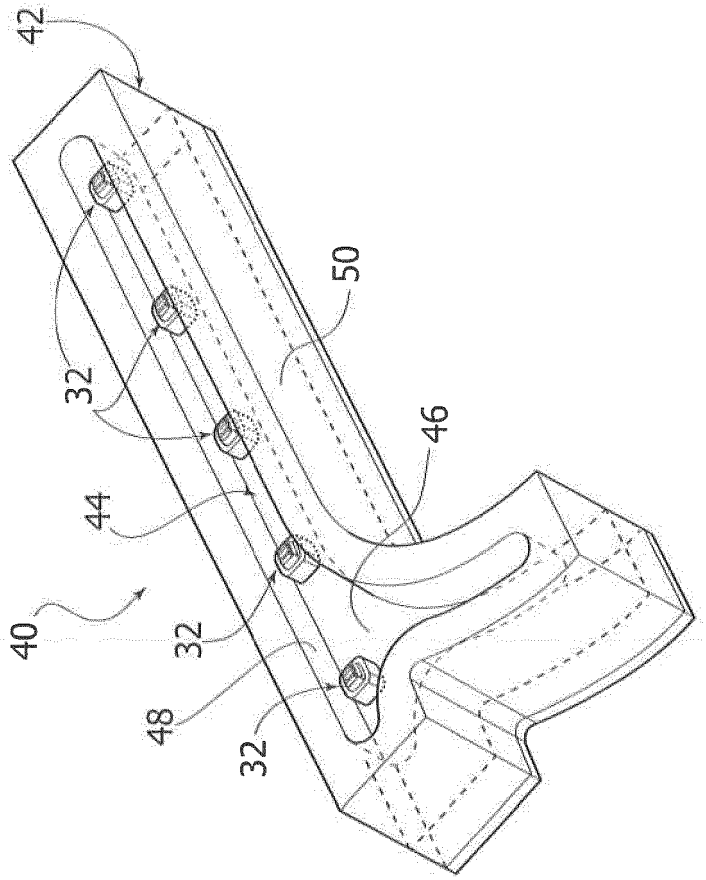


FIG. 11

REFERENCES CITED IN THE DESCRIPTION

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