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(54) **A LUMINAIRE WITH A FLEXIBLE SHEET**

(57) A luminaire in which a single flexible sheet is used to form a series of reflectors for a plurality of light emitting elements. The single flexible sheet is folded such

that a plurality of cavities or troughs are created. A light emitting element is positioned in each cavity to form the luminaire.

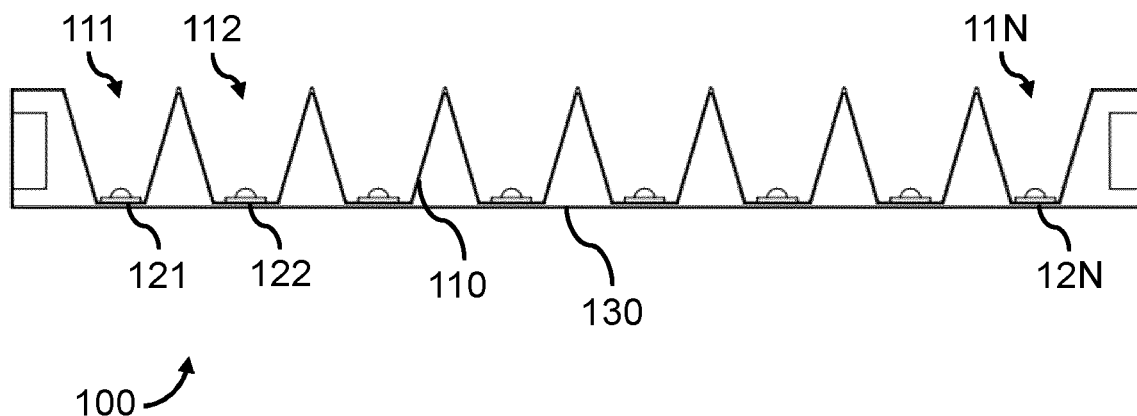


FIG. 1

Description

FIELD OF THE INVENTION

5 [0001] The present invention relates to the field of lighting, and in particular to luminaires.

BACKGROUND OF THE INVENTION

10 [0002] The use of artificial lighting is becoming increasingly common, with luminaires becoming more popular due to their high energy efficiency and flexibility of use. Luminaires are found in a wide variety of environments, including domestic, industrial, clinical, educational and/or office environments.

[0003] There is an increasing demand for luminaires that provide a high level of control over the spread and uniformity of light output therefrom.

15 SUMMARY OF THE INVENTION

[0004] The invention is defined by the claims.

[0005] According to examples in accordance with an aspect of the invention, there is provided a luminaire comprising: a single flexible sheet of reflective material, the flexible sheet being folded to form a plurality of cavities; and a plurality
20 of light emitting elements, each light emitting element being positioned in a different cavity such that each cavity forms a reflector for a respective light emitting element.

[0006] The present disclosure provides a luminaire with a flexible construction for ease of manufacturing (with a single design structure) luminaires of different beam outputs, e.g., different beam angles, light intensity distributions and so on. More particularly, the use of a folded flexible sheet of reflective material allows or permits an assembler of the
25 luminaire to choose or design for different beam intensity outputs, without the need to construct dedicated alternative designs for the reflector(s) of the light emitting elements.

[0007] In the context of the present disclosure, a sheet is considered to be a uniform, integrally formed piece of material having a low thickness (e.g., < 10mm, or < 5mm, or < 1mm). A reflector performs beamshaping on light output by a light emitting element through reflection alone, e.g., without making use of refraction.

30 [0008] The plurality of cavities may comprise at least two cavities having different cross-sectional shapes. In particular, the plurality of cavities may comprise at least five cavities having different cross-sectional shapes.

[0009] In some examples, each cavity has a width and a depth. The width of each respective cavity is measured at a base of the respective cavity.

[0010] In some examples, the plurality of cavities comprises cavities of at least two different depths and/or widths. Thus, the plurality of cavities may comprise cavities of at least two different depths. Similarly, the plurality of cavities
35 may comprise cavities of at least two different widths.

[0011] In some examples, the luminaire is configured wherein the width and/or depth of the cavity varies along a direction in which the respective cavity extends, wherein a width of a cavity is measured at a base of the cavity.

[0012] In some examples, each cavity has an associated width-depth ratio, being a ratio between the width and the
40 depth of the cavity; and the plurality of cavities comprises cavities of at least two different width-depth ratios.

[0013] This approach provides a luminaire with a non-uniform beam output for different light emitting elements. This can be advantageously configured or designed for achieving a desired overall beam output of the luminaire.

[0014] In some examples, the plurality of cavities comprises cavities of at least five different width-depth ratios.

[0015] In some examples, the plurality of cavities are arranged to lie perpendicularly to a first direction wherein with
45 increasing distance along the first direction, the width-depth ratio decreases.

[0016] This approach effectively provides a gradient wave reflector, which allows for increased emission or directing of light towards a particular direction (e.g., in a direction opposite to the first direction). This provides a system for increasing the intensity of light in a particular direction with respect to the luminaire.

[0017] Preferably, the depth of each cavity increases with increasing distance along the first direction.

50 [0018] The first direction is preferably a direction that originates at one side of the luminaire and extends to/towards another, opposite side of the luminaire.

[0019] In some examples, the plurality of cavities are arranged to lie perpendicularly to a second direction; and with increasing distance along the second direction until a reference point, of the plurality of cavities, is reached, the width-depth ratio of each cavity increases; and with increasing distance from the reference point along the second direction,
55 the width-depth ratio of each cavity decreases.

[0020] This design provides asymmetric distribution of light output by the luminaire. This can, for instance, be used to provide a greater amount of light to a particular location beneath or otherwise illuminated by the luminaire, compared to other locations.

[0021] In other examples, the plurality of cavities comprises only cavities of a substantially same size and shape. This approach provides a luminaire with increased overall uniformity of light output by the luminaire. In particular, the reflector formed by each cavity acts to perform beamshaping in a similar or identical way, such that the overall shape of the light output by the luminaire is more uniform, compared to approaches where the cavities have different sizes and/or shapes.

[0022] Preferably, each cavity in the plurality of cavities is an elongate cavity.

[0023] In some examples, each of the plurality of light emitting elements is of a same type. Thus, in this approach, the plurality of light emitting elements only require a single type of stock number of light emitting element. This can significantly reduce cost and improves recyclability of the luminaire and its components.

[0024] Optionally, each of the light emitting elements comprises an elongate light emitting element positioned in a respective cavity. For instance, each of the light emitting elements may be either: at least one discrete LED chip mounted on a single carrier; or a continuous light emitting band.

[0025] The flexible sheet preferably comprises or is coated with a white and/or specular material for reflecting light. This reduces absorption by the flexible sheet to provide a more efficient luminaire.

[0026] In some examples, the flexible sheet is formed of a wood-derived material, such as paper or cardboard. This ensures that the flexible sheet is formed of a renewable material for improved environmental impact and recyclability. The present disclosure also recognizes that a wood-derived material can provide a suitably reflective surface for acting as a reflector for a plurality of light emitting elements. Alternatively, the flexible sheet can be polymer or metal.

[0027] There is also provided a method for manufacturing a luminaire, the method comprising: folding a single flexible sheet of reflective material to form a plurality of cavities; and positioning a light emitting element in each of the plurality of cavities, such that each cavity forms a reflector for a respective light emitting element.

[0028] These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] For a better understanding of the invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example only, to the accompanying drawings, in which:

Fig. 1 illustrates a luminaire according to an embodiment;

Fig. 2 provides a perspective view of the luminaire;

Fig. 3 provides a top-down view of the luminaire;

Fig. 4 provides an enlarged view of a portion of the luminaire;

Fig. 5 illustrates an alternative luminaire;

Fig. 6 provides a perspective view of the alternative luminaire;

Fig. 7 illustrates another luminaire;

Fig. 8 provides a perspective view of the other luminaire;

Fig. 9 illustrates yet another luminaire;

Fig. 10 provides a perspective view of the yet other luminaire;

Fig. 11 provides a top-down view of an alternative luminaire; and

Fig. 12 is a flowchart illustrating steps for a method for manufacturing a luminaire.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0030] The invention will be described with reference to the Figures.

[0031] It should be understood that the detailed description and specific examples, while indicating exemplary embodiments of the apparatus, systems and methods, are intended for purposes of illustration only and are not intended to limit the scope of the invention. These and other features, aspects, and advantages of the apparatus, systems and methods of the present invention will become better understood from the following description, appended claims, and accompanying drawings. It should be understood that the Figures are merely schematic and are not drawn to scale. It should also be understood that the same reference numerals are used throughout the Figures to indicate the same or similar parts.

[0032] The invention provides a luminaire in which a single flexible sheet is used to form a series of reflectors for a plurality of light emitting elements. The single flexible sheet is folded such that a plurality of cavities or troughs are created. A light emitting element is positioned in each cavity to form the luminaire.

[0033] Embodiments are based on the realization that quick and easily customizable manufacture of a luminaire can be achieved by use of a folding technique to form cavities or troughs into which light emitting elements are to be placed. In particular, it is possible to create a luminaire with a readily customizable output light distribution.

[0034] Proposed approaches can be employed in any environment in which artificial lighting is desired, but find particular

use in indoor environments such as educational facilities, clinical facilities, industrial facilities and/or domestic environments.

[0035] Figures 1 to 3 illustrate a luminaire 100 according to an embodiment. Figure 1 provides a side view of the luminaire, Figure 2 provides a perspective view of the luminaire, and Figure 3 provides a top-down view of the luminaire.

[0036] The luminaire 100 comprises a single flexible sheet 110 of reflective material. The single flexible sheet is formed of an integrally formed piece of (flexible) material that is suited for being folded. In particular, the sheet may have a thickness of <5mm, e.g., <1mm.

[0037] A reflective material may be any material that reflects more than 50% of received light, and preferably more than 75% of received light, e.g., more than 90% of received light. Suitable examples of reflective material are known in the art, and include any material suited for being folded, e.g., coated plastics, thin sheets of metal, paper or cardboard, and so on.

[0038] The flexible sheet 110 is folded to form a plurality of cavities 111, 112, 11N. In particular, the flexible sheet may be folded in a manner analogous to a concertina fold (sometimes called an accordion fold or zig-zag fold) so as to form a sequence of cavities or troughs. A cavity is formed of at least three sides, including a base and two side walls, with an opening to allow the output of light from a light emitting element positioned in the cavity.

[0039] In the illustrated example, the folding of the flexible sheet forms a series of elongate cavities. In particular, each cavity is positioned to lie in parallel to each other cavity.

[0040] The number of cavities N in the plurality of cavities may vary depending upon the embodiment and/or use case scenario. For instance, in some examples, N is greater than 2, e.g., greater than 5. In the illustrated example, N = 8.

[0041] The luminaire 100 also comprises a plurality of light emitting elements 121, 122, 12N. Each light emitting element is positioned in a different elongate cavity 111, 112, 11N such that each elongate cavity forms a reflector for a respective light emitting element. A reflector is an element of a luminaire that performs beamshaping on received light using reflection, e.g., to control or define a beam angle of light emitted by the luminaire.

[0042] In the present embodiment, perhaps best illustrated by Figure 3, each light emitting element 121, 122, 12N comprises an elongate light emitting element positioned in a respective elongate cavity 111, 112, 11N. Each elongate light emitting element 121, 122, 12N may, for instance, comprise a string of LEDs positioned along a same line (i.e., positioned linearly).

[0043] Each light emitting element 121, 122, 12N may, for instance, be at least one discrete LED chip mounted on a single carrier. Thus, each light emitting element may be formed of a single (respective) LED chip or package having a single carrier and one or more LEDs positioned linearly on this single carrier.

[0044] In another example, each light emitting element 121, 122, 12N may comprise a continuous light emitting band or a portion of a continuous light emitting band. Examples of suitable bands may comprise a plurality of LEDs mounted on flexible substrate such as an LED ribbon or an OLED ribbon.

[0045] Preferably, each of the plurality of light emitting elements 121, 122, 12N is of a same type, e.g., each has a same structure, shape, construction and/or are produced using a same manufacturing process. This increases an ease of manufacturing or assembling the luminaire 100.

[0046] Proposed embodiments are particularly advantageous when the flexible sheet 110 is formed of a wood-derived material, such as paper or cardboard. This reduces the environment impact and improves renewability and recyclability of the sheet 110 (and overall luminaire 100).

[0047] In some examples, the flexible sheet 110 comprises or is coated with a white and/or specular material for reflecting light. Suitable examples of such materials are well established in the art. This increases the reflectivity and/or uniformity of light output by the luminaire 100. As a specific example, it is relatively trivial to prepare a flexible sheet 110 of a wood-derived material, such as paper or cardboard, that is white in color.

[0048] Turning back to Figures 1 and 2, the luminaire 100 may also comprise a backplate 130. The (single) flexible sheet 110 may be secured to this backplate 130 for enhanced robustness and reduced likelihood of the cavities 111, 112, 11N changing shape or position. The backplate 130 may be formed of any suitable material for a luminaire, e.g. plastics, metal or even wood (e.g., for improved recyclability). However, it is preferable that the backplate 130 be formed from a thermally conductive material, such as metal, which is able to act as a heat sink to reduce a risk of overheating by the luminaire 100.

[0049] For the sake of clarity, other potential features of the luminaire 100 are not illustrated, as they do not relate to the underlying inventive concept. These potential features include: driving and/or powering circuitry, control circuitry, communication circuitry, mounting mechanism, sensing arrangements, other electronic/electrical interconnects, light/color filters and so on. The skilled person would be readily capable of including such elements in a luminaire 100.

[0050] The embodiment illustrated by Figure 1 provides a relatively simple or basic example in which each cavity 111, 112, 11N or trough is identical (or near-identical) in size and shape. In this way, the light output from each cavity 111, 112, 11N will have a similar beam shape and/or angle. For the overall luminaire 100, this provides a uniform output of light across an area or region illuminated by the luminaire 100.

[0051] However, in other embodiments the size and/or shape of the cavities will be different. Thus, it is possible for

different cavities to have different characteristics. Possible characteristics that may differ for different embodiments include: cavity width; cavity depth; and/or cavity pitch. This can be achieved by folding the single sheet 110 differently to create different types of cavity patterns.

[0052] Thus, the plurality of cavities may comprise cavities of at least two different cross-sectional shapes, e.g., at least five cross-sectional shapes.

[0053] In some examples, the cavity pitch (i.e., the distance between neighboring cavities) may change in different regions or subsets of the plurality of cavities. For instance, the plurality of cavities may comprise at least two sub-sets of two or more cavities, the cavities of different sub-sets having different (cavity) pitches, such that the distancing between cavities of one sub-set is different to the distancing between cavities in another subset. The cavities in a same sub-set neighbor at least one other cavity in that subset. The at least two sub-sets may comprise at least 5 sub-set for improved flexibility and control of use.

[0054] Figure 4 provides a cross-sectional view of an example luminaire 100. Figure 4 is useful for understanding specific characteristics (e.g., dimensions) of a cavity 111, 112 and/or of the plurality of cavities.

[0055] Figure 4 illustrates how a cavity 111, 112 is formed from (only) a base 111A, 112A on which the corresponding light emitting element 121, 122 is positioned, and two side walls 111B, 111C, 112B, 112C. Each side wall 111B, 111C, 112B, 112C is sloped or angled with respect to the base 111A, 112A so that they are able to together act as a reflector of light emitted by the light emitting element 121. Light generated by a light emitting element 121 positioned within the cavity 111 escapes via an aperture 111D.

[0056] As illustrated in Figure 4, the side wall 111C of a first cavity 111 meets the side wall 112B of a second cavity 112 at a vertex 40. This configuration may hold for all of the plurality of cavities. Thus, for each cavity, at least one side wall may meet the side wall of a neighboring cavity at a vertex 40. Put another way, there may be no additional material of the sheet 110 between the side walls of neighboring cavities.

[0057] Preferably, the bases 111A, 112A of all the cavities 111, 112 are positioned to lie in a same plane. However, this is not essential.

[0058] A width w of the cavity (or "cavity width") may be a width across the base 111A of the cavity 111, 112, i.e., a minimum distance between the two side walls 111B, 111C of the cavity 111, 112. In particular, a width w of the cavity may be the smallest distance across the base 111A of the cavity 111, i.e., the smallest distance between the two side walls 111B, 111C of the cavity.

[0059] A depth d of the cavity 111, 112 (or "cavity depth") may be a distance between a plane in which the base 111A, 112A of the cavity lies (i.e., a plane in which the width w is measured) and a parallel plane that intersects the most distant part of either side wall 111B, 111C of the cavity.

[0060] A pitch p or cavity pitch may be defined as a distance between two neighboring cavities 111, 112. In particular, the pitch p may be defined as the distance between the center point of two neighboring cavities.

[0061] An angle θ represents an angle between a side wall 112B and a base 112A of a cavity, as measured within the cavity itself.

[0062] Figure 4 also more clearly demonstrates the positional relationship between the (single) flexible sheet 110, the light emitting element(s) 121, 122 and the backplate 130.

[0063] Figures 5 and 6 illustrate a luminaire 200 according to another embodiment. Figure 5 provides a side view of the luminaire and Figure 6 provides a perspective view of the luminaire.

[0064] The luminaire 200 again comprises a plurality of cavities 211, 212, 21N, which are positioned in parallel to one another. Other components are similar/identical to previously described components.

[0065] The luminaire 200 differs from the previously described luminaire in that the size and shape of each cavity 211, 212, 21N is non-identical. Thus, the luminaire 100 comprises a (single) flexible sheet 110 that has been folded to form a plurality of non-identical cavities 211, 212, 21N.

[0066] In particular, the depth d of each cavity 211, 212, 21N is different. In the context of the present disclosure, the depth d of a cavity is the distance between a plane in which the base of the cavity lies (e.g., the plane in which the light emitting element for that cavity is positioned) and a parallel plane that intersects the most distant part of the sheet 110 that forms or defines the cavity.

[0067] The width w of each cavity 211, 212, 21N is held to be substantially constant. A width is measured at the base of each cavity.

[0068] In this way, a width-depth ratio R_{WD} , being a ratio between the width w and depth d , is different for each of the plurality of cavities. The width-depth ratio R_{WD} may be defined as follows:

$$R_{WD} = \frac{w}{d} \quad (1)$$

[0069] It will be clear that each cavity is associated with its own width-depth ratio, i.e., ratio of width to depth.

[0070] In the illustrated example, each cavity 211, 212, 21N is arranged to lie perpendicularly to a first direction x_1 . In particular, each cavity 211, 212, 21N is positioned to lie in parallel to each other cavity, and each cavity extends perpendicularly to a first direction x_1 .

[0071] The first direction x_1 is a direction from a first side 291 of the luminaire 200 to/towards a second side 292 of the luminaire 200. Thus, increasing distance along the first direction x_1 is equivalent to increasing distance from the first side 291 of the luminaire. A cavity 211, 212, 21N lies perpendicular to a first direction x_1 if the direction of the cavity 211, 212, 21N (e.g., the direction in which the elongate cavity stretches) is perpendicular to the first direction.

[0072] The cavities 211, 212, 21N of the present embodiment are configured such that, with increasing distance along the first direction x_1 , the width-depth ratio decreases. In particular, as the width is kept constant or near constant, the depth of the cavities increases with increasing distance along the first direction.

[0073] Thus, cavities that are located further from the first side 291 of the luminaire 200 have a lower width-depth ratio than cavities located closer to the first side 291. This is achieved by the cavities being configured such that the cavities that are located further from the first side 291 of the luminaire 100 have a greater depth (but same width) than cavities located closer to the first side 291.

[0074] It is noted that the pitch between each cavity remains substantially constant. Similarly, the angle between the side walls of each cavity and the base of the cavity remains substantially constant.

[0075] The configuration illustrated by Figure 5 results in a non-uniform distribution of light output by the overall luminaire 200. In particular, the respective beam angle of light output from/by each successive cavity 211, 212, 21N will decrease or become narrower with increasing distance along the first direction (i.e., with increasing distance from the first side 291). This creates a non-uniform beam distribution, in particular creating a gradient of light intensity.

[0076] This can be advantageous for illuminating some areas/regions that receive light from the luminaire to a greater extent than others. This approach can advantageously be used to highlight such regions (e.g., a location where a speaker/teacher is standing) or to take account of existing lighting into a room (e.g., through a window) to create uniform lighting within the room as a whole.

[0077] This configuration also allows for control over glare and beam density.

[0078] Figures 7 and 8 illustrate a luminaire 300 according to another embodiment. Figure 7 provides a side view of the luminaire and Figure 8 provides a perspective view of the luminaire.

[0079] The luminaire 300 again comprises a plurality of cavities 311, 312, 31N, which are positioned in parallel to one another. Other components are similar/identical to previously described components.

[0080] The luminaire 300 differs from the previously described luminaire in that the plurality of cavities are configured such that, with increasing distance along a second direction x_2 (e.g., increasing distance from a first side 391), the width-depth ratio of the cavities initially increases before subsequently decreasing (e.g., when approaching a second side 392). This is achieved with appropriate folding of the single flexible sheet 110.

[0081] In particular, the plurality of cavities may be arranged to have mirror symmetry. Thus, as illustrated in Figures 7 and 8, one half of the plurality of cavities is a mirror reflection of the other half of the plurality of cavities.

[0082] Put another way, the plurality of cavities are arranged to lie perpendicularly to a second direction x_2 . The second direction is similar/identical to the first direction previously described, e.g., and goes from the first side 391 to/towards the second side 392). With increasing distance along the second direction x_2 until a reference point 350, of the plurality of cavities, is reached, the width-depth ratio of each elongate cavity increases. With increasing distance from the reference point along the second direction (e.g., towards the second side 392), the width-depth ratio of each elongate cavity decreases.

[0083] In this way, cavities that are located further from the reference point 350 of the luminaire 200 have a lower width-depth ratio than cavities located closer to the reference point 350. The reference point may lie midway between the first side 391 and the second side 392 of the luminaire 300. However, this is not essential and variations may position the reference point at other positions between the first and second sides of the luminaire.

[0084] Similarly, the closer that a cavity is to either the first side 391 or the second side 392, the greater the width-depth ratio of that cavity.

[0085] This configuration for the sheet 110 also results in a non-uniform distribution of light output by the overall luminaire. In particular, the respective beam angle of light output from/by each successive cavity will decrease or become narrower with increasing distance from the reference point 350. This creates a non-uniform beam distribution. The illustrated configuration can be advantageous for controlling glare and beam density.

[0086] In particular, the illustrated configuration is particularly advantageous for reducing perceived glare of the luminaire. By positioning cavities of a greater depth at the sides of the luminaire, the amount of light emitted out of the luminaire at relatively high angles (with respect to an optical axis) is reduced, thereby reducing perceived glare.

[0087] Figures 9 and 10 illustrate a luminaire 400 according to yet another embodiment. Figure 9 provides a side view of the luminaire and Figure 10 provides a perspective view of the luminaire.

[0088] The luminaire 400 again comprises a (single) flexible sheet 110 that has been folded to form a plurality of non-identical cavities 411, 412, 41N. A light emitting element 121, 122, 12N is positioned in each cavity 411, 412, 41N.

[0089] Each cavity 411, 412, 41N is configured to have a same depth and width. However, the angle between each side wall (of the cavity) and the base (of the cavity) is different for each cavity. This also causes the beam angle of light output by each cavity to have a different shape.

[0090] In the illustrated example, differently angled side walls are achieved by changing a pitch between cavities 411, 412, 41N for increased distance along a third direction x_3 . The third direction x_3 is similar/identical to the first/second direction previously described, and goes from a first side 491 of the luminaire 400 to/towards a second side 492. A pitch p is a distance between two cavities. A pitch may be defined as the distance between the center of the base of two cavities.

[0091] In the illustrated example, the angle between the side wall(s) and the base of each cavity decreases in the range of 180° to 90° (as measured within the cavity itself) with increasing distance along the third direction. Thus, the closer a cavity is to the second side 492, the smaller the angle between the side wall(s) and the base of the cavity (as measured within the cavity itself).

[0092] This configuration for the sheet 110 also results in a non-uniform distribution of light output by the overall luminaire. In particular, the respective beam angle of light output from/by each successive cavity will become decrease narrower with increasing distance from the first side 491. This creates a non-uniform beam distribution. The illustrated configuration can be advantageous for controlling glare and beam density.

[0093] Figure 11 illustrates a luminaire 500 according to yet another embodiment, and provides a top-down view of the luminaire 500.

[0094] Rather than the cavities 511, 512, 51N being arranged as parallel elongate cavities, the cavities are instead arranged in a fan-formation. Conceptually, each cavity 511, 512, 51N is positioned to align with a respective hypothetical line 501, 502, 50N, wherein all the hypothetical lines intersect at a same intersection point 550.

[0095] In this way, the single flexible sheet 100 is folded analogously to a fan.

[0096] This technique facilitates manipulation of the single flexible sheet into nonlinear shapes, allowing for increased flexibility and selection of light distribution.

[0097] In particular, in this example, the width of each the cavity varies along a direction in which the respective cavity extends. It will be appreciated that, in some examples, the depth of a cavity varies along a direction in which the respective cavity extends.

[0098] The above described example configurations for the single flexible sheet are non-exhaustive, and serve to demonstrate how various folding configurations of the single flexible sheet can be used in order to achieve different distributions of light output by the overall luminaire.

[0099] Figure 12 is a flowchart illustrating a method 1200 for manufacturing or assembling a luminaire.

[0100] The method 1200 comprises a step 1210 of folding a single flexible sheet of reflective material to form a plurality of cavities. The method also comprises a step 1220 of positioning a light emitting element (e.g., a different light emitting element) in each of the plurality of elongate cavities, such that each elongate cavity forms a reflector for a respective light emitting element.

[0101] Various folding configurations have been previously illustrated and described, and could be employed in the method 1200. The skilled person would be readily capable of modifying the method 1200 to produce any herein described product.

[0102] The proposed method provides highly customizable configurations for the reflector of the luminaire, thereby providing high customization over the light distribution and/or output by the luminaire.

[0103] Variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality.

[0104] The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

[0105] If the term "adapted to" is used in the claims or description, it is noted the term "adapted to" is intended to be equivalent to the term "configured to". If the term "arrangement" is used in the claims or description, it is noted the term "arrangement" is intended to be equivalent to the term "system", and vice versa.

[0106] Any reference signs in the claims should not be construed as limiting the scope.

Claims

1. A luminaire (100, 200, 300, 400, 500) comprising:

a single flexible sheet (110) of reflective material, the flexible sheet being folded to form a plurality of cavities (111, 112, 11N, 211, 212, 21N, 311, 312, 31N, 411, 412, 41N, 511, 512, 51N); and
a plurality of light emitting elements (121, 122, 12N), each light emitting element being positioned in a different cavity such that each cavity forms a reflector for a respective light emitting element.

2. The luminaire (200, 300, 400, 500) of claim 1, wherein the plurality of cavities comprises at least two cavities having different cross-sectional shapes.

3. The luminaire (200, 300, 400, 500) of claim 2, wherein the plurality of cavities comprises at least five cavities having different cross-sectional shapes.

4. The luminaire (200, 300, 400, 500) of any of claims 1 to 3, wherein:

each cavity has a width (w) and a depth (d);
the width of each respective cavity is measured at a base of the respective cavity; and
at least one of the following:

- the plurality of cavities comprises cavities (211, 212, 21N, 311, 312, 31N, 411, 412, 41N) of at least two different depths and/or widths; and/or
- for each cavity (511, 512), the width and/or depth of the cavity varies along a direction in which the respective cavity extends.

5. The luminaire of claim 4, wherein for each cavity (511, 512), the width and/or depth of the cavity varies along a direction in which the respective cavity extends.

6. The luminaire (200, 300, 400, 500) of claim 4 or 5, wherein:

each cavity has an associated width-depth ratio, being a ratio between the width (w) and the depth (d) of the cavity; and
the plurality of cavities comprises cavities of at least two different width-depth ratios.

7. The luminaire (200) of claim 6, wherein:

the plurality of cavities are arranged to lie perpendicularly to a first direction (x_1); and
with increasing distance along the first direction, the width-depth ratio decreases.

8. The luminaire (300) of claim 6, wherein:

the plurality of cavities (311, 312, 31N) are arranged to lie perpendicularly to a second direction (x_2); and
with increasing distance along the second direction until a reference point (350), of the plurality of cavities, is reached, the width-depth ratio of each cavity increases; and
with increasing distance from the reference point (350) along the second direction, the width-depth ratio of each cavity decreases.

9. The luminaire (100) of claim 1, wherein the plurality of cavities comprises only cavities of a substantially same size and shape.

10. The luminaire (100, 200, 300, 400, 500) of any of claims 1 to 9, wherein each cavity in the plurality of cavities is an elongate cavity.

11. The luminaire (100, 200, 300, 400, 500) of any of claims 1 to 10, wherein each of the plurality of light emitting elements is of a same type.

12. The luminaire (100, 200, 300, 400, 500) of any of claims 1 to 11, wherein each of the light emitting elements (121, 122, 12N) comprises an elongate light emitting element positioned in a respective cavity.

13. The luminaire (100, 200, 300, 400, 500) of claim 12, wherein each of the light emitting elements is either:

at least one discrete LED chip mounted on a single carrier; or
a continuous light emitting band.

14. The luminaire (100, 200, 300, 400, 500) of any of claims 1 to 13, wherein the flexible sheet (110) comprises or is coated with a white and/or specular material for reflecting light.

EP 4 464 935 A1

15. The luminaire (100, 200, 300, 400, 500) of any of claims 1 to 14, wherein the flexible sheet (110) is formed of a wood-derived material, such as paper or cardboard.

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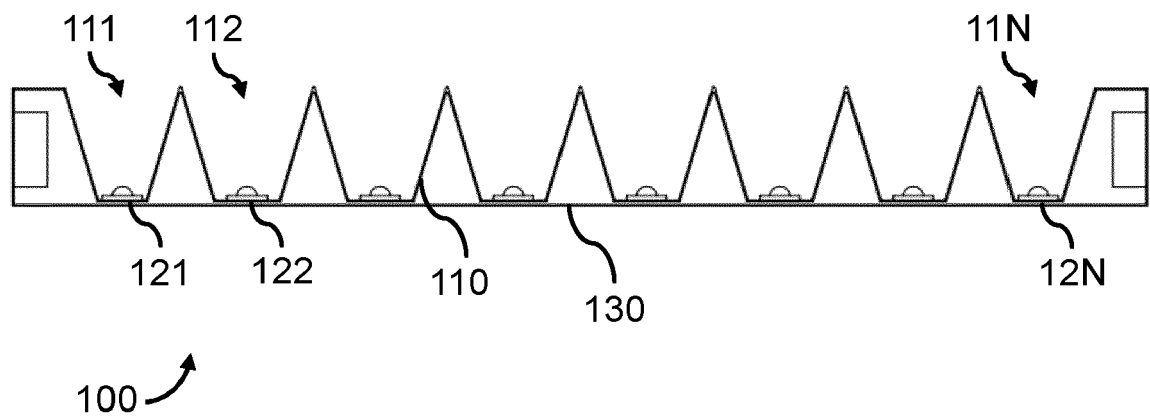


FIG. 1

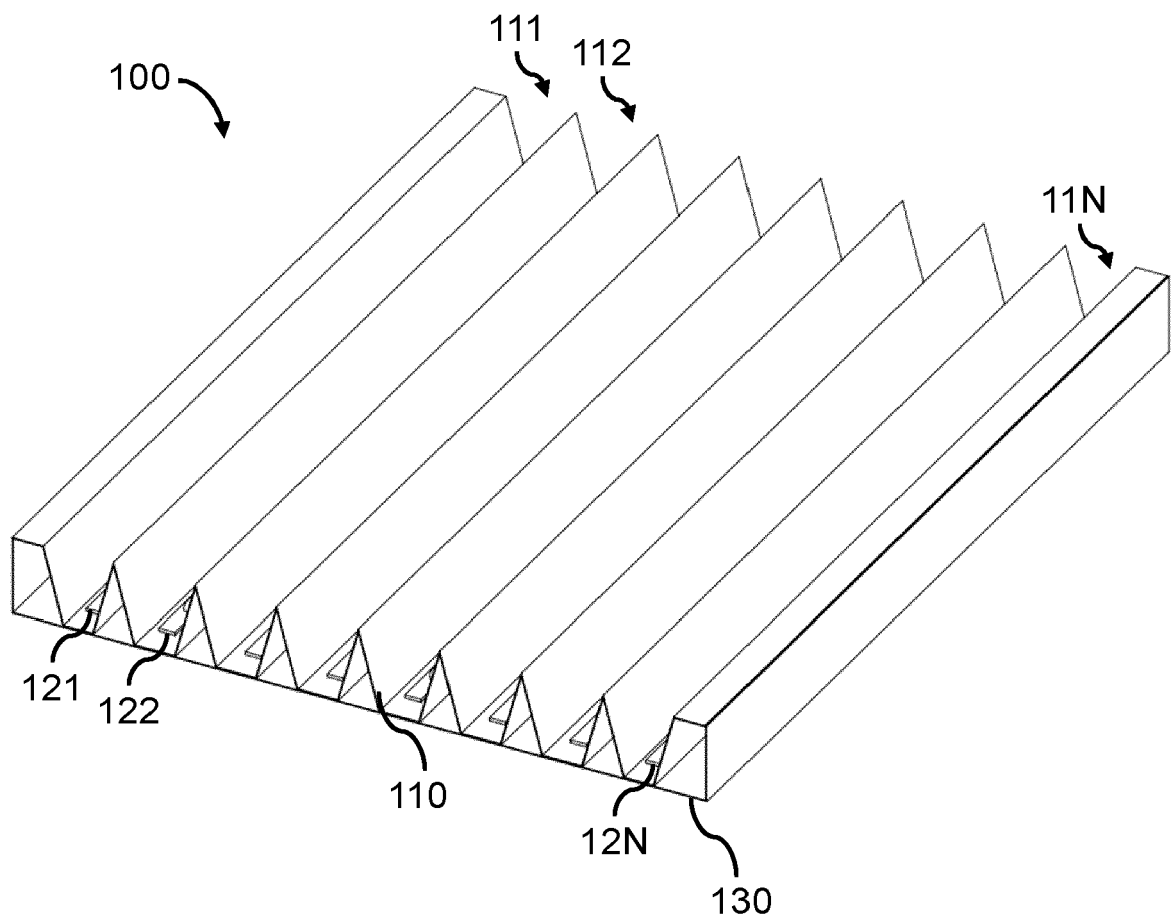


FIG. 2

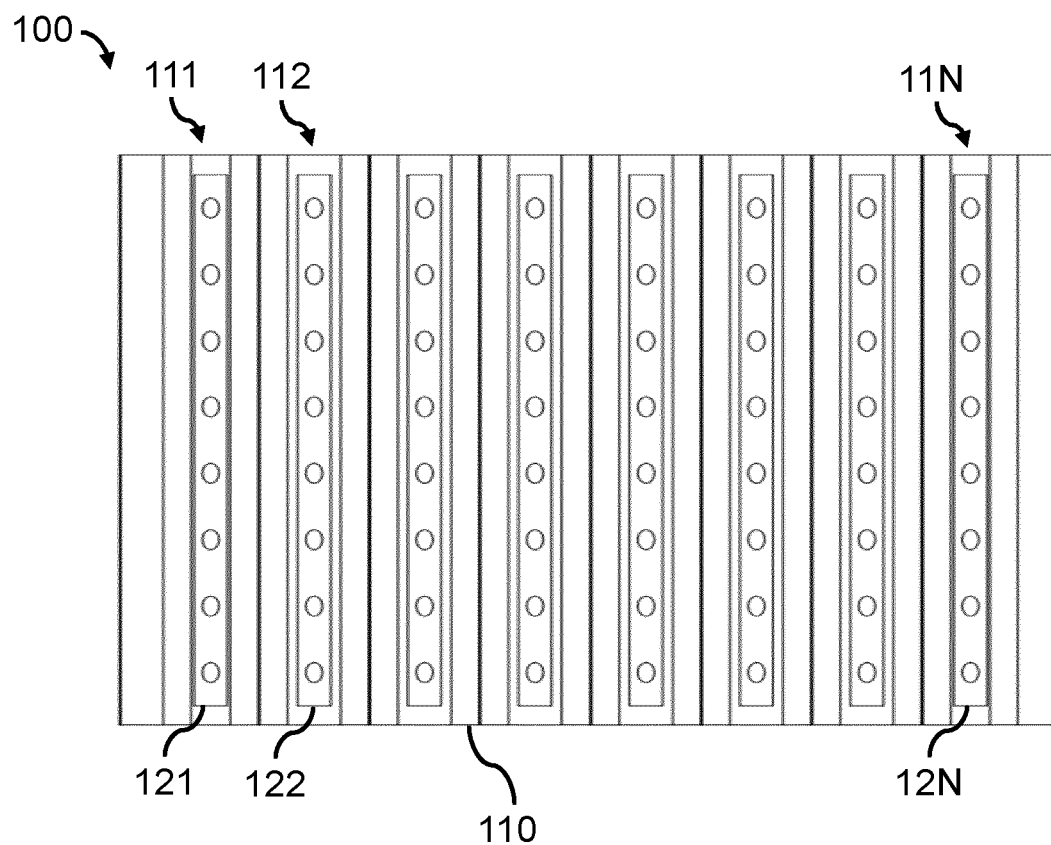


FIG. 3

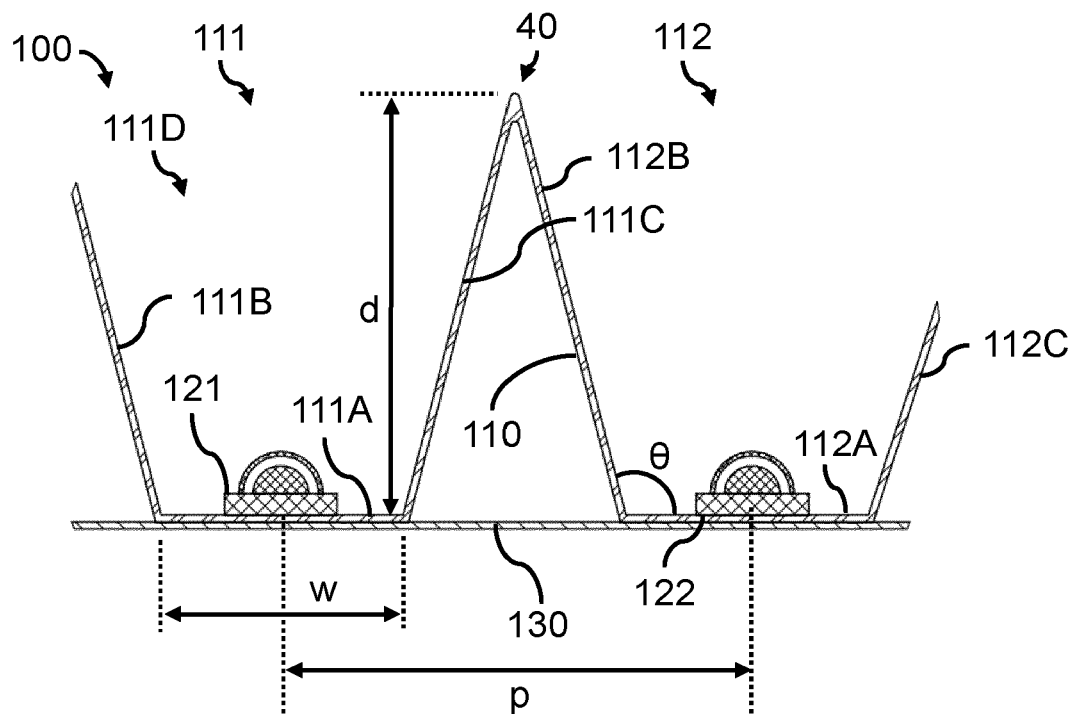


FIG. 4

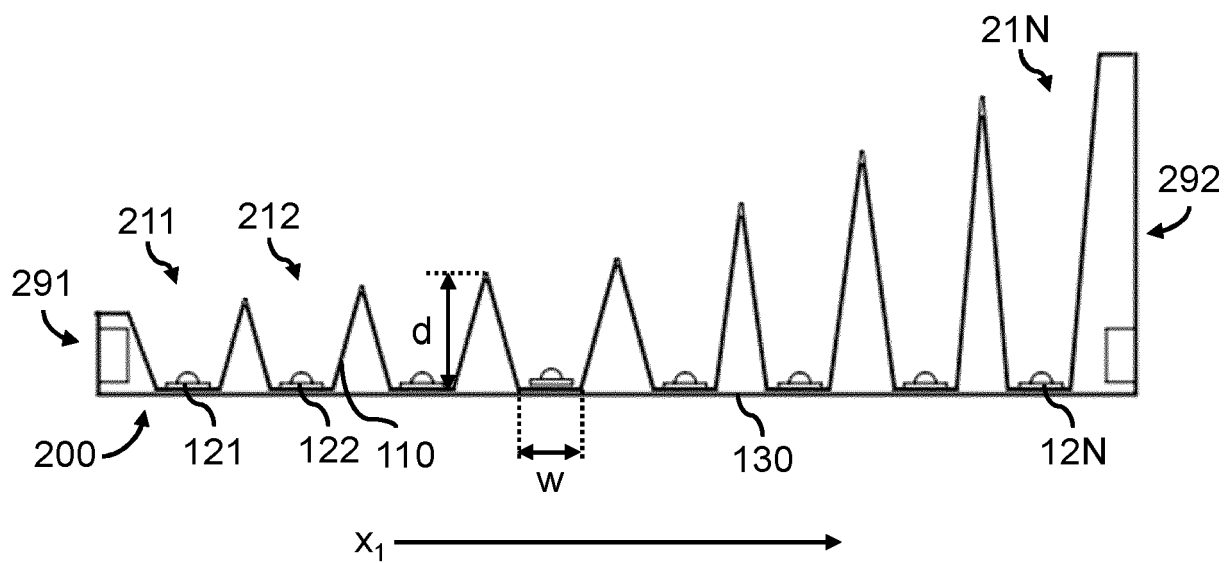


FIG. 5

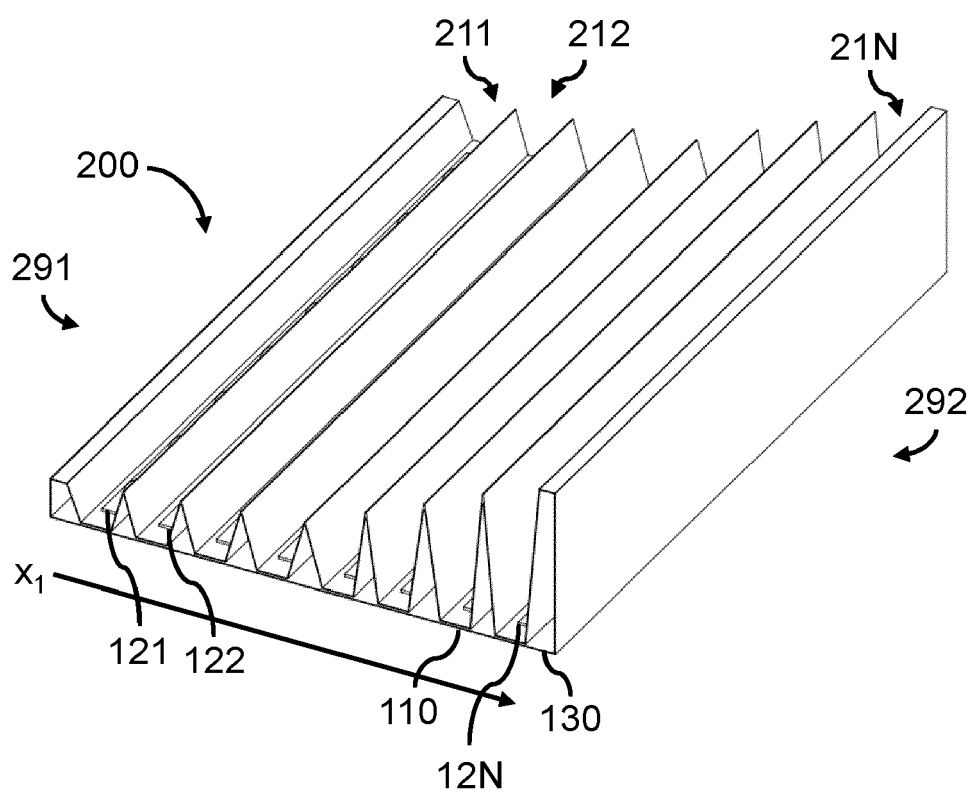


FIG. 6

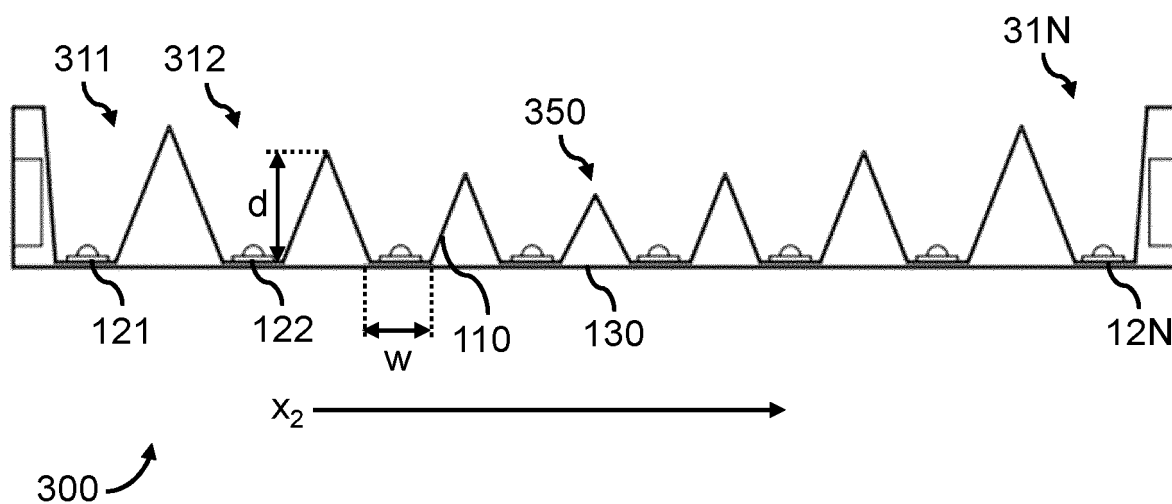


FIG. 7

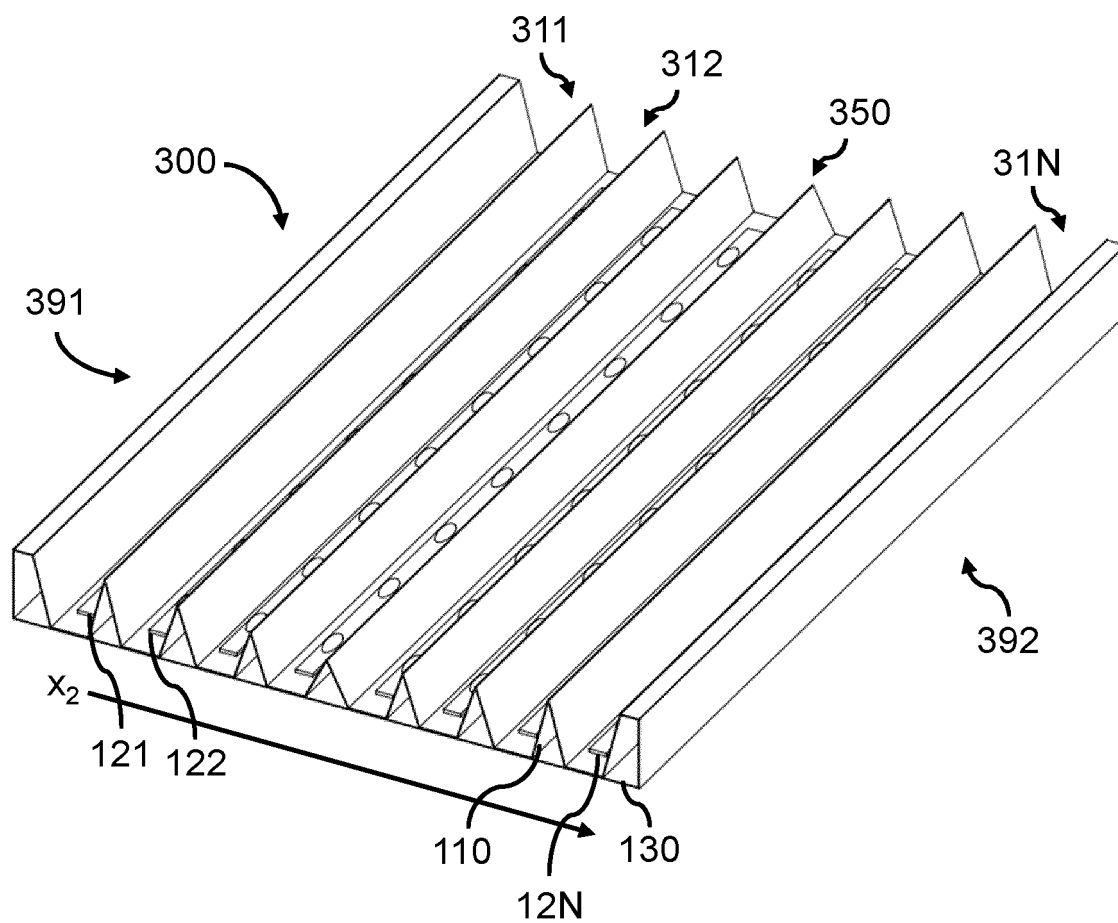


FIG. 8

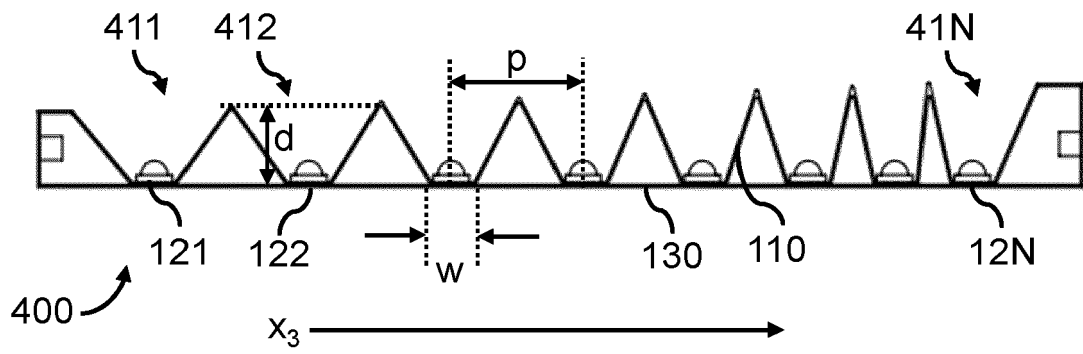


FIG. 9

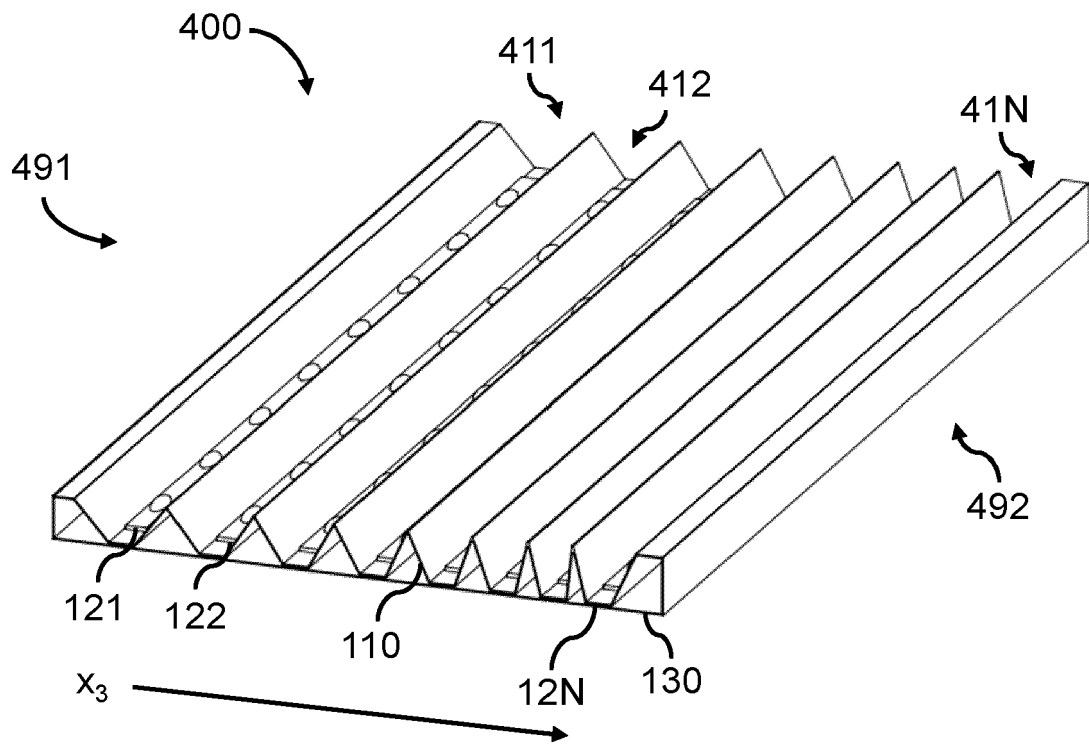


FIG. 10

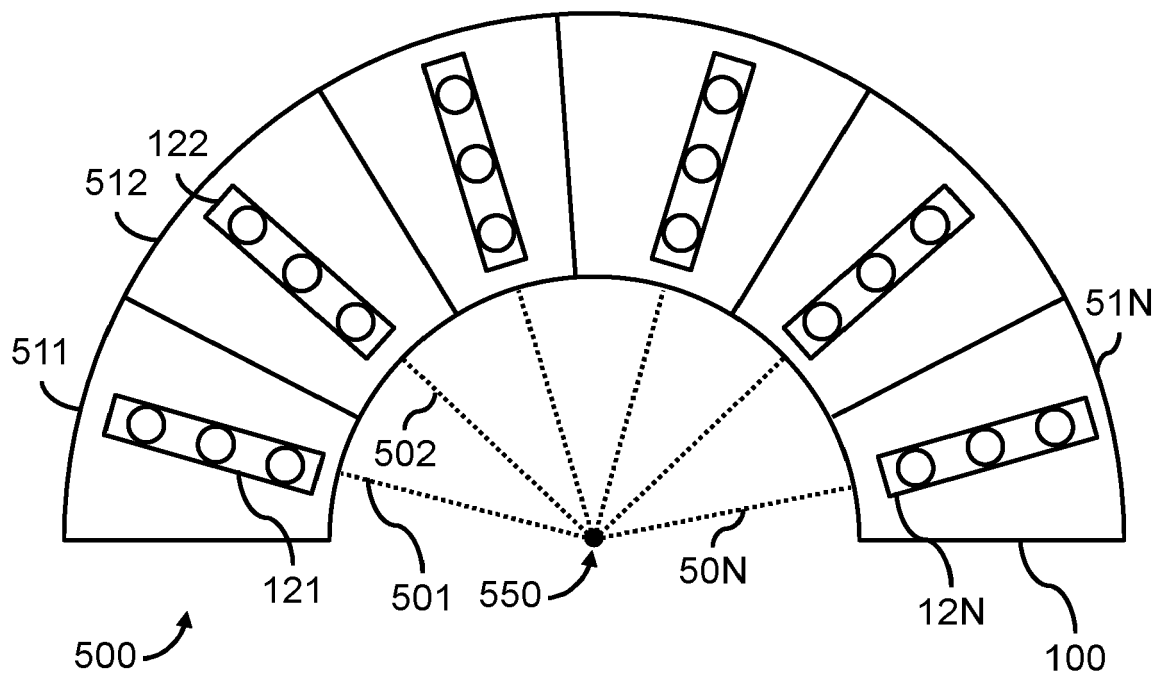


FIG. 11

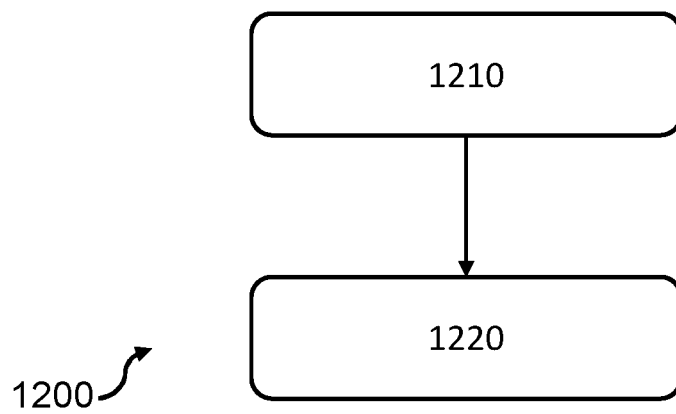


FIG. 12



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Application Number

EP 23 17 3945

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			F21V F21Y
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 October 2023	Examiner Krikorian, Olivier
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EP 23 17 3945

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