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(54) **PANEL FOR THE CONSTRUCTION OF ROOFING ARRANGEMENTS**

(57) A panel (1) is described for the construction of roofing arrangements comprising two substantially opposite surfaces (2, 3) and made of thermoplastic material, preferably polycarbonate, characterized by comprising a plurality of recesses (4) formed on a first surface (2) of said two surfaces (2, 3) of said panel (1), and in that said recesses (4) comprise a first base area (5) having polygonal or substantially circular shape, or a combination thereof, which lies substantially on said first surface (2) of the panel (1), and have tapered shape extending towards the second surface (3) of the panel (1).

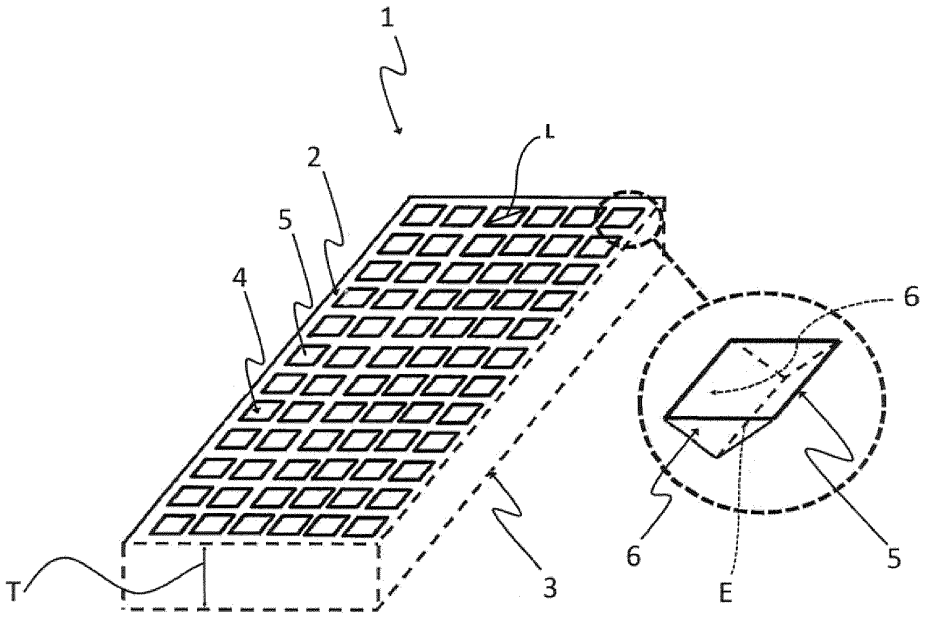

Fig. 1A

EP 3 018 263 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to building panels and in particular panels for the construction of roofing arrangements of structures, able to diffuse light coming from the outside within the structure. The invention relates as well to a roofing arrangement implemented with one or more panels according to the invention.

KNOWN PREVIOUS ART

[0002] In the building field, in particular the industrial one, one of the methods of implementing roofing arrangements is to use panels made of lightweight and cheap materials, such as for example thermoplastic materials. Generally, panels made of polycarbonate, for example of honeycomb or compact type, methacrylate, PVC, etc., are used.

[0003] The use of panels made of thermoplastic material in the building field is particularly popular for several typologies of structures that are, in their own turn, made in a known way through the use of different possible materials, let's consider for example structures made of metal, wood, masonry, and the like.

[0004] In general, the use has considerably developed of metal supporting structures that are combined with roofing arrangements formed with different modular panels made of inter-connected thermoplastic materials that combine high mechanical strength in addition to high resistance against weather conditions with the lightness characteristics typical of these materials.

[0005] The panel according to the present invention can be used for the construction of roofing arrangements for different structure typologies, for both residential and industrial use such as for example warehouses, industrial sheds, large work surfaces. In particular, the panel according to the present invention applies particularly in the construction of roofing arrangements of structures inside which an optimal light diffusion through the panel is required.

[0006] Transparent panels are known that allow the light, for example sunlight outside the structure, to cross the panel and thus penetrate to the inside of the structure.

[0007] In order to avoid the unwanted glare effect perceivable by people inside the structure, and in general due to the light passing through the panel, some panels known in the art have a satin finished surface, and in general a surface made opaque.

[0008] Such panels allow reducing the glare phenomenon and, in some instances, increasing the uniformity of light diffusion, for example with respect to a completely transparent surface panel in general lacking of a satin finished.

[0009] However, the uniformity of diffusion of light crossing the panel leads to a reduction of the intensity of light diffused inside the structure. Such attenuation is due to the satin finish of the panel, that in many instances reduces the transparency thereof, thereby providing the panel with a whitish coloring resulting in an unwanted increase of the reflection of the incident light on the panel.

[0010] Object of the present invention is to solve the above briefly discussed problems and drawbacks of the panels for roofing arrangements.

[0011] Further object of the present invention is to provide a panel for the construction of roofing arrangements of structures, preferably made of plastic material, which ensures high and uniform light diffusion while reducing the glare problem.

[0012] In addition, it is object of the present invention to provide a panel for the construction of roofing arrangements of structures that, under the same intensity of incident light, is able to uniformly diffuse light intensity inside the structure higher than currently available panels.

SUMMARY OF THE INVENTION

[0013] These and other objects are obtained by a panel for the construction of roofing arrangements, according to the present invention, comprising two substantially opposite surfaces which define the panel. Such surfaces are spaced apart by a determined, preferably constant, thickness. In addition, the panel comprises a plurality of recesses formed on a first surface of the two surfaces of the panel.

[0014] According to an aspect of the present invention, the recesses comprise a first base area which substantially lies on the first surface of the panel, in other words, the recesses comprise a first base area substantially arranged at the first surface of the panel.

[0015] The recesses have a shape tapered towards the second surface of the panel. In other words, the recesses have a tapered shape extending from the first surface of the panel towards the second surface of the panel. With such an expression, the recesses are meant to reduce their own sizes (shrink) with respect to the first base area in their extension inside the thickness of the panel towards the second surface of the panel.

[0016] It has to be observed that the term recess is used herein and in the following to denote a curved-inwards portion present on the first surface of the panel and made in the thickness of the panel itself, and therefore preferably not protruding thereby determining a modification also of the second surface of the panel.

[0017] According to an aspect of the present invention, the recesses extend from the first surface towards the second surface of the panel by a depth (D) smaller than two-thirds of the panel thickness. According to a possible embodiment the depth of the recesses is smaller than half of the panel thickness.

[0018] The panel according to the present invention is made of thermoplastic material, preferably polycarbonate. The thermoplastic material is preferably substantially transparent.

[0019] In addition, the term "substantially transparent"

herein has to be intended with the meaning that the panel is not opaque and can thus be crossed by light. Herein also a panel, having a coloring according to installation requirements, will be meant substantially transparent.

[0020] Furthermore, as mentioned afore, each of the recesses has geometrical shape comprising a first base area, which lies substantially on the first surface of the panel. According to an aspect of the present invention, the first base area can have polygonal, or substantially circular shape, or a combination thereof By the term "substantially circular" a base area is meant whose perimeter is formed by a curved line, such as for example a circle, an oval, an ellipse etc. By the term polygonal a figure is preferably meant and formed by a broken line, preferably a closed broken line. According to an aspect of the present invention, the polygonal shape can be a simple polygon. According to a further aspect of the present invention, the polygonal shape is a convex polygon. However, it is not excluded that the polygonal shape can be a concave polygon.

[0021] In other words, according to possible embodiments, the polygonal shape can correspond to a convex or concave polygon.

[0022] As said, the first base area of the recesses can be defined by a combination of a polygonal shape and a substantially circular shape. In other words, the shape of the first base area (and thus its perimeter) can comprise at least one portion formed by at least one segment (straight line) and at least one portion formed by at least one curved line.

[0023] According to an aspect of the present invention, the geometrical shape of the recesses comprises at least one lateral surface connecting the first base area to either at least one second base area having width smaller than the first base area, or at least one segment, or at least one point.

[0024] According to an aspect of the present invention, the at least one lateral surface extends from the first surface of the panel towards the second surface of the panel in order to connect the first base area to either a second base area having width smaller than the first base area, or a segment, or a point.

[0025] It has to be observed that the second base area of the recess can take an equal or different shape, with respect to the first base area of the recess. Also, what herein described about the first base area can be applied to the second base area of the recess as well.

[0026] According to an aspect of the present invention, the first surface of the panel comprising the plurality of recesses, and in particular the first base surface of the recesses, constitutes the internal surface of the roofing arrangement implemented by the panel in use.

[0027] According to a preferred aspect of the present invention, the recesses on the surface of the panel are equal one to another, however it is also possible providing further possible embodiments wherein the recesses are different from one another. For example, a portion of the surface of the panel can comprise recesses having a determined shape (and/or size), whereas one or more further portions of the surface of the panel comprise recesses having different shape (and/or size).

[0028] It has to be observed that the recesses can be different from one another, for example by changing the shape (and/or size) of the first base area and/or the modality they are tapered, i.e. they can provide different shapes (and/or size) of the second base area, or the point, or segment connected to the first base area through the at least one lateral surface.

[0029] In addition, it has to be observed that the recesses can be provided with depth different from one another.

[0030] According to a further aspect of the present invention, the recesses are arranged so as to substantially occupy the entire first surface of the panel.

[0031] Preferably, the recesses are arranged uniformly, i.e. substantially equidistant from one another.

[0032] With the expression "substantially the entire surface of the panel" the recesses are meant to cover at least 40%, preferably at least 70% and even more preferably at least 90% of the first surface of the panel.

[0033] According to a possible embodiment the recesses can be arranged with the first base areas of the recesses spaced apart by a distance equal to, or smaller than, twice the maximum distance between two points of the first base area of the recess, preferably equal to, or smaller than, the maximum distance between two points of the first base area of the recess, and even more preferably equal to, or smaller than, half of the maximum distance between two points of the first base area of the recess.

[0034] The maximum distance between two points of the first base area of the recess is measured along a straight line.

[0035] In addition, according to a possible embodiment, the recesses are arranged with the first base areas spaced apart by a distance smaller than the radius of the circumference circumscribed in, or corresponding to (in case of circular base), said first base area.

[0036] By this expression it is meant also that, according to a possible embodiment, the recesses can be arranged with the first base areas spaced apart by a distance smaller than the radius of the circumference comprising (i.e. containing) in its inside said first base area. The circumference comprising in its own inside the first base area of the recess is preferably the minimum circumference, i.e. the circumference with smallest dimensions, able to contain in its own inside the first base area of the recess. Preferably, the recesses are substantially arranged contiguously on the first surface of the panel. By the expression "substantially arranged contiguously" the first base areas of the recesses are meant to share at least one portion of their own perimeter. The shared portion can comprise at least one point and/or at least one straight or curved side depending on the geometrical shape of the first base areas. According to a possible embodiment of the present invention, the first base area

of the recesses can have a width

[0037] (i.e. a surface) equal to, or smaller than, 60 mm^2, preferably 40 mm^2, more preferably 30 mm^2, even more preferably 15 mm^2.

[0038] According to an aspect of the invention, the first base area of the recesses has a width (i.e. a surface) between the afore mentioned values, i.e. comprised in different ranges having the afore mentioned values as bounds.

[0039] According to a possible embodiment of the present invention, the maximum distance between two points of the first base area measured along a straight line is equal to, or smaller than, 7 mm.

[0040] Advantageously, the panel according to the present invention is particularly effective in diffusing light.

[0041] According to an aspect of the present invention, configurations and arrangements of recesses on the first surface of the panel render the panel made of thermoplastic material particularly effective in diffusing light. In fact, characteristic aspect of the present invention is that light diffusion occurs by means of a set of deflections due to the tapered configuration of recesses formed on one of the panel surfaces.

[0042] In particular, the light crossing the panel is deflected by the recesses, for example by the at least one lateral surface of the recesses. Thus, light incident preferably on the second surface of the panel (surface free from recesses) is subjected to a set of deflections similar to those observed in scattering phenomena, and coming out from the first surface of the panel, it becomes uniformly diffused in all directions.

[0043] It follows that the presence of recesses provides the panel according to the present invention with high light-diffusing power and is therefore able to uniformly diffuse light. Thanks to the present invention it is therefore possible obtaining, under the same light intensity of the light incident on the panel, higher light intensity of the diffused light with respect to the panels of known art wherein the diffusion occurs by means of satin finished surfaces.

[0044] For these reasons, the panel according to the present invention can be advantageously used for the construction of roofing arrangements, for example of structures where high lighting is required. A further advantage provided by the panel according to the present invention, is of being particularly simple and inexpensive to implement, in fact the recesses it is provided with can be directly formed on the surface of the panel during the manufacturing thereof, and in particular during the realization by extrusion. Further characteristics, aspects (possible embodiments) and advantages of the present invention will be more evident from the following description made for illustration purposes and without limitation, referring to the accompanying figures, in which:

- figures 1A-1C are perspective views of a portion of panel according to the present invention in three particular embodiments;
- figures 2A and 2B are sectional views of the panel according to the present invention that show some possible embodiments of the recesses;
- figures 3 to 6 and figure 9 are plan views of the first surface of the panel according to the present invention that show some possible embodiments of the recesses;
- figure 7 is a sectional view of a possible embodiment of the panel according to the present invention having a wavy configuration;
- figures 8 and 8a are sectional and perspective views of a possible embodiment of the panel according to the present invention having fretted configuration.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0045] Referring to the accompanying figures, the present invention relates to a panel 1 for the construction of roofing arrangements comprising two substantially opposite surfaces 2, 3 defining the panel 1. The panel 1 is made of thermoplastic material, preferably polycarbonate. The first surface 2 and the second surface 3 of the panel 1 are spaced apart by a determined thickness T, preferably comprised between about 0.7 mm and about 2.5 mm.

[0046] The panel 1 is substantially transparent, i.e. not opaque and thus allowing light, which is incident on one of the two surfaces 2, 3, propagating inside the panel and coming out from the other surface.

[0047] Preferably, the panel 1 according to the present invention is formed by an extrusion process, advantageously allowing the implementation of very long panels. For example, panels about 13 meters long can be formed. However, larger lengths can be anyway obtained such as for example 15 meters, or 18 meters, and even beyond.

[0048] Preferably, the panel according to the present invention is of compact type and thus features material continuity between the two opposite surfaces 2, 3.

[0049] The panel 1 comprises a plurality of recesses 4 obtained on the first surface 2 of the panel 1.

[0050] The recesses extending towards the second surface 3 of the panel 1 have geometrical shape comprising a first base area 5 having polygonal, or substantially circular, shape or resulting from the combination of a polygonal shape and a substantially circular shape. The first base area 5 lies on the first surface 2 of the panel.

[0051] The recess 4 has a tapered shape, i.e. the geometrical shape of the recess 4 tapers extending from the first surface 2 of the panel 1 towards the second surface 3 of the panel 1. In particular, the geometrical shape of every recess 4 comprises at least one lateral surface 6 that, extending from the first surface 2 of the panel 1 towards the second surface 3 of the panel 1, connects the first base area 5 to either a second base area 7 having a width smaller than the first base area 6, or a segment E, or a point P. The lateral surface 6 can comprise flat or

curved portions (walls) to connect the first base area to either the second base area, or a segment E, or a point P.

[0052] The lateral surface 6 can have different tilts with respect to the first surface 2 of the panel, for example depending on the shape and/or size of the first base area 5 and the second base area 7, or segment E, or point P that are connected through the lateral surface 6.

[0053] In addition, the at least one lateral surface 6 can comprise a combination of flat or curved portions (walls) in order to connect the first base area to either the second base area, or a segment E, or a point P.

[0054] Figures 1A-1C show a portion of panel 1 in three possible embodiments. In particular in figures 1A-1C, within a dotted circle, an enlargement is shown of the recess 4 in order to more clearly visualize the lateral surface 6 of the recess 4.

[0055] The panel 1 shown in figure 1A has a plurality of recesses 4 comprising at least one lateral surface 6 connecting the first base area 5 to a segment E. In this particular embodiment, the recesses 4 have triangular-prism shape wherein the two side triangles form part of the lateral surface 6 of the recess 4.

[0056] In figure 1B a further embodiment of the recesses 4 is shown, wherein the lateral surface 6 connects the first base area 5 to a point P. In figure 1C a further embodiment is shown wherein the lateral surface 6 connects the first base area 5 to a second base area 7 having width smaller than the first base area 5.

[0057] For a better visualization of the three embodiments of the recesses 4 shown in figures 1A-1C, a panel 1 has been preferably shown wherein the recesses 4 have a first squared base area 5. However, the depicted embodiment has not to be meant as limitative, in fact as mentioned, the panel 1 comprises a plurality of recesses 4 wherein the first base area 5 can have polygonal, or substantially circular, shape.

[0058] Figure 2A shows an embodiment of the panel 1 wherein the tapered geometrical shape of the recesses 4 comprises a first base area 5 having polygonal, or substantially circular, shape or a combination thereof, and a lateral surface 6 connecting the first base area to a point P (vertex).

[0059] In figure 2A the cross section of a portion of panel 1 according to the present invention is shown, wherein the recesses 4 extend, from the first surface 2 of the panel 1 towards the second surface 3 of the panel 1, with tapered geometrical shape comprising a lateral surface 6 connecting the first base area 5 to the point P.

[0060] Thus, for example if the first base area 5 has squared shape (such as in the embodiments shown in figures 1A-1C), the recess 4 has pyramidal geometrical shape (squared pyramid, for example a straight squared pyramid) whose base coincides with the first base area 5 of the recess 4. Similarly, if the first base area has a substantially circular shape, the recess has a substantially conical geometrical shape.

[0061] Figure 2B shows an embodiment of the panel 1 wherein the tapered geometrical shape of the recesses 4 comprises a first base area 5 having polygonal, or substantially circular shape (or a combination thereof), and a lateral surface 6 connecting the first base area 5 to a second base area 7 having width smaller than the first base area.

[0062] In figure 2B the cross section of a portion of panel 1 according to the present invention is shown, wherein the recesses 4 extend from the first surface 2 of the panel 1 towards the second surface 3 of the panel 1 with tapered geometrical shape comprising a lateral surface 6 connecting the first base area 5 to a second base area 7 having width smaller than the first base area 5. According to an aspect of the present invention, the second base area 7 is preferably parallel to the first base area 5.

[0063] The second base area 7 has preferably the same geometrical shape of the first base area 5. However an embodiment can be provided wherein the first and the second base area have different geometrical shapes while remaining in the protection scope of the present invention.

[0064] Thus, if the first base area 5 and the second base area 7 are squared, for example (as in the embodiments shown in figures 1A-1C), the recess 4 has truncated-pyramid shape (squared pyramid trunk) whose larger base coincides with the first base area 5 of the recess 4 and the smaller base coincides with the second base area 7 of the recess 4. Similarly, if the recesses 4 have a substantially circular first base area, the recesses have a substantially truncated-cone shape.

[0065] The recesses 4 extend from the first surface of the panel towards the second surface of the panel by a depth D smaller than two-thirds of the thickness T of the panel. According to a possible embodiment, the depth D is smaller than half of the thickness T of the panel 1.

[0066] The depth D is defined as the distance between the first base area 5 lying on the first surface 2 of the panel 1 and the deepest point of the recess 4, i.e. the closest to the second surface 3 of the panel 1.

[0067] Thus, in the case of the embodiment of figure 1A, the deepest point of the recess belongs to the segment E, whereas in the case of the embodiment of figure 2A the deepest point of the recess coincides with the point P, finally in the case of the embodiment of figure 2B, the deepest point of the recess belongs to the second base area 7 of the recess 4.

[0068] Preferably, the recesses extend from the first surface 2 of the panel 1 towards the second surface 3 of the panel 1 for a depth D between 0.2 mm and 1.4 mm.

[0069] As explained above, the recesses have geometrical shape comprising a first base area having polygonal, or substantially circular, shape or resulting from a combination thereof (i.e. in part polygonal and in part curved). Figures 3-6 and figure 9 are plan views of a portion of panel 1 showing some example embodiments of the present invention related to the geometrical shape of the first base area 5 of the recesses 4 and to their arrangement on the first surface 2 of the panel 1.

[0070] Figure 3 shows a plan view of a portion of panel 1 according to the present invention, wherein the recesses 4 have geometrical shape comprising a first base area 5 with squared shape (similar to the embodiments shown in figures 1A-1C).

[0071] In this embodiment, the recesses are arranged on the first surface 2 of the panel in parallel rows so as to form a sort of array in which rows and columns can be discriminated and in which every recess is surrounded by eight recesses.

[0072] Figure 4 shows a further embodiment of the panel according to the present invention, wherein the base areas 5 of the recesses 4 are arranged in parallel rows staggered from one another so that every recess 4 is surrounded by six recesses.

[0073] Figure 5 shows a further embodiment wherein the recesses 4 have a geometrical shape comprising a first hexagonal base area. As visible for example in figure 5, the arrangement of the first base areas on the first surface of the panel is similar to a beehive one, i.e. every recess is surrounded by six recesses (one for each side).

[0074] In detail, inside the circle of figure 5, the configuration of the recesses and their shape tapered towards the second surface of the panel can be seen more in detail.

[0075] Further embodiments can provide the first base areas of the recesses having in general polygonal shape, with a number of sides larger than three (triangles, rhombuses, pentagons, etc.). Polygonal shapes formed by a closed broken line, i.e. by a plurality of segments, having a substantially star shape, have not to be excluded.

[0076] Furthermore, according to an aspect of the present invention, if the recesses have a first base area with polygonal shape, every recess is surrounded by a number of recesses equal to or larger than the number of sides of the polygon.

[0077] Figure 9 shows a plan view of a portion of panel 1 according to the present invention, wherein the recesses 4 have geometrical shape comprising a first base area 5 with rhombus shape. In the detailed view of figure 9, the lines among the recesses 4 represent the surface of the panel on which the recesses are formed and that is comprised among two or more recesses.

[0078] Recesses having the shape of rhombus are used in the embodiment shown in figures 8 and 8a.

[0079] Figure 6 shows a further embodiment of the panel 1 wherein the shape of the first base areas of the recesses 4 is elliptical. Further embodiments can provide the first base areas having circular or oval shape, in general the first base areas can have a substantially circular shape, falling into the protection scope of the present invention.

[0080] If the first base areas of the recesses have a substantially circular shape, the recess can have a substantially conical or truncated-conical shape depending whether its own lateral surface connects the first base area respectively to either a point P, or a second base area also substantially circular and with width smaller than the first base area.

[0081] Referring to the accompanying figures, the recesses 4 are substantially arranged uniformly on the first surface 2 of the panel 1, i.e. substantially equidistant from one another.

[0082] In other words, the portion of the first surface 2 of the panel 1, not occupied by the first base areas of the recesses, forms a sort of grid spacing apart the first base areas by a determined distance S preferably substantially constant, along the first surface of the panel.

[0083] According to a possible embodiment the recesses 4 can be arranged on the first surface 2 of the panel 1 with the first base areas 5, for example of at least two recesses, spaced apart by a distance S equal to or smaller than twice the maximum distance L between two points of the first base area 5 of the recess 4, preferably spaced apart by a distance S equal to or smaller than the maximum distance L between two points of the first base area 5 of the recess 4, even more preferably spaced apart by a distance S equal to or smaller than half of the maximum distance L between two points of the first base area 5 of the recess 4.

[0084] As can be seen for example in the figures, the maximum distance L between two points of the first base area 5 of the recess is measured along a straight line.

[0085] As shown for example in the accompanying figures, the distance S between two recesses 4 is preferably measured between two sides, or two portions, of two base areas of two recesses. Preferably, the distance S is the minimum distance (measured along a straight line) between two points belonging to two base areas 5 of two different recesses 4.

[0086] According to a possible embodiment, the recesses are arranged on the first surface 2 of the panel 1 with the first base areas, for example of at least two recesses, spaced apart by a distance S smaller than the radius R of the circumference circumscribed to the first base area 5.

[0087] According to a possible embodiment, the recesses can be arranged with the first base areas spaced apart by a distance S smaller than the radius R of the circumference comprising in its inside the first base area 5 of the recesses 4.

[0088] Further embodiments can provide the recesses being substantially arranged contiguously on the first surface 2 of the panel 1. In this case, the first base areas of the recesses share at least one portion of their own perimeter. The shared portion can comprise at least one (touching) point and/or at least one straight, or curved, side depending on the geometrical shape of the first base areas.

[0089] The recesses are arranged with the first base areas occupying substantially the entire first surface 2 of the panel 1. According to an aspect of the present invention, the recesses cover at least 40%, preferably at least 70%, and even more preferably at least 90% of the first surface 2 of the panel 1.

[0090] According to an aspect of the present invention,

the first base area 5 of the recesses 4 can have a width equal to, or smaller than, 60 mm^2, preferably 40 mm^2, more preferably 30 mm^2, even more preferably 15 mm^2.

[0091] According to an aspect of the present invention, the maximum distance L measured along a straight line, for example visible in the accompanying figures between two points of said first base area 5, is equal to, or smaller than, 7 mm.

[0092] The panel 1 according to the present invention can take various configurations, thus in addition to be planar it can be corrugated, i.e. the surfaces 2, 3 of the panel can be waved or bent in order for example to have a fretted configuration. In both cases, the thickness T of the panel is substantially constant between the two opposite surfaces 2, 3 of the panel.

[0093] In addition, both the depth D of the recesses and the distance S between the first base areas of the recesses is preferably constant along the extension of the panel in case of both planar and corrugated configurations.

[0094] In particular, in the embodiment shown in figures 1 - 6, the panel 1 according to the present invention has a substantially flat shape, however it can be corrugated, i.e. can have surface bends or curves. More in detail, the two opposite surfaces of the panel 2, 3 can be bent or curved at one or more lines so as to cause a modification in the whole shape of the panel, as depicted in figures 7, 8 and 8a.

[0095] Generally, the panels used for the construction of roofing arrangements are corrugated so as to have a wave-like or fretted surface.

[0096] In the first case, as for example visible in the embodiment of figure 7, the surfaces 2, 3 are curved at some lines, so that the panel takes a wave profile.

[0097] With regard to the fretted shape (for example shown in figures 8 and 8a), for its construction the surfaces of the panel 2, 3 are bent at some lines so as they can take a profile in which substantially trapezoidal figures alternate, thereby generating the so-called Greek fret shape.

[0098] The recesses 4 formed on the first surface 2 of the panel extend towards the second surface 3 of the panel also at the bent areas, preferably by a depth D substantially constant along the extent of the panel 1.

[0099] In the embodiment shown in figure 8a, the recesses have rhombus-shaped base area, as shown in figure 9.

[0100] It has to be observed that in the embodiment illustrated in figure 8a, the recesses obtained on the bent portions of the panel have a slightly different, and in particular slightly elongate, shape with respect to the recesses arranged on the flat portions of the panel, following of the deformation which the panel is subjected for forming the fretted shape.

[0101] Further embodiments, depending on the thermoplastic material used for implementing the panel and in general based on installation requirements, can provide applying a thin UV ray protective layer (for example by a film or a varnish, but preferably during the manufacturing step by the co-extrusion technique) on the second surface 3 of the panel 1 (i.e. the surface not having recesses 4) so that the visible light incident on the second surface of the panel can propagate inside the panel and diffuse as coming out from the first surface of the panel, whereas the UV radiation is advantageously reflected by the protective layer.

Claims

1. Panel (1) for the construction of roofing arrangements comprising two substantially opposite surfaces (2, 3) and made of thermoplastic material, preferably polycarbonate, **characterized by** comprising a plurality of recesses (4) formed on a first surface (2) of said two surfaces (2, 3) of said panel (1), wherein said recesses (4) comprise a first base area (5) having polygonal or substantially circular shape, or a combination thereof, which lies substantially on said first surface (2) of the panel (1), and wherein said recesses have a tapered shape extending towards the second surface (3) of the panel (1).

2. Panel (1) according to claim 1, wherein said recesses (4) comprise at least one lateral surface (6) which connects said first base area (5) to either a second base area (7) having a width smaller than said first base area (5), or a segment (E), or a point (P).

3. Panel (1) according to any one of the preceding claims, wherein said recesses (4) extend from said first surface (2) towards said second surface (3) of the panel (1) by a depth (D) which is smaller than two-thirds of the thickness (T) between the surfaces (2, 3) of the panel (1).

4. Panel (1) according to any one of the preceding claims, wherein the thickness (T) between the two surfaces (2, 3) of the panel (1) is between about 0.7 mm and about 2.5 mm.

5. Panel (1) according to any one of the preceding claims, wherein said recesses (4) extend from said first surface (2) of the panel (1) towards said second surface (3) of the panel (1) by a depth (D) of between about 0.2 mm and about 1.4 mm.

6. Panel (1) according to any one of the preceding claims, wherein said recesses (4) are arranged substantially uniformly on said first surface (2) of the panel (1).

7. Panel (1) according to any one of the preceding claims, wherein said recesses (4) are arranged on said first surface (2) of the panel (1) with said first base areas (5) of at least two recesses (4) spaced

apart by a distance (S) which is smaller than the radius (R) of the circumference circumscribed in, or corresponding to, said first base area (5).

8. Panel (1) according to any one of the preceding claims, wherein said recesses (4) are arranged on said first surface (2) of the panel (1) with said first base areas (5) of at least two recesses (4) spaced apart by a distance (S) which is smaller than twice the maximum distance (L) between two points of said first base area (5), preferably spaced apart by a distance (S) which is smaller than the distance (L) between two points of said first base area (5), even more preferably spaced apart by a distance (S) which is smaller than half of the maximum distance (L) between two points of said first base area (5).

9. Panel (1) according to any one of the preceding claims, wherein said recesses (4) are arranged substantially contiguously on said first surface (2) of the panel (1).

10. Panel (1) according to any one of the preceding claims, wherein said recesses (4) are arranged on said first surface (2) so as to occupy substantially the entire first surface (2) of the panel (1).

11. Panel (1) according to any one of the preceding claims, wherein said first base area (5) of said recesses (4) has a width equal to, or smaller than, 60 mm^2, preferably 40 mm^2, more preferably 30 mm^2, even more preferably 15 mm^2.

12. Panel (1) according to any one of the preceding claims wherein the maximum distance (L) between two points of said first base area (5) measured along a straight line is equal to, or smaller than, 7 mm.

13. Panel (1) according to any one of the preceding claims, **characterized in that** it is corrugated, said two opposite surfaces (2, 3) being bent or curved.

14. Use of at least one panel (1) according to any one of the preceding claims for the construction of roofing arrangements.

15. Roofing arrangement for a structure **characterized by** comprising at least one panel (1) according to any one of claims 1 to 13, wherein the first surface (2) of said panel (1) comprising said plurality of recesses (4) constitutes the internal surface of said roofing arrangement.

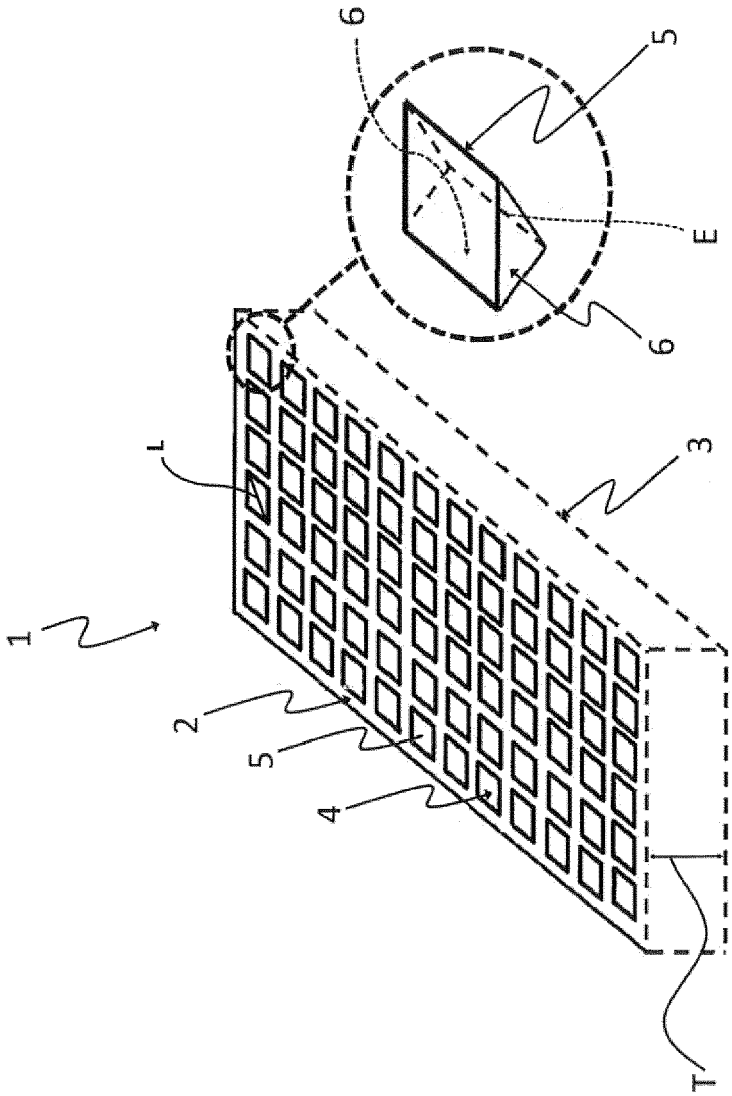

Fig. 1A

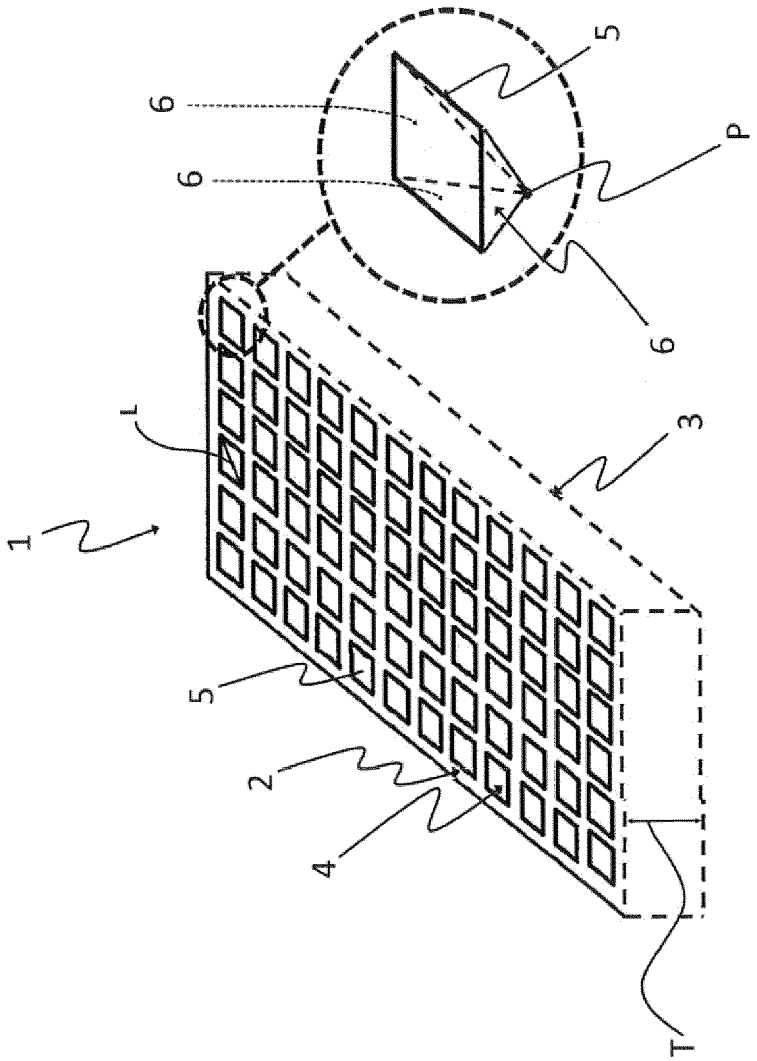

Fig. 1B

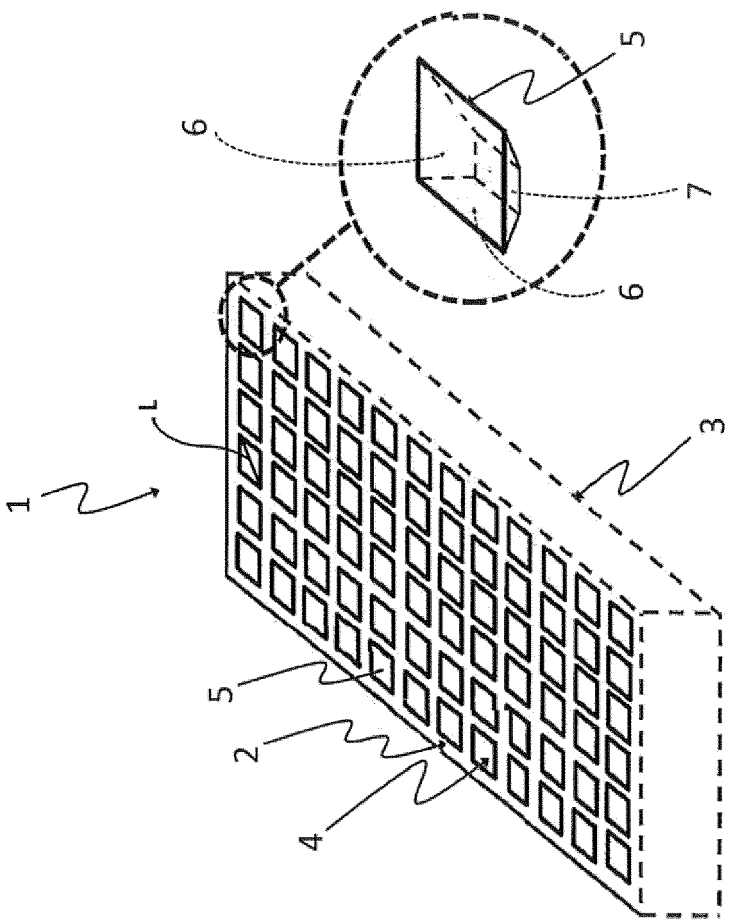

Fig. 1C

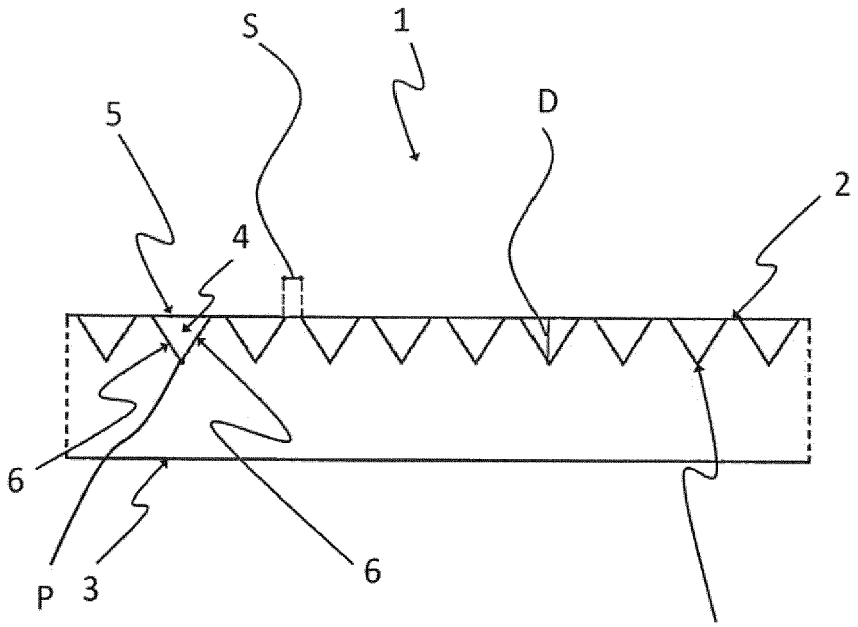

Fig. 2A

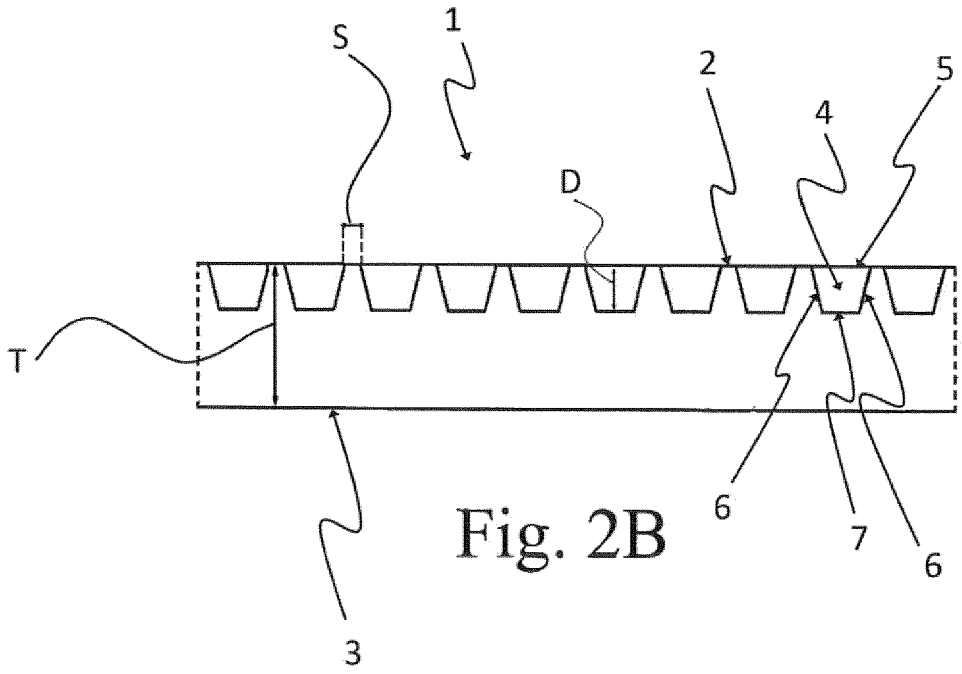

Fig. 2B

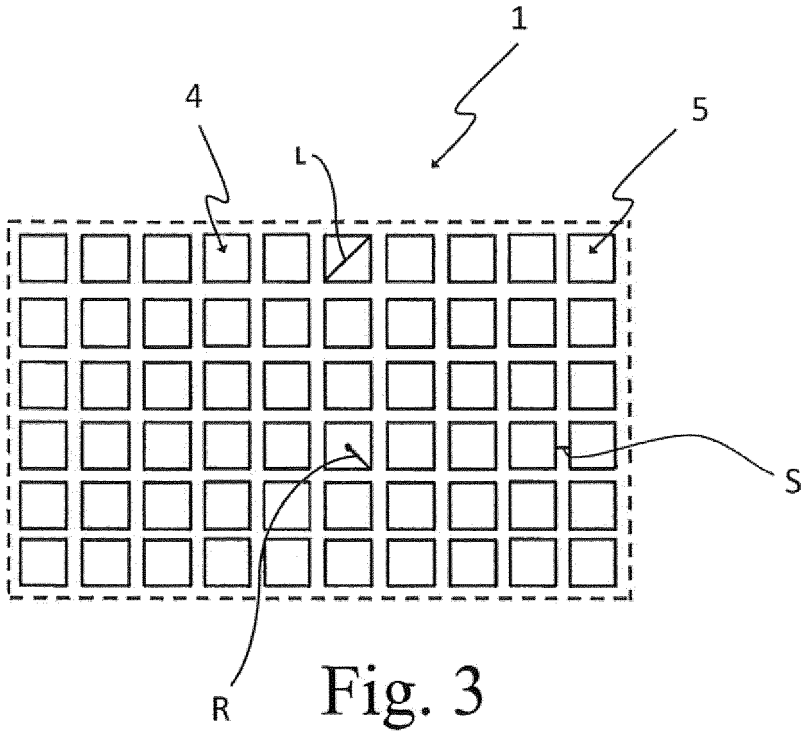

Fig. 3

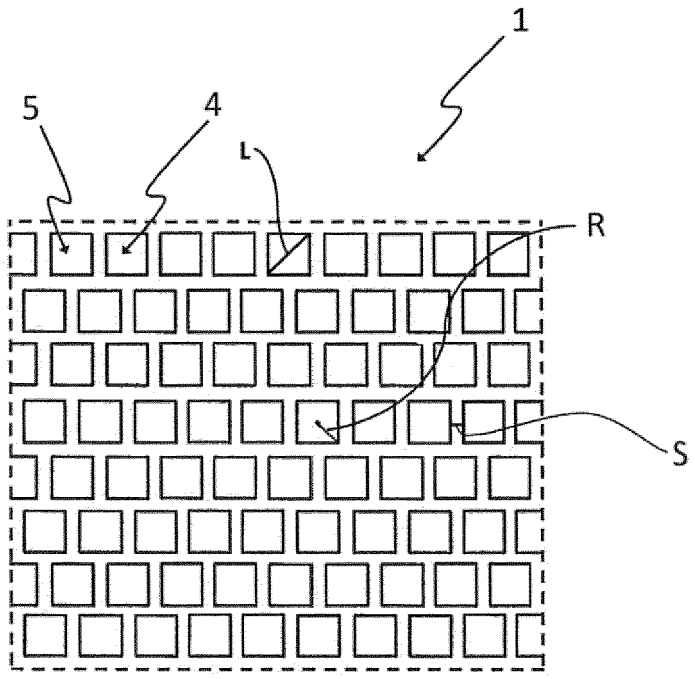

Fig. 4

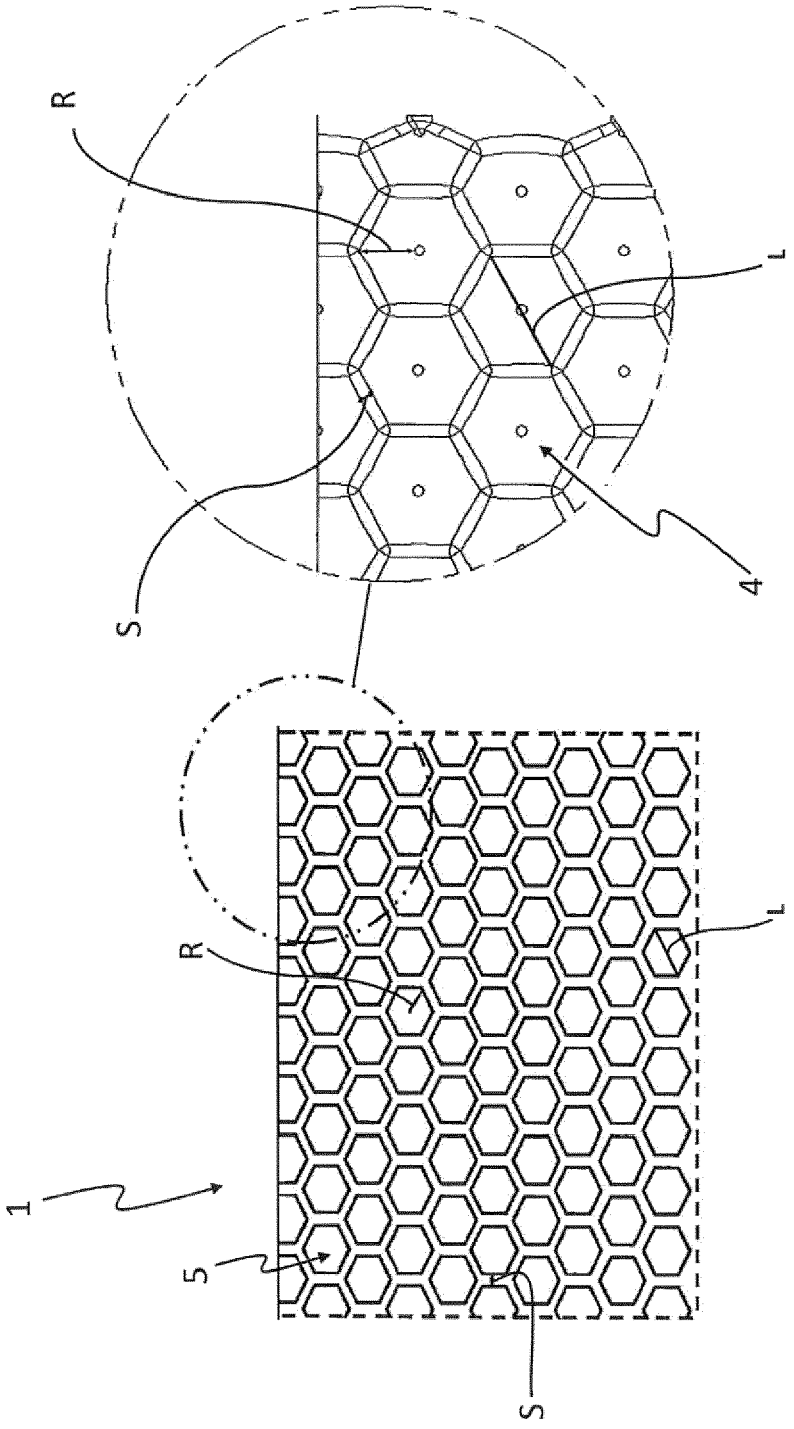

Fig. 5

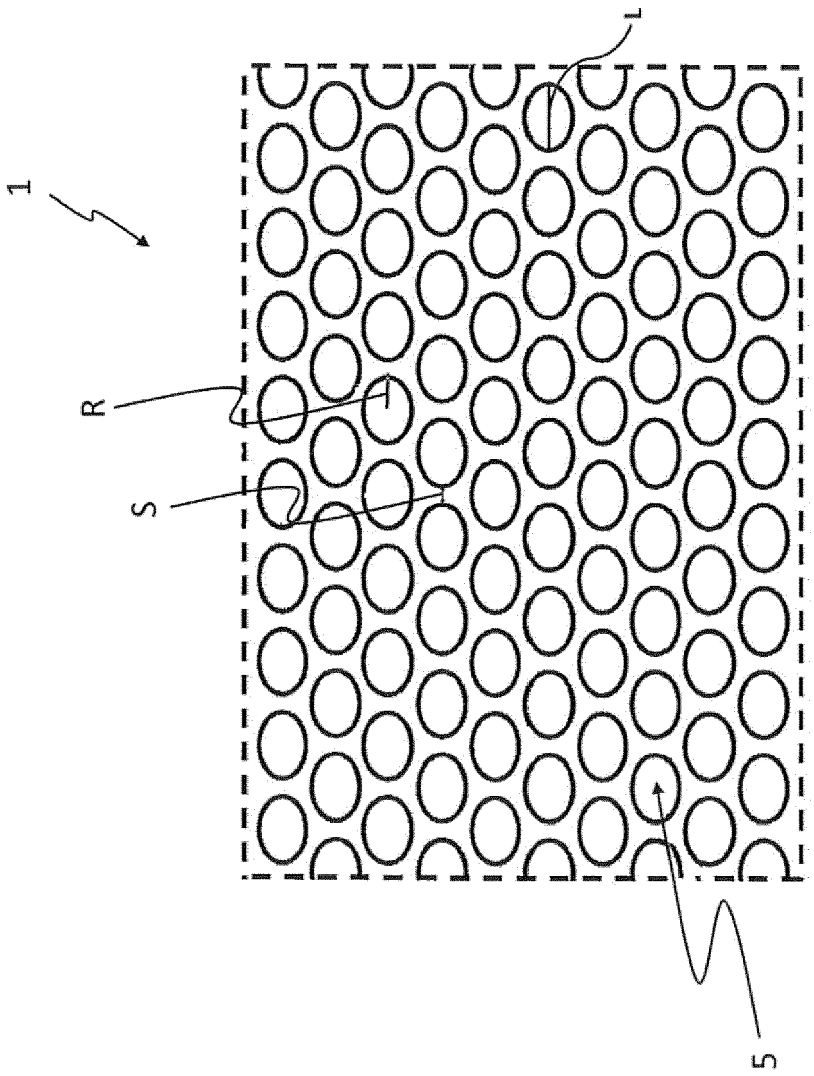

Fig. 6

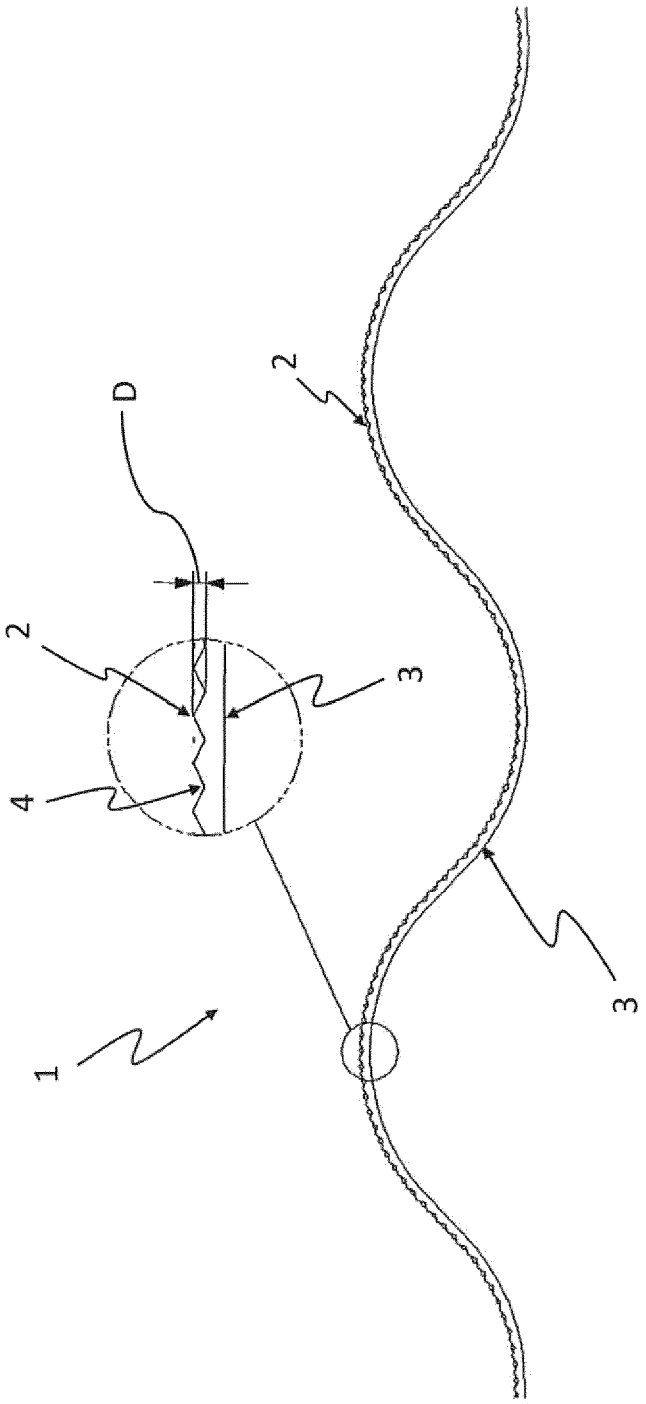

Fig. 7

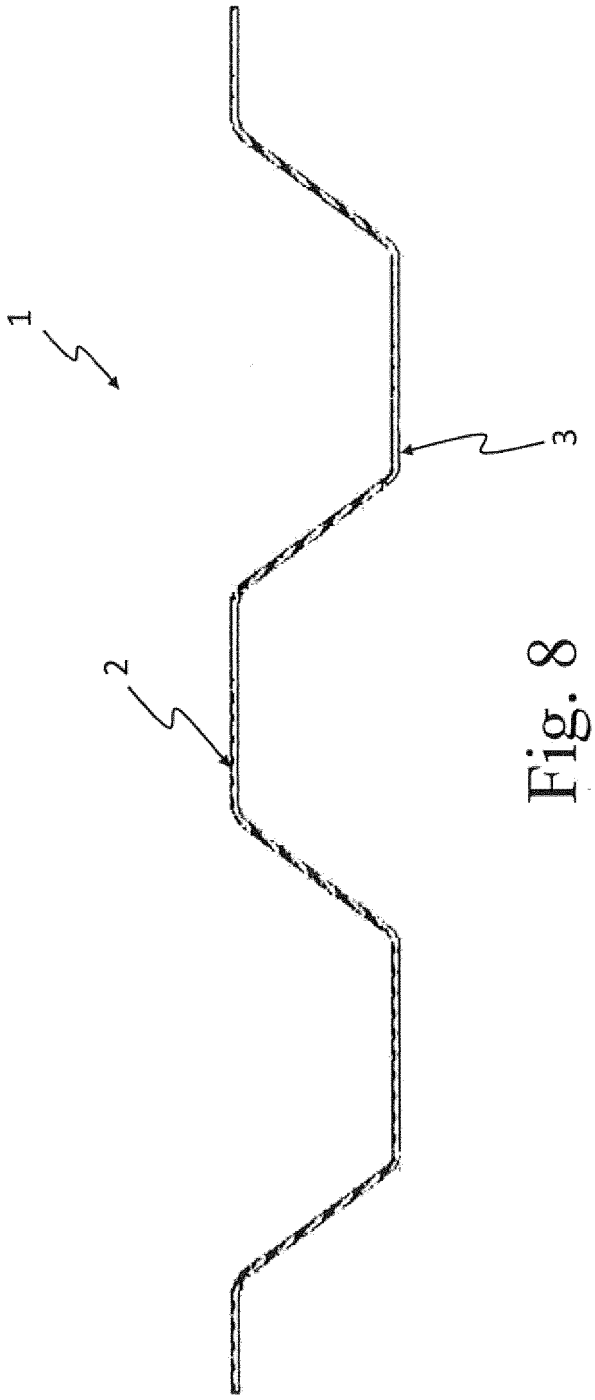

Fig. 8

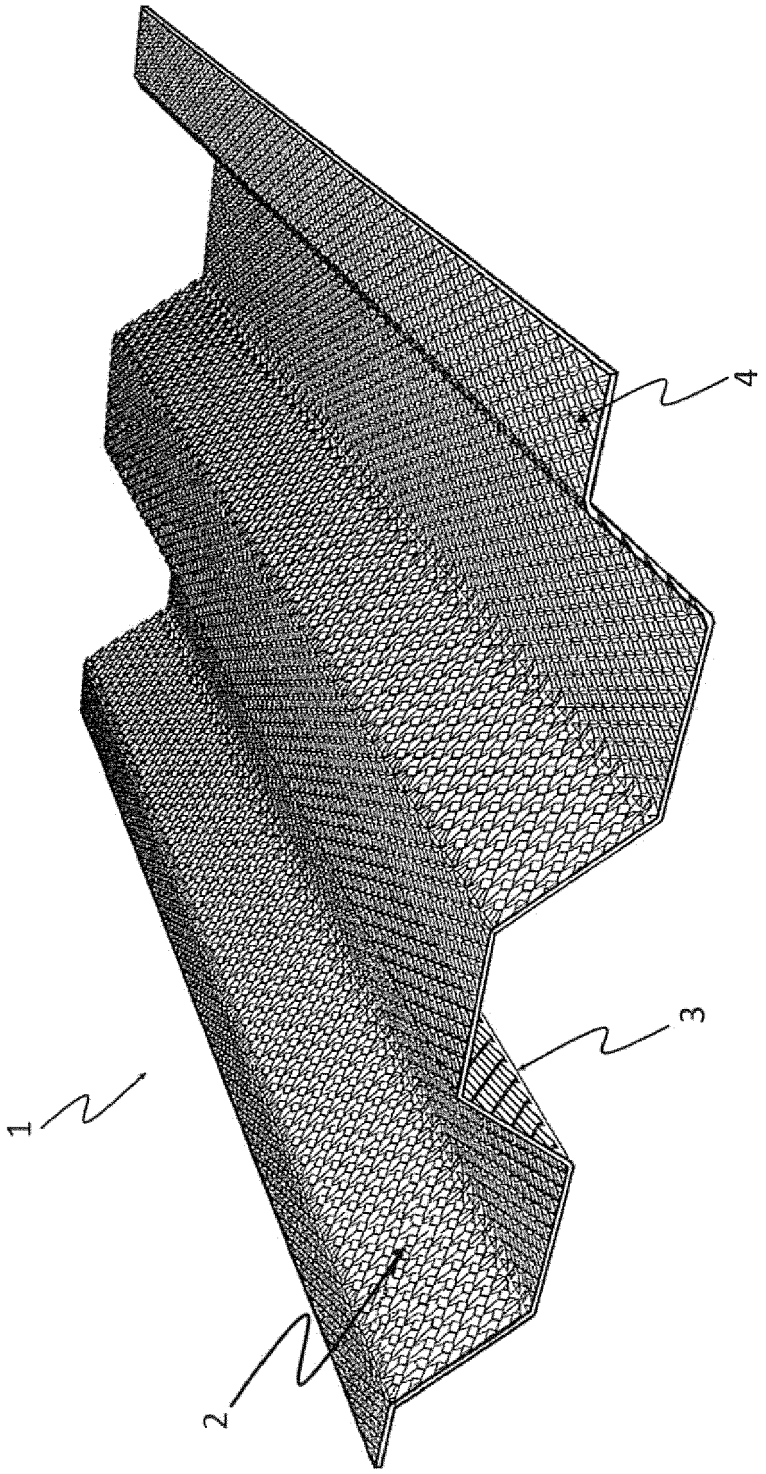

Fig. 8A

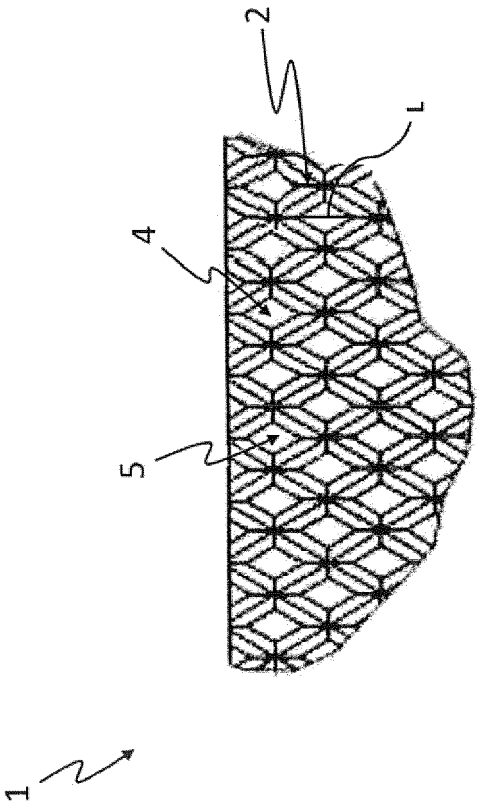

Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 15 19 3527

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X	FR 2 832 811 A1 (SAINT GOBAIN [FR]) 30 May 2003 (2003-05-30) * figure 4 * * page 6, lines 1,2; claim 39 * * page 7, lines 4-7; claim 41 * * page 8, lines 27-31 *	1-12	TECHNICAL FIELDS SEARCHED (IPC) E04D A01G E04C
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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	11 January 2016	Leroux, Corentine

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L : document cited for other reasons

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