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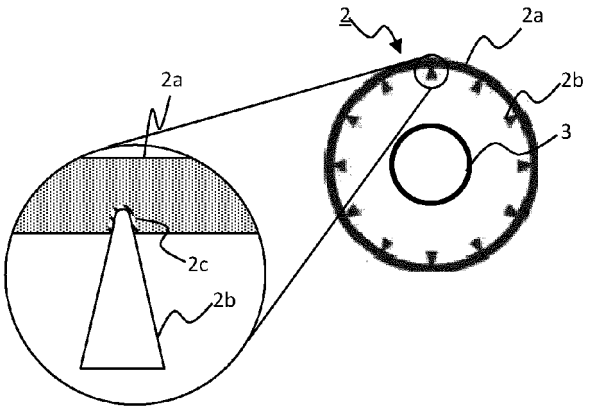
(71) Applicant: **Trislot N.V.**
8790 Waregem (BE)

(72) Inventors:
- **Vancoillie, Jonathan**
  8790 Waregem (BE)
- **Struyve, Yves**
  8790 Waregem (BE)

(74) Representative: **BiiP cvba**
Culliganlaan 1B
1831 Diegem (Bruxelles) (BE)

(54) **Structural lamp fixture**

(57) The present invention concerns an elongated light unit extending at least on a first linear direction (X) and comprising:
(c) A light source (3) capable of emitting light over at least a portion of the length of the unit along the first linear direction (X), and
(d) A pervious to light protective metal screen (2) extending substantially parallel to said first linear direction (X) over the whole length of the unit, and positioned between the light source and the space to be lighted,
Characterized in that, said pervious to light protective metal screen is made of metal surface profiles (2a) fixed to metal support profiles (2b) such that the surface profiles are aligned side by side at a distance from each other not exceeding 2.5 mm.



(a)

FIGURE 1

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Description

Technical Field

[0001] The present invention relates to a multifunctional light unit combining lighting function with structural, mechanical function. The light unit of the present invention can be integrated in a mechanical structure in a working sites, in urban environments, and the like.

Background for the invention

[0002] Nowadays, comfort and security impose the illumination of spaces or structures as soon as darkness falls. This is the case at home, of course, but also in more aggressive environments such as working sites, warehouses, city streets, ships, and the like. A light unit can be used to illuminate a whole space, and can then be positioned quite high, out of reach of potential accidental or sometimes voluntary impacts with projectiles, such as street lights and ceiling lights in warehouses. But sometimes, a specific structure must be illuminated, such as staircases, tunnels, pedestrian under-passages, emergency exits, barriers, protective structures, fixtures in sports and play grounds, and the like, and the light sources must be positioned much closer to the ground and are thus exposed to impacts from gravel projected by passing vehicles, from manoeuvring vehicles, or even from vandalism, the latter having expensive consequences in urban environments. In such conditions, the light source must be protected or shielded from such impacts. The problem is that transparent protective materials such as polymers or glass are also damaged by such impacts and impact resistant materials are usually opaque and are therefore not suitable. Furthermore, it would be advantageous that the light unit may be integrated into a structure as a part thereof, and not as a mere external addition, fixed to a complete structure.

[0003] Light units included in a tubular structure have been proposed in the art. For example, EP0098504 and EP1498656 propose a tubular metal structure comprising a longitudinal slot in which is introduced a row of diodes enclosed in a transparent housing. Similar tubular structures with a light source located in a slot extending along the length of a metal tube can be found e.g., in:

> http://www.lamiwood.nl/trapleuning-stalen-buis-3000x35mm-kersen-lichtgevende-strip_pid1114.html
> http://www.rvsgrepen.nl/index.php?main_page=index&cPath=70_266 http://www.lumenrail.com/pages/Lumenrail.htm

[0004] These systems are interesting because they can be assembled to one another to form a modular structure integrated, e.g., in a banister to combine both structural and lighting functions. Unfortunately, these solutions allow to illuminate in one direction only; and the larger is the slot width, the more exposed are the light sources to external impacts. Furthermore, these solutions seem to be restricted to the use of diodes (LED's) and other types of light sources, such as fluorescent tubes, seem difficult to be implemented. Finally, such light units offer little protection to the light source to acts of vandalism, since the light sources are exposed and can be damaged (alas!) with a screw driver or gimlet.

[0005] The present invention proposes a new light unit, which combines the advantages of the light systems discussed supra, but further allows an illumination in all directions, it can be used with any type of light source, and is more resistant to acts of vandalism.

Summary of the invention

[0006] The present invention is defined in the appended independent claims. Preferred embodiments are defined in the dependent claims. In particular, the present invention concerns an elongated light unit extending at least on a first linear direction and comprising:

> (a) A light source capable of emitting light over at least a portion of the length of the unit along the first linear direction), and
> (b) A pervious to light protective metal screen extending substantially parallel to said first linear direction (X) over the whole length of the unit, and positioned between the light source and the space to be lighted,

Characterized in that, said pervious to light protective metal screen is made of metal surface profiles fixed to metal support profiles such that the surface profiles are aligned side by side at a distance from each other not exceeding 2.5 mm. The light emitted by the source located behind the protective screen can propagate through the numerous slits separating two adjacent surface profiles. By varying the thickness of the profiles, in particular the surface profiles, and the distance between two adjacent surface profiles, the mechanical properties and lighting power (in lumen) for a given light source can be varied at will.

[0007] A light unit according to the present invention preferably comprises coupling means for being coupled side by side to other light units of the same type, so that a modular mechanical and illuminated structure can thus be formed. The coupling means should comprise anchoring means of course, but also electric connecting means, so that external wiring of the structure is not required.

[0008] In a preferred embodiment, the pervious to light protective metal screen is in the shape of a tubular sheath surrounding the light source. Such tubular protective screen can be formed of a surface profile wound around a number of support profiles. Alternatively, a support profile may be wound around closely packed surface profiles. The surface profiles may be aligned substantially parallel to the first linear direction (X), but they may also

be wound side-by-side about said linear direction (X). Any of the foregoing tubular construction are suitable for providing the light unit with sufficient mechanical properties to be used as integral parts of indoor and outdoor structural applications. These include for example, banisters, staircases, gates, doors or window frames, scaffoldings, protective structures in urban environments, and the like.

[0009] In an embodiment alternative to tubular units, the protective metal screen does not surround completely the light source. It can shield it only over a limited angular range, over which it is supposed to illuminate and be protected. The protective screen may be curved or planar depending on the applications. Here again, a modular construction is advantageous, allowing large areas to be back-illuminated, whilst still offering an effective protection to the light source(s).

[0010] Regardless of the overall geometry of the protective screen (tubular or planar), the metal surface profiles may extend substantially normal to said first linear direction (X) and said metal support profiles may extend substantially parallel thereto. Inversely, the metal surface profiles may extend substantially parallel to said first linear direction (X) and th metal support profiles may extend substantially normal thereto. The two solutions are possible and their implementation depend on the requirements of the light unit. Alternatively, neither surface, nor support profiles are parallel to the first direction, such as for example a tube of wound surface and support profiles discussed above.

[0011] The properties of such light unit, both mechanical and lighting properties depend on a number of parameters, which allow great freedom for modulating them to create a wide variety of units with different properties.

- First, the distance or gap between two adjacent surface profiles is of course importance for the lighting efficacy. A broad gap between two adjacent surface profiles afford for more light passing through the screen. On the other hand, a more open structure generally reduces mechanical properties of the screen and exposes more the light source to impacting missiles or acts of vandalism. The gap should preferably not exceed 1.5 mm. It can preferably be not more than 1.0 mm, more preferably not more than 0.7 mm, most preferably not more than 0.4 mm.
- Second, the cross-sectional shape of the surface and support profiles influences both mechanical and light perviousness of the screen. In particular, the surface profiles may have a cross-sectional shape selected from triangular, square, trapezoidal, round, elliptic, star-shaped, H-, I-, V-, L-, or T-shaped.
- Third the dimension of the profiles is important for both mechanical and light transmission properties. In this context, the largest linear dimension of the cross section of the surface profiles is preferably lower than 20.0 mm, preferably lower than 5.0 mm, more preferably lower than 3.5 mm, most preferably lower than 2 mm and even lower than 1.0 mm. The greatest linear dimension of the orthogonal projection of a surface profile onto the light source is preferably not more than 20.0 mm, preferably not more than 10.0 mm for large structures, and for smaller structures, it is preferred that it is not more than 4 mm, preferably not more than 3 mm, more preferably not more than 1.5 mm, most preferably not more than 0.7 mm.

[0012] In a preferred embodiment, the surface profiles are welded to the support profiles. This solution gives the structure high mechanical strength and stiffness, and is quite cost effective, as a welding process can be fully automated with very high accuracy. A light unit according to the present invention may extend along a first linear direction (X) which can be rectilinear, or which can be curvilinear. Similarly, the other two dimensions of the screen can be rectilinear or curvilinear. This design freedom combined with the high mechanical properties that the present light unit can reach render it particularly suitable for use in a number of indoor or outdoor applications, such as for example, elements integrated in a barrier, a banister, a gate, a door, a window frame, a scaffolding, a bulkhead, a traffic signal, urban furniture, a pole, or a staircase.

Brief description of the Figures

[0013] For a fuller understanding of the nature of the present invention, reference is made to the following detailed description taken in conjunction with the accompanying drawings in which:

Figure 1: shows (a) a cross sectional view of a tubular light unit according to the present invention and (b) a cut-off perspective view of a corresponding light pervious metal protective screen.

Figure 2: shows two alternative constructions of a tubular protective screen suitable for the present invention.

Figure 3: shows perspective views of two alternative planar protective screens.

Detailed description of the invention

[0014] The present invention concerns a light unit comprising a light source shielded by a specific protective screen which is pervious to light and yields excellent mechanical properties, which make such unit suitable as a structural element in applications exposed to severe aggressive environments. Figure 1 illustrates a tubular embodiment of a light unit according to the present invention. In this embodiment, a light source (3) is provided, extending along a first linear direction (X) (in Figure 1(a) said direction (X) is normal to the Figure, and in Figure 1 (b) it is vertical) which can be any light source known in the art, such as a series of light emitting diode (LED)

or incandescent bulbs, a fluorescent tube, and the like. A tubular metal protective screen (2) surrounds the light source and is composed of a surface profile (2a) wound around and fixed to a series of support profiles (2b). In a preferred embodiment, the surface profile(s) are welded to the support profile(s) as this is a most efficient fixing technique, which is quick, accurate, can be fully automated, and yields a strong structure. As can be seen in Figure 1(b), which represents a cut-away perspective view of a protective screen of the type depicted in Figure 1(b), the metal protective screen (2) seems to form an opaque tubular structure. In reality, each successive layer of surface profile does not contact and is spaced apart from the next by a given distance. The light emitted by a source of light (3) located inside the tubular protective screen (2) can propagate through the thin, but numerous gaps separating adjacent surface profiles. Light transmission through the protective screen is enhanced with broader gaps between adjacent surface profiles and with thinner surface profile but, depending on the application, it could be detrimental to the mechanical properties, in particular stiffness, of the structure. To ensure sufficient mechanical properties the gap between adjacent surface profiles should not exceed 2.5 mm. It is preferred that the gap does not exceed 2.0 mm. The gap can be not more than 1.5 mm, preferably not more than 1.0 mm, more preferably not more than 0.7 mm, most preferably not more than 0.4 mm. With gaps between adjacent surface profiles less than 0.2 mm, the light transmission through the screen may be insufficient for many applications.

[0015] As can be seen in Figure 1(a) and (b) the surface profiles (2a) and support profiles (2b) may have different cross-sectional geometries. Figure 1(a) shows support profiles (2b) having a triangular cross-section, whilst the support profiles (2b) illustrated in Figure 1(b) have a square cross-section with a sharp triangular protrusion jutting out of the side of the support profile contacting and fixed to the surface profiles. Such sharp ridge contacting the surface profiles enhances the strength of the welding point (2c) between support profile and surface profile. If other fixing techniques than welding are used to fix the surface profiles to the support profiles, such as glue, then such sharp tip is not desired. The surface profiles may have a broad variety of cross sections, the choice of one over the other depending on the desired mechanical and light transmission properties required by the lamp unit. For example, the surface profiles may have a cross-sectional shape selected from triangular as represented in Figure 1(b), but also square, trapezoidal, round, elliptic, star-shaped, H-, I-, V-, L-, or T-shaped. The cross-sectional geometry of the surface profile will influence the mechanical properties of the tube, but also the way the light will propagate through the gaps between two adjacent surface profiles. A triangular cross-sectional geometry, in particular an isosceles triangular geometry, with one summit pointing towards the light source, and the side opposite thereto facing outside the tube is particularly preferred, as this geometry gives the tubular structure a high bending stiffness and focuses the light rays through the thin gaps between two adjacent surface profiles.

[0016] The surface profiles are preferably in the form of relatively thin wires. For large structures, the largest linear dimension of the cross section of the surface profiles can be up to 30.0 mm, preferably up to 20.0 mm. For smaller structures, it can be lower than 10.0 mm, preferably lower than 5.0 mm, more preferably lower than 3.5 mm, most preferably lower than 2 mm and even lower than 1.0 mm. The largest linear dimension of the cross-section is not necessarily the one exposed to the exterior and obstructing light transmission as can be seen for example in Figure 1(b) wherein the largest linear dimension of the isosceles triangular cross-section defines the thickness of the protective screen. The greatest linear dimension of the orthogonal projection of a surface profile onto the light source is preferably not more than 20.0 mm, preferably not more than 10.0 mm for large structures, and for smaller structures, it is preferred that it is not more than 4 mm, preferably not more than 3 mm, more preferably not more than 1.5 mm, most preferably not more than 0.7 mm. With thinner surface profiles, more gaps per unit length of the light unit are provided, allowing transmission of the light therethrough. This is; however; detrimental to the mechanical properties of the protective screen.

[0017] A tubular protective screen suitable for a light unit according to the present invention can be obtained in different ways. A first construction, illustrated in Figure 1 and discussed above, comprises a number of support profiles (2b) extending substantially parallel to a first linear direction (X) around which a surface profile (2a) is densely wound to extend substantially normal to said first linear direction (X). In an alternative embodiment illustrated in Figure 2(a) a tubular screen can be obtained by aligning closely packed surface profiles (2a) surrounding substantially parallel thereto a first linear direction (X), and winding around said surface profiles (2a) a support profile with wide winding steps. Alternatively to winding a support profile (2b), several loop shaped support profiles (2b) can define the cross-sectional geometry of the tubular screen structure and fix the surface profiles in position, in the manner of a wine barrel. In yet an alternative embodiment, both surface and support profiles (2a, 2b) are wound about a first linear direction (X), the former with a tight winding step, leaving a gap between adjacent surface profiles of not more than 2.5 mm, the latter with a broader winding step. There is therefore no strict limitation regarding the orientation of the surface and support profiles with respect to the first linear direction (X). The surface profiles may thus extend substantially normal to said first linear direction (X) and said metal support profiles extend substantially parallel thereto or, alternatively, the surface profiles may extend substantially parallel to said first linear direction (X) and said metal support profiles extend substantially normal thereto. Fi-

nally, neither the surface nor the support profiles need be normal or parallel to the first linear direction (X), such as in the co-wound structure discussed above. The best configuration depends on the required properties of the light unit, as well as on a number of parameters, such as desired gap width, profile dimensions, size of the light unit, complexity of the geometry and required light transmission and mechanical properties of the light unit.

[0018] In Figures 1&2, only straight, cylindrical geometries are represented, but it is clear, that the first linear direction (X) can be curvilinear, defining a winding tubular structure. The cross-sectional geometry of the tubular geometry is not necessarily a circle, but can be any closed loop, with or without angles. Finally, the cross-sectional geometry of the tubular screen needs not be constant along the linear direction (X), and can vary in both shape and size.

[0019] In a preferred embodiment, a light unit according to the present invention can be coupled side-by-side —in the case of a tubular structure it should be said end-to-end, the latter expression being herein considered as comprised within the meaning of the former— so that a modular superstructure can be built by coupling such units together. In this embodiment, the light unit should be provided with anchoring means suitable for mechanically coupling two such units side-by-side. It should also be provided with connecting means, such that no external wiring is required to power the whole superstructure.

[0020] The discussion above was centred on tubular protective screens. Though offering many advantages, it is clear, however, that the present invention is not restricted to such tubular screens. Indeed, in an alternative embodiment, the protective metal screen (2) does not surround completely the light source (3). A protective screen according to the present invention can be planar, as illustrated in Figure 3. It can define any three dimensional surface as desired and as permitted by the type of surface profile (2a) and support profile (2b) selected. All the various aspects of a light unit of the present invention presented above with respect to tubular structures apply to non-tubular structures alike. Indeed, a three dimensional surface structure could be obtained from a tubular structure as discussed above. For example, the graphical cut of the perspective view illustrated in Figure 1(b) could be done to a real protective screen to obtain an open tube which defines a non-tubular structure. The tube could also be flattened to give it a different geometry.

[0021] The particular construction of the protective screen of a light unit according to the present invention gives it very high mechanical properties, with high stiffness and strength values allowing it to be incorporated as a structural element of a mechanical structure. For example, tubular light units can form the top rail or vertical supports of a banister and a barrier, it can be integrated into gates, doors, or window frames, or used in scaffoldings and staircases. When the light is off, such profile is difficult to distinguish from any other metal tube. But when the light is put on, the whole structure becomes illuminated, enhancing visibility, and thus safety.

[0022] Light units according to the present invention can find many applications in urban environments, where lights most needed for traffic and people safety and yet are most exposed to vandalism and to impacts by stones projected by vehicles or by the vehicles themselves doing wrong manoeuvres. For example, any obstacle to a vehicle is advantageously illuminate to prevent a driver from not seeing it. For example, a curb, a tree, a pole, a wall corner, a sharp curve, a chicane or other speed control means, a pedestrian passage, underground passages and tunnels, school exits, traffic signalling panels, urban furniture, and the like can advantageously be lit by light units according to the present invention, which provide illumination and high resistance to impact and, in particular, to vandalism acts.

Claims

1. An elongated light unit extending at least on a first linear direction (X) and comprising:

   (a) A light source (3) capable of emitting light over at least a portion of the length of the unit along the first linear direction (X), and
   (b) A pervious to light protective metal screen (2) extending substantially parallel to said first linear direction (X) over the whole length of the unit, and positioned between the light source and the space to be lighted,
   Characterized in that, said pervious to light protective metal screen is made of metal surface profiles (2a) fixed to metal support profiles (2b) such that the surface profiles are aligned side by side at a distance from each other not exceeding 2.5 mm.

2. Light unit according to claim 1, comprising coupling means for being coupled side by side to other light units of the same type, said means comprising both anchoring means and electric connecting means.

3. Light unit according to claim 1 or 2, wherein said pervious to light protective metal screen (2) is in the shape of a tubular sheath surrounding the light source (3).

4. Light unit according to the preceding claim, wherein the tubular protective screen is formed of a surface profile (2a) wound around a number of support profiles (2b) or, alternatively, of a support profile (2b) wound around closely packed surface profiles (2a), preferably aligned substantially parallel to the first linear direction (X).

5. Light unit according to claim 3 or 4, wherein the tu-

bular protective metal screen provides the light unit with sufficient mechanical properties to be used in structural indoor and outdoor applications such as banisters, gates, doors, or window frames, scaffoldings.

6. Light unit according to claim 1 or 2, wherein said protective metal screen does not surround completely the light source (3) and is preferably planar.

7. Light unit according to any of the preceding claims, wherein the metal surface profiles (2a) extend substantially normal to said first linear direction (X) and said metal support profiles (2b) extend substantially parallel thereto.

8. Light unit according to any claims 1 to 5, wherein the metal surface profiles (2a) extend substantially parallel to said first linear direction (X) and said metal support profiles (2b) extend substantially normal thereto.

9. Light unit according to any of the preceding claims, wherein the distance between two adjacent surface profiles (2a) does not exceed 1.5 mm, is preferably not more than 1.0 mm, more preferably not more than 0.7 mm, most preferably not more than 0.4 mm.

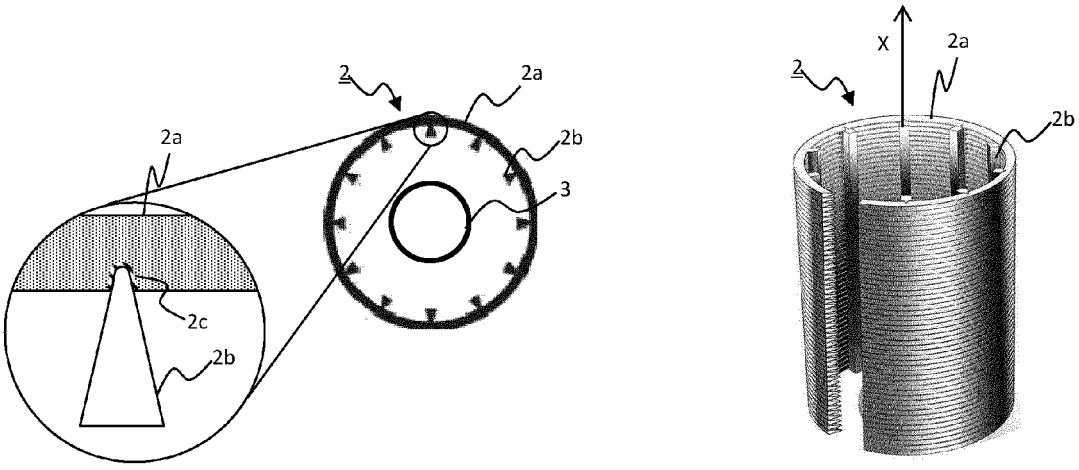
10. Light unit according to any of the preceding claims, wherein the surface profiles (2a) have a cross-sectional shape selected from triangular, square, trapezoidal, round, elliptic, star-shaped, H-, I-, V-, L-, or T-shaped.

11. Light unit according to any of the preceding claims, wherein the largest linear dimension of the cross section of the surface profiles (2a) is lower than 30.0 mm, preferably lower than 20.0 mm or it is not more than 10.0 mm, preferably not more than 5.0 mm, more preferably lower than 3.5 mm, most preferably lower than 2 mm and even lower than 1.0 mm, and/or wherein the greatest linear dimension of the orthogonal projection of a surface profile onto the light source is preferably not more than 20.0 mm, preferably not more than 10.0 mm for large structures, and for smaller structures, it is preferred that it is not more than 4 mm, preferably not more than 3 mm, more preferably not more than 1.5 mm, most preferably not more than 0.7 mm.

12. Light unit according to the preceding claim, wherein the surface profiles (2a) are welded to the support profiles (2b).

13. Light unit according to any of the preceding claims, wherein the first linear direction (X) is curvilinear.

14. Use of a light unit according to any of the preceding claims, in indoor or outdoor applications such as elements integrated in a barrier, a banister, a gate, a door, a window frame, a scaffolding, a bulkhead, a traffic signal, urban furniture, a pole, or a staircase.



(a) (b)

FIGURE 1

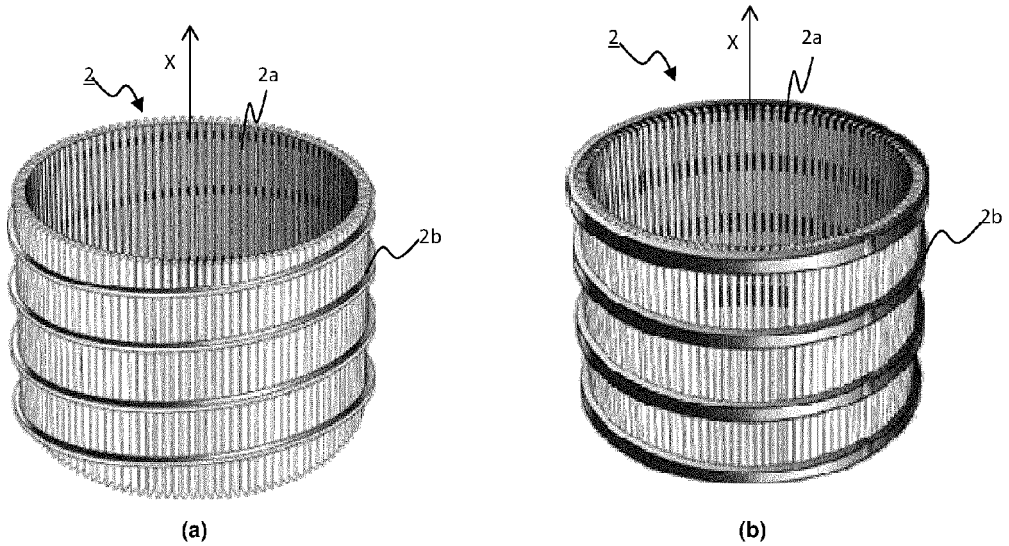


FIGURE 2

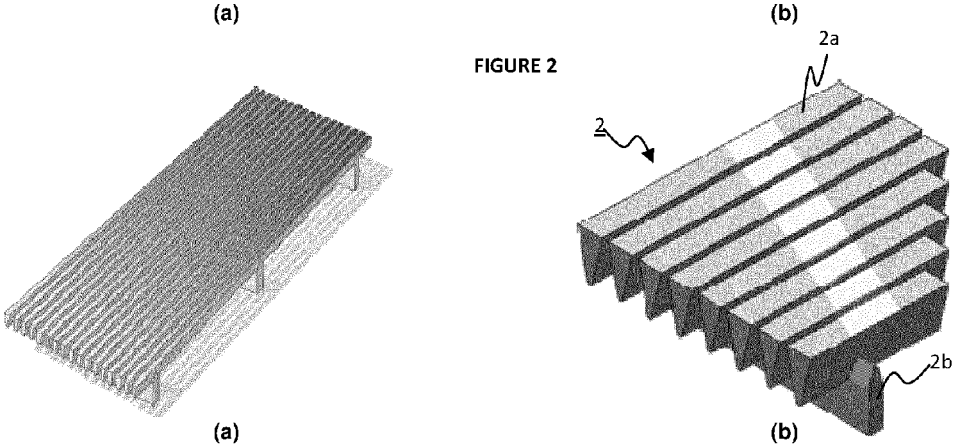


FIGURE 3

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EUROPEAN SEARCH REPORT

Application Number
EP 11 18 9874

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 March 2012	Schulz, Andreas

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- EP 1498656 A **[0003]**