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(54) **CONNECTING ELEMENT FOR PANELS AND RELATED ROOFING SYSTEM**

(57) The invention concerns a connecting element (30,30') for transparent panels (15) for forming coverings (10), wherein the connecting element (30,30') comprises a main portion (30g) having at its ends (31) two lateral portions (30a,30d), wherein each lateral portion (30a,30d) connects the main portion (30g) to a respective

supporting portion (30b,30e), and each supporting portion (30b,30e) is spaced out from the main portion (30g) and is configured for the connection to a transparent panel (15). The invention also concerns a roofing system (10).

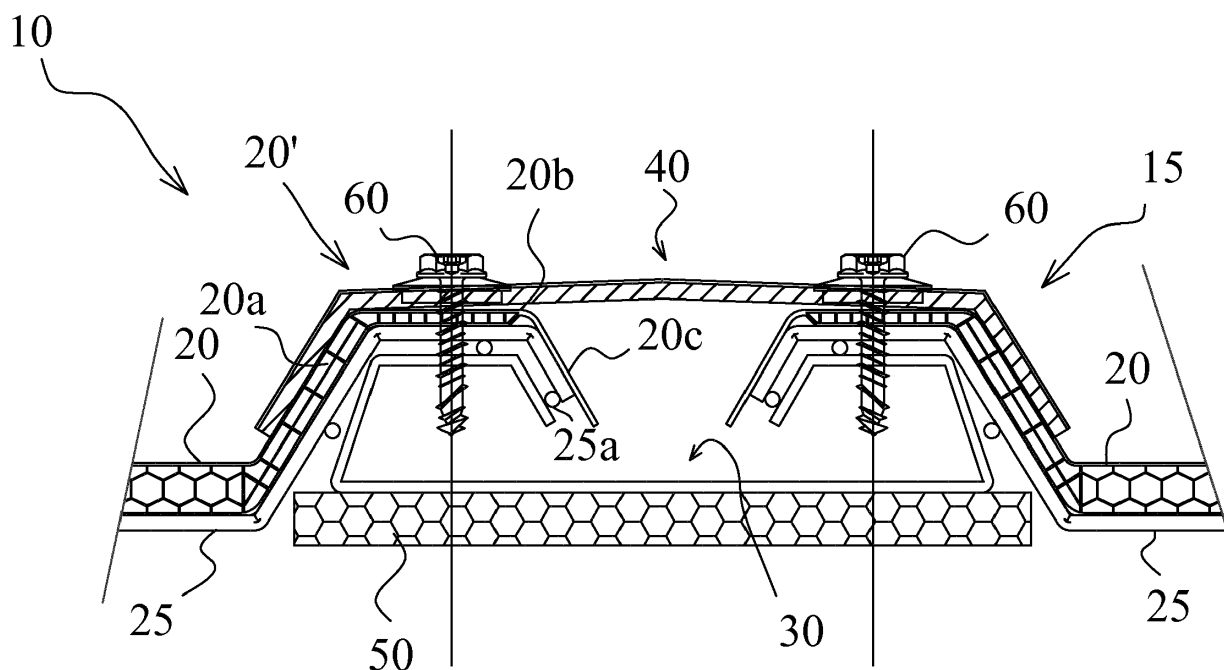


FIG.1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a connecting element for panels for the formation of coverings and the related roofing system (or covering), i.e. the assembly comprising the panels that are connected by the interposition of at least one connecting element.

[0002] More in details, the present invention relates to a connecting element for transparent panels for forming coverings suitable to let the light to pass through the same (such as skylight), for example in buildings for industrial use, such as warehouses, storehouses and the like.

[0003] The invention relates also to the relative connection way and in particular to a roofing system comprising at least two panels that are connected through the interposition of at least one connecting element according to the invention.

BACKGROUND OF THE INVENTION

[0004] It has to be noted that with the term transparent, or translucent, here and in the following is intended a panel made of a material allowing the light radiation passing through the same.

[0005] In building industry and in particular in the industrial field, it is known providing some areas of the coverings, typically made by metal panels or non-transparent material, with panels made of transparent material, in order to allow natural light to be admitted within the structure.

[0006] Transparent panels comprise a layer made of light material, such as for example polycarbonate, or polyester, plexiglas or other plastic materials, and in particular polymers. For example, transparent panels can be made of thermo-plastic material, for example by extrusion. Transparent panels can be either of compact type or of honeycomb type.

[0007] Transparent panels are constrained to panels, preferably made of metal material, forming the covering. In other words, transparent panels are constrained laterally to covering panels, preferably to panels made of metal.

[0008] In order to provide resistance to breach or to impact with bodies or objects, it is known to provide transparent panels with a reinforcing net allowing the light to pass through it and therefore not to darken the transparent panel, and at the same time to hold possible bodies or objects, which, upon impact with the transparent panel, would otherwise fall down inside the structure, such as described for example in the document EP 2 781 667, in the name of the Applicant.

[0009] The reinforcing net is constrained in contact with the surface of the layer made of transparent material, in particular to the lower surface of the layer made of transparent material, in contact with it.

[0010] This constraint can be made, for example, by

means of an adhesive suitable for this purpose, such as for example a two-component adhesive. Preferably, an adhesive of fluid type is used.

[0011] Panels also have constraining ends, or protruding portions, forming constraining cavities suitable to accommodate corresponding constraining ends of the adjacent metal panels of the covering. The constraining ends or protruding constraining portions have substantially a 'U' shape, and in particular an 'inverted U' shape and preferably comprise three inclined surfaces, according to the shape of a greek profile, widely used in the sector of roofing panels. Preferably, each panel is provided with two protruding constraining portions, preferably 'U'-shaped and extending at the two opposite sides of the panel.

[0012] These protruding portions, for example with an 'inverted U' shape, are used to constrain the panel to the covering, for example by means of screws or bolts.

[0013] In solutions of this kind, a covering is provided with a series of metal panels alternated to skylights, i.e. areas of the covering designated to let the light pass through from the outside of the structure, the skylights being realised by means of the transparent panels described above.

[0014] However, solutions of this kind allow the covering to be provided with a limited area designated as skylight, since each panel made of transparent material is necessarily constrained to other non-transparent panels at each end.

[0015] However, in case two or more transparent panels are intended to be connected, in particular each one equipped with a respective reinforcing layer constrained to it, due to the overlapping of the ends of the panels to be connected, this results in a high overall thickness of the connection, and this can lead to infiltrations in the covering and/or to problems in panels alignment.

[0016] It is therefore an object of the present invention to provide a system allowing the connection of two or more transparent panels, and in particular transparent panels provided with a reinforcing layer extending at least partially on the constraining ends or protruding constraining portions of the panel, in a simple and economic way.

SUMMARY OF THE INVENTION

[0017] This and other objects are reached by a connecting element for panels for forming coverings according to the first independent claim and the following dependent claims.

[0018] An aspect of the present invention provides for a connecting element for transparent panels for forming covering, wherein the above mentioned connecting element comprises a main portion having at its ends two lateral portions, where each lateral portion connects the main portion to a respective supporting portion. Each supporting portion is spaced out (arranged at a distance) from the main portion and each supporting portion is configured for the connection to a transparent panel, and in

particular for the connection to a constraining end or protruding constraining portion of a transparent panel.

[0019] An advantage of this embodiment is the fact that the connecting element has a complementary shape of the constraining ends or protruding constraining portions of the transparent panels, thus allowing an easy installation of one panel next to another, by means of the interposition of the connecting element.

[0020] In particular, the lateral portions connected to the supporting portions are arranged in correspondence of two ends, i.e. two sides of the main portion, and therefore they determine the formation of two protrusions, or raised portions (in relief) with respect to the main portion, substantially complementary to the constraining ends or protruding constraining portions of the transparent panel.

[0021] In this way, two transparent panels can be quickly and effectively constrained one next to another, by means of the interposition of the connecting element, each one in correspondence of a supporting portion of the connecting element. In other words, the presence of lateral portions extending in correspondence of two ends, or sides, which are opposite sides and are preferably parallel to the main portion, from which in turn supporting portions extend spaced from the main portion, determines the formation of two raised portions of the connecting element, having cavity underneath, each one is intended to cooperate with (in particular to be at least partially inserted into) the constraining ends or protruding constraining portions of a transparent panel.

[0022] Advantageously, there is no need to constrain overlapped one on another the constraining ends (or protruding portions) of the transparent panels in correspondence of which the reinforcing layer extends, thus avoiding the undesired overlapping of two ends having the reinforcing layer of two panels.

[0023] Advantageously, by the connecting element, or coupling element, according to the present invention, two transparent panels preferably equipped with a reinforcing layer in correspondence of its constraining ends can be installed one next to the other, by means of the connecting element, without having the ends of two panels overlapped (superimposed) and of the respective reinforcing layers extending in correspondence of the constraining ends.

[0024] According to an aspect of the present invention, each of the supporting portions extend towards the centreline of the main portion.

[0025] It should be noted that the term 'centreline' is used herein to indicate the middle part of the main portion, i.e. the portion which is equidistant from the ends, or sides, of the main portion from which the lateral portions extend.

[0026] According to another aspect of the present invention, each supporting portion depart from the centreline of the main portion, i.e. it extend away from the centreline of the main portions. In other words, the supporting portion extends from the lateral portion away from the centreline of the middle part, i.e. extending outwardly

with respect to the main portion.

[0027] According to an aspect of the present invention, the main portion is provided with a width (X) measured between the ends, or opposed sides, from which the lateral portions extend, that is comprised between 50 centimetres and 5 centimetres, preferably comprised between 30 centimetres and 5 centimetres, even more preferably comprised between 20 centimetres and 5 centimetres.

[0028] Advantageously, the width of the main portion, smaller than the width of the metal panels commonly used on coverings, which, as it is known have an extension in width greater than one metre, allows the constraint of two transparent panels one next to the other and one close to another, without overlapping the respective constraining ends or protruding constraining portions, thus reducing the covered (non-transparent) area occupied by the connecting element. Meanwhile, the connecting element leads to the effective, safe and stable connection of two transparent panels, without their overlapping.

[0029] It should be noted that according to an aspect of the present invention, the connecting element, or coupling element, has a predominant lengthwise extension. In other words, the connecting element has an extension in length (Y) greater than the other two dimensions, and in particular greater than the width (X). Advantageously, the length of the connecting element, i.e. the extension in length of the ends, or opposed sides, of the main portion where the lateral portions extend from, is greater than the width of the main portion measured between these two ends, or opposed sides, of the main portion from which the lateral portions extend.

[0030] The width of the connecting element, that is reduced in comparison with its extension in length, allows to keep close the supporting portions allowing the connection to two panels, and in general allows to keep close the supporting portions with respect to the main portion which are intended to cooperate with the constraining ends or constraining portions of the panel. This configuration allows to give to the connecting element the necessary stiffness, while at the same time keeping its size limited when arranged between two panels which are connected through it.

[0031] According to an aspect of the present invention, each one of the two lateral portions is angled with respect to the main portion. In other words, the lateral portion extends from the main portion forming an angle (α) with it. This angle allows to set the supporting portion, that is connected to the main portion through the lateral portion, at a distance (spaced out) from the main portion. According to an aspect of the present invention, each one of the two lateral portions is connected to an end of the main portion forming an acute angle.

[0032] In other words, according to an aspect of the present invention, the lateral surface is extending from the end of the main portion forming an acute angle between them. In particular, it should be noted that the angle is measured internally with respect to the two surfaces,

i.e. the angle faces the centreline or the middle part of the main portion.

[0033] Advantageously, an acute angle allows the lateral surface extending from the main portion to project towards the centreline (middle part) of the main portion forming an inclined lateral surface cooperating in increasing the stability and the stiffness of the connecting element.

[0034] Moreover, the presence of an acute angle provides that the lateral surface, as well as the supporting portion extending from it, do not extend sideways outside the size in width of the main portion.

[0035] According to another aspect of the present invention, each one of the two lateral portions is connected with an end of the main portion forming an obtuse angle. In this embodiment, the lateral surface and the supporting portion extending from it, extend sideways outside the size in width of the main portion. However, their side extension is limited and is substantially equal to the width of the supporting portion, therefore keeping reduced the total size in width of the connecting element.

[0036] According to an aspect of the present invention, the supporting portions are substantially parallel to the main portion. Advantageously, this configuration allows to have a flat surface suitable to cooperate with a corresponding flat surface, preferably parallel to the surface of the transparent panel (or the plane according to which the panel extends), which is intended to be constrained to the connecting element.

[0037] An aspect of the present invention provides for a roofing system (also indicated as covering or set of panels for forming a covering) comprising at least two transparent panels and at least one connecting element according to the invention. At least two panels are connected to the connecting element and therefore are constrained through the interposition of the connecting element.

[0038] According to an aspect of the invention, the panels comprises at least one constraining end or protruding constraining portion and, in the roofing system according to the invention, a constraining end of a first transparent panel is connected to a first supporting portion of the connecting element, and a constraining end of a second transparent panel is connected to a second supporting portion of the connecting element.

[0039] According to an aspect of the present invention, the connection of the transparent panels, preferably of a constraining end or of a protruding constraining portion of the panel with the connecting element, and in particular with the supporting portion of the connecting element, is carried out by connection means, for example screws.

[0040] According to an aspect of the present invention, the panels of the roofing system comprises a reinforcing layer extending on the constraining end of the panel and a constraining end of a first panel is connected to a first supporting portion of the connecting element, with the interposition of the reinforcing layer, and a constraining end of a second transparent panel is connected to a sec-

ond supporting portion of the connecting element, with the interposition of the reinforcing layer.

[0041] It should be noted that the features here described and/or claimed with reference to the connecting element can be referred to the roofing system, and vice versa.

[0042] The present invention relates also to the use of a connecting element here described and/or claimed for the connection of at least two transparent panels.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043] Further aspects and advantages of the present invention will be evident by the following description with reference to the enclosed drawings, given by way of non-limiting example, wherein:

Figure 1 is a section view of two transparent panels jointed together by a connecting element according to an embodiment of the present invention;

Figure 2 is a section view of a portion of a covering comprising two panels jointed together by the connecting element of Figure 1;

Figure 3 is a section view of the connecting element of Figure 1; and

Figure 4 is a section view of a protection element for the connecting element of Figure 1;

Figure 5 is a perspective view of a possible embodiment of the connecting element;

Figure 6 is a section view of an alternative embodiment of the connecting element; and

Figure 7 is a partial perspective view of a possible embodiment of a panel having a reinforcing layer which can be constrained to the connecting element according to the invention.

DETAILED DESCRIPTION OF SOME EMBODIMENTS OF THE PRESENT INVENTION

[0044] With reference to Figure 1, the assembly 10 of two transparent panels 15 jointed together through a connecting element 30 is shown in details, according to an embodiment of the invention. Figure 7 shows a partial perspective view of a possible embodiment of a panel 15 which can be used with the connecting element 30.

[0045] The panels 15 can be used in the formation of skylights and in general of surfaces suitable to let the light pass through the same, for example in buildings for industrial use or similar, for example warehouses or storehouses.

[0046] For this purpose, panels 15 are provided with a layer 20 made of transparent material, i.e. a material which allows the light radiation to pass through it.

[0047] This layer 20 can be made of polycarbonate. Despite this, other materials can be used, such as Plexiglas, or other polymeric materials, and in general plastic or thermoplastic material, which, in addition to have a high transparency, are also light and cost-effective to pro-

duce, for example by extrusion.

[0048] It should be noted that the layer of transparent material can be made of polycarbonate with an honeycomb structure as well, as for example in the embodiment shown in figures.

[0049] The panels 15 also comprises ends 20', or protruding portions, that are used to constrain the panel to another element of the covering. According to the present invention, the constraining end, or protruding constraining portion 20', of the panel is constrained to the connecting element 30. The constraining end or protruding constraining portions 20' extend along the entire length of the panel sides on which they are provided.

[0050] The constraining ends or protruding constraining portions 20' of the panel 15 can have a substantially 'U' shape, and in particular an 'inverted U' shape.

[0051] Preferably, the panel is provided with two protruding 'U' shaped portions extending on two opposed sides of the panel 15.

[0052] Here and hereafter, the expression substantially 'U-shaped' will be used to indicate that the constraining ends or protruding constraining portions 20' of the panel are shaped according to the configuration known in the field of roofing panels as a greek profile (i.e. according to a substantially trapezoidal shape). For example, the constraining ends or protruding constraining portions 20' have substantially three surfaces 20a, 20b e 20c which, preferably, extend from the layer of the transparent material.

[0053] More in details, as for example shown on Figure 1 and in Figure 7, according to a possible embodiment, the substantially 'U' shaped portions have a first inclined surface 20a, a second surface 20b parallel to the extension of the layer made of transparent material of the panel, and therefore of the panel 15, and a third surface 20c which is extending from the second surface 20b. As already mentioned, this shape is commonly identified in the field of covering as a greek profile or greek fret profile.

[0054] Other embodiments are possible, for example according to an alternative embodiment, not represented for simplicity, the protruding constraining portions of the panel can comprise only two surfaces 20a, 20b which, preferably, extend from the layer of the transparent material.

[0055] It should also be noted that the main portion of the panel can be flat or can have, as shown for example in the figures, one or more corrugations in shape of a greek profile, or wave, or other shapes.

[0056] It should also be noted that the panel 15 and in particular the layer of transparent material 20, as well as the constraining ends or protruding constraining portions 20' can be at least partially curved for forming a curved covering. In particular, the panel 15 can be curved along its length, i.e. along its extension according to the sides where the constraining ends or protruding constraining portions 20' are arranged. As it will be discussed in greater detail below, also the connecting element 30, 30' according to the present invention, can have an extension

in length either curved (not shown), or flat (i.e. straight) as for example in the possible embodiment shown in Figure 5. It should be noted that what described here can be applied both to the embodiment according to which the panel 15 and the connecting element 30, 30' present a curvature along their extension in length, and to the embodiment according to which they present a flat, i.e. straight, extension.

[0057] For example, it should be noted that the section views of the Figures 1, 2, 3 and 6 of the connecting element can be referred both to the embodiment according to which it has a straight extension (as for example shown in Figure 5), and to a possible embodiment according to which the connecting element is curved along its extension in length.

[0058] A reinforcing layer comprising a net 25, preferably made of metal, is constrained to the panels 15, as seen for example in the partial perspective view of Figure 7.

[0059] The net 25 comprises a plurality of wires, preferably bound together by welding.

[0060] According to an aspect of the present invention, the metal net is preferably welded, and in particular electrically welded. However, chain link nets (single twist), double twist nets, etc. can be used, too.

[0061] Furthermore, the net can have different mesh shapes, and preferably a rectangular or square mesh is used, that is to say formed by substantially straight wires and parallel one to another which substantially cross perpendicularly.

[0062] As for example shown in Figure 1 and in Figure 7, the net comprises straight wires 25a, i.e. wires extending along the extension in length (Y) of the panel (in the direction identifying the length of the panel 15). According to an embodiment, the wires 25a extend substantially parallel to the extension in length of the panel, and in particular to the opposed ends of the panel.

[0063] The reinforcing layer, i.e. the net, can be replaced by any other material, like for example a plastic material, possibly reinforced with fibres, composite materials, etc., which at the same time allows the light to pass through and gives a greater resistance to loads or to impacts than the layer of transparent material of the panel.

[0064] The reinforcing layer 25 is constrained to the lower layer of the panel. It should be noted that the constraint between the reinforcing layer or layers 25 with the panel can be obtained in different ways.

[0065] According to a preferred aspect, the constraint is obtained by an adhesive suitable to this purpose, like for example a two-component adhesive.

[0066] The adhesive can be arranged only in some points or areas of the surface of the panel or else it can be arranged on the entire surface to which the reinforcing layer 25 has to be constrained. It has to be noted that with the term "adhesive", any glue is meant suitable to allow the constraint of the reinforcing layer/s to the first layer of transparent material. Preferably, a glue of fluid

type is used.

[0067] According to a possible embodiment, the net 25 is arranged in such a way that the wires 25a composing the same, are arranged at the folds of the surface of the layer of transparent material, and at the protruding constraining portions which allow the constraint of the panel. Preferably, the folds are straight and extend substantially parallel to the lengthwise development of the panel.

[0068] In general the reinforcing layer, and in particular the reinforcing net 25, is shaped, preferably upon deformation thereof, so that to fit the panel shape, and in particular to the folds thereof.

[0069] It should be noted that in case the panel has a curved surface, for example in its extension along the length (according to the sides in correspondence of which the constraining ends or protruding constraining portions 20' are located), the reinforcing layer 25 and in particular the net will be arranged so as to get adapted and therefore to fit the shape of the surface of the panel where it is secured.

[0070] According to a preferred embodiment, the reinforcing layer 25 is extending in correspondence of the constraining ends or protruding constraining portions 20' of the panel. For example, the reinforcing layer, for example a net preferably made of metal material, can extend in correspondence of at least one surface 20a, 20b, 20c of the panel.

[0071] According to an embodiment, the reinforcing layer extends at least in correspondence of the first and of the second surface 20a, 20b of the protruding constraining portion of the panel. Moreover, according to a possible embodiment, as shown for example in Figure 1 and in Figure 7, the reinforcing layer 25 extends in correspondence of three surfaces 20a, 20b, 20c of the constraining ends or protruding constraining portions 20' of the panel, and in particular in correspondence of all the surfaces of the greek profile shape of the protruding constraining portion of the panel.

[0072] Panels 15 of this type are for example described in the document EP 2 781 667, in the name of the Applicant. These panels 15, shown for example in the partial perspective view of Figure 7, can be used with the connecting element 30, 30' according to the present invention and connected between them through this connecting element so as to form a roofing system.

[0073] With regards to the connecting element 30, 30' of panels 15, according to a possible embodiment, it comprises a main flat portion 30g provided at its ends 31 with two lateral portions 30a, 30d, which, as disclosed in detail in the following, can be bent at an angle with respect to the main portion 30g, wherein each one of the lateral portions 30a, 30d is connected to a supporting portion 30b, 30e, which is spaced out (arranged at distance) from the main portion.

[0074] According to a possible embodiment, as shown for example in Figures 1, 2, 3, and 5, the connecting element 30 of panels 15 comprises a flat main portion 30g having at its ends 31 two lateral portions 30a, 30d,

forming an acute angle α with the main portion 30g. A supporting portion 30b, 30e extends from the end of the lateral portion, which is spaced out from the main portion and extends towards the centreline A of the main portion 30g.

[0075] In other words, this configuration of the connecting element 30 is made in a way so that the supporting portions 30b, 30e, extending from the respective lateral portions 30a, 30d, overlap the main portion 30g, so as to form raised portions with respect to the main portion 30g.

[0076] In other words, this configuration results in the presence of two cavities arranged substantially underneath each supporting portion 30b, 30e which allow, as it can be seen in the following, the accommodation of at least part of the connection means 60 of the panels 15 to the connecting element, such as for example screws, etc.

[0077] According to an aspect of the present invention, the supporting portion is angled with respect to the lateral portion, preferably at an obtuse angle. The angle between the surfaces is the one facing the main portion, i.e. the one that according to the positioning of the connecting element in the figures is measured underneath the lateral portions and supporting portions.

[0078] As already said before, the word 'centreline' A is used to indicate the middle part of the main portion 30g. The centreline A (see for example Figure 1) corresponds therefore to the portion equidistant from the ends 31 of the main portion 30g where the lateral portions 30a, 30d extend from. According to a possible embodiment, the centreline A corresponds to a plane perpendicular to the main portion 30g which is equidistant from the ends 31, or sides, of the main portion 30g from which the lateral portions 30a, 30d extend.

[0079] It should be noted that the extension of the supporting portions 30b, 30e towards the centreline A can occur according to various inclinations. According to a preferred embodiment, the supporting portions 30b, 30e are parallel to the main portion 30g.

[0080] It should be noted that the main portion 30g can either be flat or can be provided with one or more curved or corrugated portions, like for example a greek profile or wave-shaped. It should be noted that the condition of parallelism of the supporting portions 30b and 30e, in case the main portion 30g is not completely flat, can anyway be referred to the plane according to which the main portion 30g extends, although having corrugations or curvatures, otherwise it can be referred to a plane on which the main portion 30g can be laid.

[0081] Therefore, the connecting element 30 comprises two protrusions, or relief portions (raised), with respect to the main portion, each one having a lateral surface 30a, 30d and a supporting portion 30b, 30e which is spaced out from the main portion 30g.

[0082] Advantageously, these raised portions are suitable to cooperate with the constraining ends or protruding constraining portions 20' of two panels 15 which are in-

tended to be constrained to the connecting element 30.

[0083] In a section view, as for example shown in Figure 1 and in Figure 3, the main portion, the lateral portions and the supporting portions are represented by segments.

[0084] According to an aspect of the present invention, the raised portions, each comprising the lateral surface 30a, 30d and the supporting portion 30b, 30e are substantially shaped in a way complementary to the constraining ends or protruding constraining portions 20' of the panel 15.

[0085] Each lateral surface 30a, 30d forming an angle with the main portion 30g, and the supporting portion 30b, 30e which is spaced out from the main portion 30g (preferably parallel to it), are therefore substantially shaped (for example according to the shape of a greek profile) in a way substantially complementary to the shape (for example of a greek profile) of the constraining ends or protruding constraining portions 20' of the panel 15.

[0086] More in details, an end 20' of a first transparent panel 15, which, as already said, can be equipped with the reinforcing layer 25, is connected to one of the supporting portions 30b of the connecting element 30 and an end 20' of a second transparent panel 15 is connected to the other supporting portion 30e of the connecting element 30. In general, each one of the supporting portions 30b, 30e is configured for the connection to a transparent panel 15.

[0087] In particular, according to a possible embodiment, the second surface 20b of the end 20' of the panel, which is substantially parallel to the plane of extension of the panel itself, is configured to be overlapped (superimposed) with the supporting portion 30b, 30e of the connecting element 30.

[0088] In particular, the connection of the ends 20' of the transparent panels 15 with the respective parallel supporting portions 30b, 30e can be achieved by means of screws 60 or by any other known connection means.

[0089] As for example shown in Figure 1, the reinforcing layer 25 of the panel, and in particular, the net preferably made of metal, is positioned in-between the panel 15 and the connecting element 30, and in particular, positioned in-between at least part of the constraining ends or protruding constraining portions 20' of the panel and at least part of the raised portion of the connecting element. More in details, the reinforcing layer 25 is for example interposed between the supporting portion 30b, 30e and the surface 20b of the end 20' of the panel that is overlapped with the supporting portion.

[0090] In other words, the connection of the panel 15 to the connecting element 30 is made by positioning in-between the reinforcing layer 25, as for example shown in Figure 2, which is a section view of an assembly composed by two panels 15 jointed together by the connecting element 30, and also in the detailed view of Figure 1.

[0091] It should be noted that in Figure 2 is shown a possible embodiment where the transparent panels 14

have corrugations, or greek profiles in their central portion.

[0092] According to a possible embodiment, as for example shown in Figure 3, which is a section view of the connecting element 30 of Figure 1, an end portion 30c, 30f is connected to each supporting portion 30b, 30e. In other words, from each supporting portion extends another portion, also indicated herein as end portion.

[0093] Preferably, each one of these end portions 30c, 30f is angled with respect to the main portion 30g and in particular is angled so as to extend approaching towards the main portion 30g (or anyway to extend downward), starting from the supporting portion.

[0094] According to an aspect of the present invention, the end portion is angled with respect to the supporting portion, preferably at an obtuse angle. The angle between the surfaces is the one facing the main portion, i.e. the one measured underneath the end portions and the supporting portions according to the position of the connecting element in the figures.

[0095] The presence of the inclined end portion 30c, 30f allows the connecting element 30 to adapt itself to the ends 20' of the panels 15 to which it is connected. In particular, the presence of the end portion 30c, 30f leads to the formation of a raised portion with respect to the main portion, which comprises three surfaces angled between them, to determine a substantially 'U' shape, and in particular an inverted 'U' shape, or a greek profile, so as to adapt to the ends 20' of the panel 15.

[0096] In particular, from the two ends 31, or sides, of the main portion 30g, a lateral portion 30a, 30d extends, from which, in turn, a supporting portion 30b, 30e extends and from which a third portion, or end portion 30c, 30f extends. This configuration allows the connecting element to have a shape complementary to the shape of the ends 20' of the panels 15 and in particular to the greek profile shape, where it comprises three surfaces 20a, 20b, 20c angled between them.

[0097] It should be noted that the presence of three surfaces and in particular the presence of the end portion 30c, 30f allows to provide support also for the third surface 20c of the constraining ends or protruding constraining portions 20' of the panel. Despite this, it should be noted that the end portion 30c, 30f is an option. In absence of the end portion, the connecting element 30 according to the present invention is able to get adapted and to effectively support the corrugated shape of the end 20' of the panel comprising two or three surfaces.

[0098] It should be noted that the dimensions of the flat surface 30g, and in particular its width X and its length Y, can vary according to installation needs, for example in relation to the dimensions of the panels 15 that are intended to be constrained to the connecting element 30.

[0099] In general, the flat surface 30g has a width X comprised between about 50 centimetres and about 5 centimetres, preferably comprised between about 30 centimetres and about 5 centimetres, and even more preferably comprised between about 20 centimetres and

about 5 centimetres. For example, some possible embodiments provide a width X of the main portion of about 15 centimetres, or about 12 centimetres.

[0100] According to an aspect of the present invention, the connecting element 30 has a predominant lengthwise extension, as shown for example in the perspective view of Figure 5. As discussed above, it should be noted that, even if in Figure 5 the connecting element is shown to have a straight extension in length, i.e. according to an axis (which determines for example a straight extension of the ends 31), according to other possible embodiments not shown, the connecting element can be curved along its extension in length (determining for example a curved extension of the ends 31).

[0101] The connecting element has an extension in length Y, greater than the other two dimensions, and in particular than the width X. The extension in length Y of the connecting element can be for example equal to, or greater than 15 centimetres. However, it should be noted that the length Y is preferably greater than the width X of the connecting element.

[0102] As already said, the connecting element 30 can be provided with a length Y corresponding to that of the panels 15 which are intended to be constrained to it, otherwise it can be provided with a shorter length. In case the connecting element 30, 30' has a length Y shorter than that of the panels to be constrained to it, two or more connecting elements can be used, arranged in sequence along the length of the panel, if necessary with an empty gap between two or more connecting elements.

[0103] The maximum extension in length Y of the connecting element can be chosen according to the installation needs and for example can be up to about 15 metres or up to 13 metres which correspond for example to possible lengths of the panels 15.

[0104] In fact, the extension in length of the transparent panels which are intended to be constrained to it, and can be for example equal to 30 centimetres, but can be up to 15 metres as well, preferably up to about 13 metres.

[0105] It should be noted that the length Y of the connecting element is preferably measured along a straight line, also in case the connecting element develops in a curved way along its length. For example, the length Y is measured along a straight line extending between the two end sections of the connecting element, for example between two parallel planes delimiting the connecting element in its extension in length.

[0106] It should also be noted that according to an aspect of the present invention, the width X' of each of the supporting portions 30b and 30e can conveniently be chosen to allow the passage of connection means 60 of the panel to the connection means, such as for example screws, besides corresponding substantially to the shape/dimensions of the protruding constraining portions 20' of the panel 15.

[0107] The width X' of each of the supporting portions 30b and 30e can be between about 1 centimetre and about 6 centimetres, preferably between about 2 centi-

metres and about 5 centimetres.

[0108] The connecting element 30 can be made in metal plate (metal sheet), for example in iron-zinc plate. In general, a metal plate is used for making of the connecting element 30. For making the lateral portions 30a, 30d, and of the supporting portions 30b, 30e and of the end portions 30c, 30f (where present) it is possible to use a plate which is conveniently bent, through means known in the technique, to form the connecting element 30 and the related angles between its portions. The plate has preferably a fixed thickness, as shown for example in the attached figures.

[0109] According to an aspect of the present invention, in the junction area between two transparent panels 15 it is possible to add, as an option, at least a second layer 50 of transparent material, positioned underneath the connecting element 30 and constrained to it.

[0110] Moreover, according to a further embodiment, it is possible to arrange a protection element 40 of the connecting element 30 (Figure 4).

[0111] The protection element 40 for the connecting element 30 is shown in Figure 4, where the protection element 40 is shaped to cover on the upper part the ends 20' of the panels 15 constrained to the connecting element 30, 30' as well as the gap present between the two ends 20' of the panels 15 constrained to the connecting element. In other words, the protection element substantially provides a cover positioned on the upper portion of the protruding constraining portions 20' of the panels connected to the connecting element.

[0112] Preferably, the protection element 40 is shaped in a complementary way to the ends 20' of the panels connected to the connecting element 30, 30' and is preferably positioned on top of them before installing the connection means 60, for example screws.

[0113] In fact, according to an aspect of the present invention, the protruding constraining portions 20' of the panels 15 are interposed, and then held after the installation of connection means 60, between the protection element 40 positioned on the top of them and the connecting element 30, 30', and in particular its supporting portion 30b, 30e, positioned below the constraining portions 20' of the panels.

[0114] According to a possible embodiment, the protection element is provided with a main portion, that can comprise two surfaces 40b and 40c arranged at a small folding angle between them, and ending in correspondence of two ends of the main portion with two angled portions 40a and 40d.

[0115] The protection element 40 can be realized in metal plate, for example in aluminium plate.

[0116] It should also be noted that, as shown for example in Figure 1 and in Figure 4, a layer 41 of insulating material (for example a foamed polyurethane) can be arranged on the lower surface of the protection element which is intended to contact, in use, with the upper portion of the constraining portions 20' that is constrained to the connecting element 30, 30'. This layer of insulating ma-

terial allows to increase the tightness and consequently acts as a gasket against the passage of water, dust, impurities, etc. from outside. Moreover, this layer of insulating material 41 profitably allows the elimination, or at least the reduction, of any possible formation of water condensation.

[0117] Figure 6 is a section view of an alternative embodiment of the connecting element, shown with the numerical reference 30'.

[0118] The connecting element 30' of panels 15 comprises a main flat portion 30g having at its ends 31 two lateral portions 30a, 30d angled (at an obtuse angle α) with respect to the main portion 30g, where each one of the lateral portions 30a, 30d is connected to a supporting portion 30b, 30e which is spaced out from the main portion.

[0119] In the connecting element 30', each of the supporting portions 30b, 30e depart (extend away) from the centreline (A) of the main portion 30g.

[0120] In other words, the connecting element 30 is shaped in such a way that the supporting portions 30b, 30e, extending from the respective lateral portions 30a, 30d, do not overlap, in general, with the main portion 30g, but are anyway on a different plane with respect to the main portion 30g.

[0121] In other words, this shape results in the presence of two cavities substantially arranged underneath each supporting portion 30b, 30e, which allow, like in the case of the connecting element 30 previously described, the housing of at least parts of connection means 60 of the panels 15 to the connecting element, as for example screws, etc.

[0122] Finally, it should be noted that in the connecting element 30', each one of the two lateral portions 30a, 30d is connected at obtuse angle to one end of the main portion 30g. It should be noted that what here described and/or claimed with regards to the first embodiment of the connecting element 30 can be referred to a further embodiment of the connecting element shown in Figure 6, and vice versa, with the exception of the different extension of the supporting portions 30b, 30e, that in one case extend towards the centreline of the main portion so as to result overlapped to it, and that in the second case they extend sideways as regards the main portion away from the centreline.

[0123] Advantageously, the connecting element 30, according to the present invention (as well as the connecting element 30') allows the connection of two panels in adjacent position, i.e. one next to the other one, by the interposition of the connecting element 30 between them, in a quick and simple, but also effective and safe way.

[0124] It should be noted that, according to the invention, the roofing system comprises, as described above, at least two panels and a connecting element 30, 30' every two panels 15 that has to be connected, as for example shown in Figure 2 and in the detailed view of Figure 1.

[0125] According to the present invention, a roofing

system (or set of panels for forming covering) comprises a plurality of panels where two adjacent panels 15 are constrained by means of a connecting element 30, 30'.

[0126] As already said, the connection of the constraining ends 20' of the transparent panels 15, for example of a surface 20b of the constraining ends with a connecting element 30, and in particular with the respective supporting portions 30b, 30e, is carried out by connection means, preferably screws 60.

[0127] To this purpose, it should be noted that, in correspondence of the constraining ends or protruding constraining portions 20' of the panel 15, preferably in correspondence of an area of a surface of the protruding constraining portion, screws 60, or other similar connection means, are installed.

[0128] In particular, according to a possible embodiment, as for example shown in Figure 1, the second surface 20b allow the installation of connection means 60, and in particular of screws that, when in use, are let to pass through it, and through the supporting portion 30b, 30e of the connecting element, down until remaining at least partially housed in the cavity formed underneath the supporting portion which, as already said, is spaced out from the main portion 30g.

[0129] Along the extension in length of the panel, a plurality of connection means 60, for example screws, will be installed at variable spacing according to constructive requirements.

[0130] The reinforcing layer, and in particular the net 25, is laid, as said before, in correspondence of the constraining ends or protruding constraining portions 20' of the panel and interposed between the panel and the connecting element.

[0131] More in details, according to a possible embodiment, the net 25 is arranged in a such way that the connection means 60 (for example screws) are inserted at least in one mesh of the net, as for example shown in the embodiment of Figure 1.

[0132] Moreover, according to a possible embodiment, as for example shown in Figure 1, at least one mesh of the net 25 is positioned externally compared to the mesh where the connection means 60 are inserted. In fact, the net extends also on the surface 20c of the protruding constraining portions 20' of the panel 15, and the meshes arranged in correspondence of this surface 20c remain outside the connection means 60.

[0133] More generally, the reinforcing layer 25, and in particular the net, has an extension on the constraining ends or protruding constraining portions 20' of the panel, so as, after the installation of the connection means 60 (for example a screw), at least one wire 25a, and preferably at least two wires 25a of the net (as for example shown in the embodiment of Figure 1), extending preferably along the panel length, remain outside the connection means 60.

[0134] By doing so, it is possible to increase the resistance and the safety offered by the panel and by the connecting system according to the invention.

[0135] It has to be noted that the term "outside" or "externally" is used to indicate that the meshes, or the wires 25a, are placed laterally with respect to the connection means 60, away from the centreline A (middle part) of the connecting element.

[0136] Obviously, changes or improvements, dictated from specific or particular reasons, may be introduced to the invention as described, without departing from the scope of the invention.

[0137] For example, as previously said, the connecting element 30, 30' of panels 15, can have an extension along the length and therefore an extension along the ends 31, or sides of the main portion, so as to have a curvature instead of having a straight extension as shown for example in the embodiment of Figure 5.

Claims

1. A connecting element (30,30') for transparent panels (15) for forming coverings (10), wherein said connecting element (30,30') comprises a main portion (30g) having at its ends (31) two lateral portions (30a,30d), wherein each lateral portion (30a,30d) connects the main portion (30g) to a respective supporting portion (30b,30e), and each supporting portion (30b,30e) is spaced out from the main portion (30g) and is configured for the connection to a transparent panel (15).
2. The connecting element (30) according to claim 1, **characterised in that** each supporting portion (30b,30e) extends towards the centreline (A) of the main portion (30g).
3. The connecting element (30') according to claim 1, **characterised in that** each supporting portion (30b,30e) departs from the centreline (A) of the main portion (30g).
4. The connecting element (30,30') according to any previous claims, **characterised in that** the main portion (30g) has a width (X) comprised between 50 centimetres and 5 centimetres, preferably comprised between 30 centimetres and 5 centimetres, and even more preferably between 20 centimetres and 5 centimetres.
5. The connecting element (30,30') according to any previous claims, **characterised in that** each of the lateral portions (30a,30d) is angled with respect to the main portion (30g), preferably each lateral portion (30a,30d) is connected at an acute or at an obtuse angle (α) to one of the ends (31) of the main portion (30g).
6. The connecting element (30,30') according to any previous claims, **characterised in that** the support-

ing portions (30b,30e) are substantially parallel to the main portion (30g).

7. The connecting element (30,30') according to any previous claims, wherein an end portion (30c,30f) extends from the ends of said supporting portions (30b, 30e), preferably said end portion (30c,30f) is angled with respect to the main portion (30g).
8. The connecting element (30,30') according to any previous claims, **characterised in that** it is realized in metal plates, preferably in iron-zinc plates.
9. The connecting element (30,30') according to any previous claims, **characterised in that** it has a prevailing lengthwise extension.
10. A roofing system (10) comprising at least two transparent panels (15) and at least one connecting element (30,30') according to any previous claims, wherein said at least two panels (15) are connected to said at least one connecting element (30,30').
11. The roofing system (10) according to claim 10, wherein said panels (15) comprise at least one constraining end (20'), and where a constraining end (20') of a first transparent panel (15) is connected to a first supporting portion (30b) of the connecting element (30,30'), and a constraining end (20') of a second transparent panel (15) is connected to a second supporting portion (30e) of the connecting element (30,30').
12. The roofing system (10) according to claim 11, wherein said panels (15) comprise a reinforcing layer (25) extending on at least part of said constraining end (20') of the panel (15), and wherein a constraining end (20') of a first transparent panel (15) is connected to a first supporting portion (30b) of the connecting element (30,30') by the interposition of the reinforcing layer (25), and a constraining end (20') of a second transparent panel (15) is connected to a second supporting portion (30e) of the connecting element (30,30') by the interposition of the reinforcing layer (25).
13. The roofing system (10) according to any claims 10 to 12, wherein the connection of the constraining ends (20') of the transparent panels (15) with the respective supporting portions (30b,30e) is carried out by connection means, preferably screws (60).
14. The roofing system (10) according to any claims 10 to 13, where in an area of connection between two transparent panels (15), at least one layer (50) of transparent material positioned underneath the connecting element (30,30') is provided and is constrained to it.

15. The roofing system (10) according to any claims 10 to 14, comprising a protection element (40) of the connecting element (30,30'), preferably the protection element (40) is realized in metal plates, more preferably in aluminium plate.

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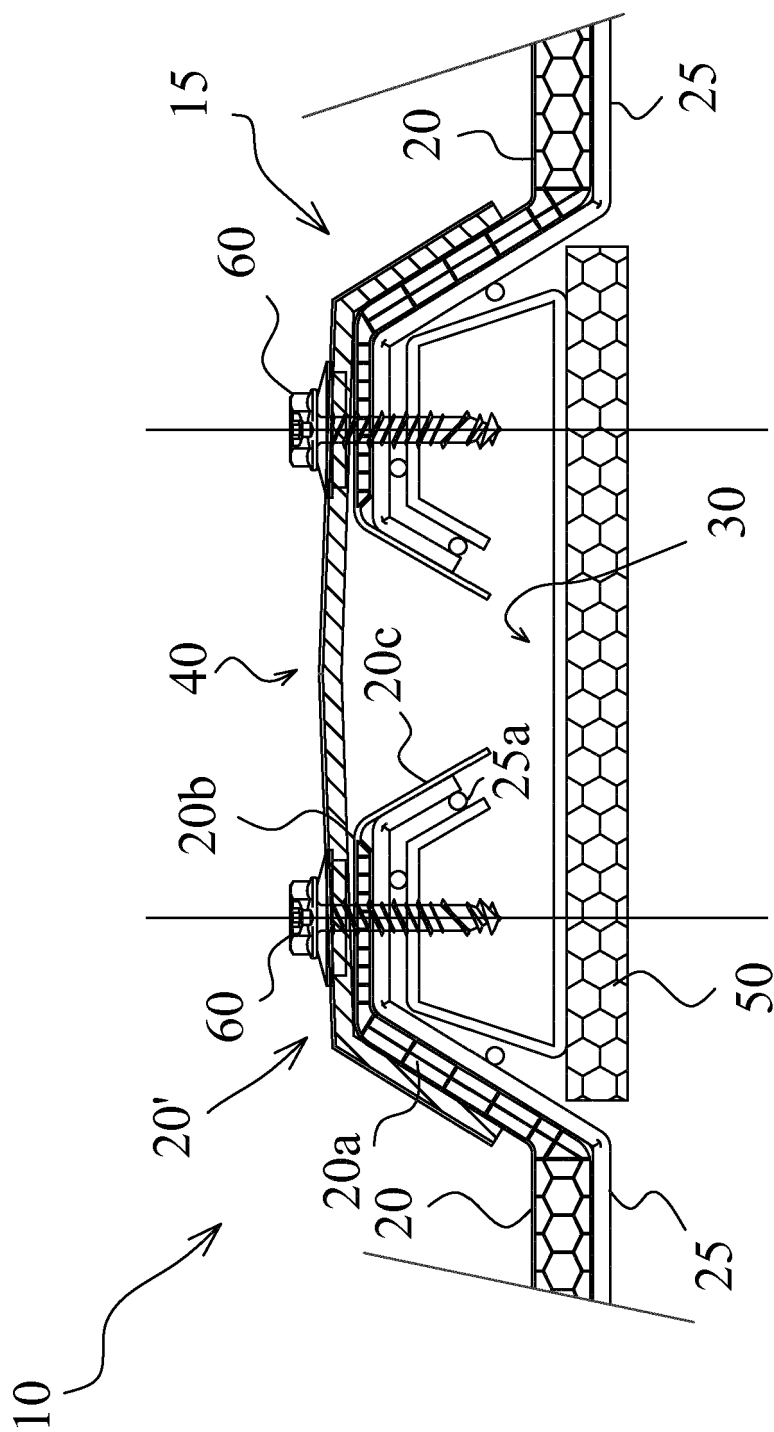


FIG. 1

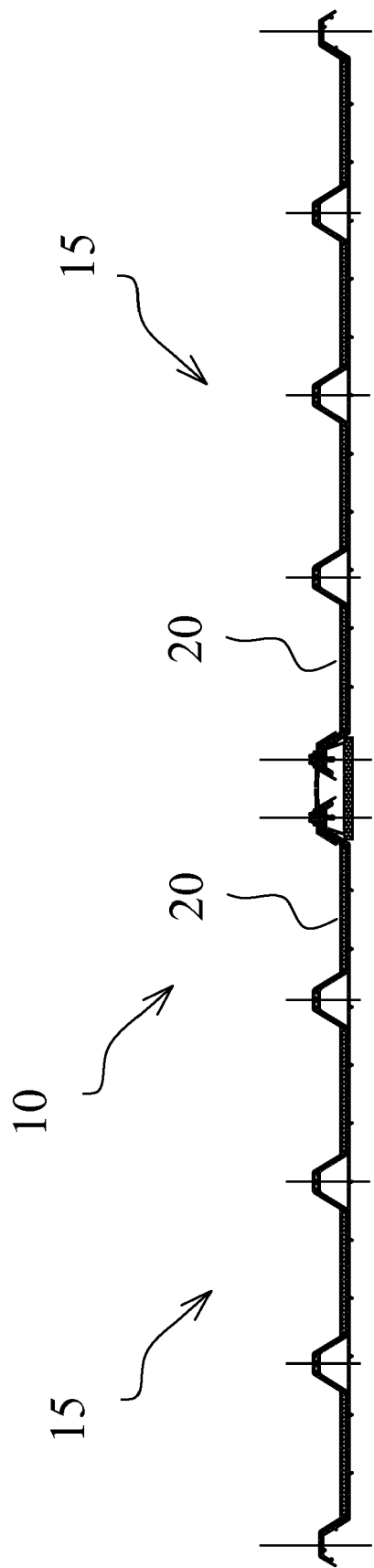


FIG.2

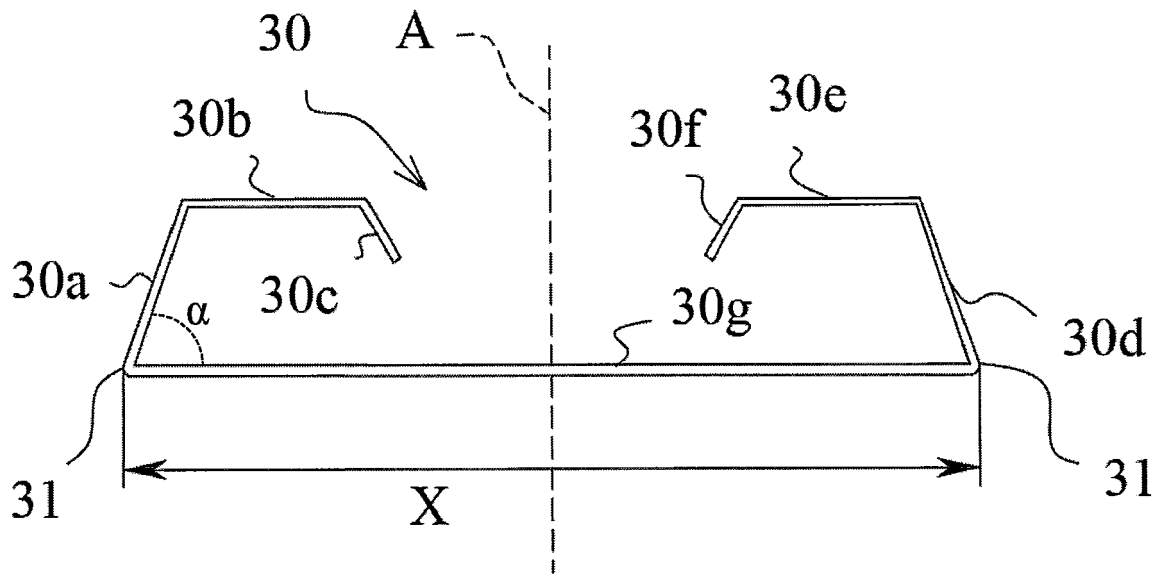


FIG.3

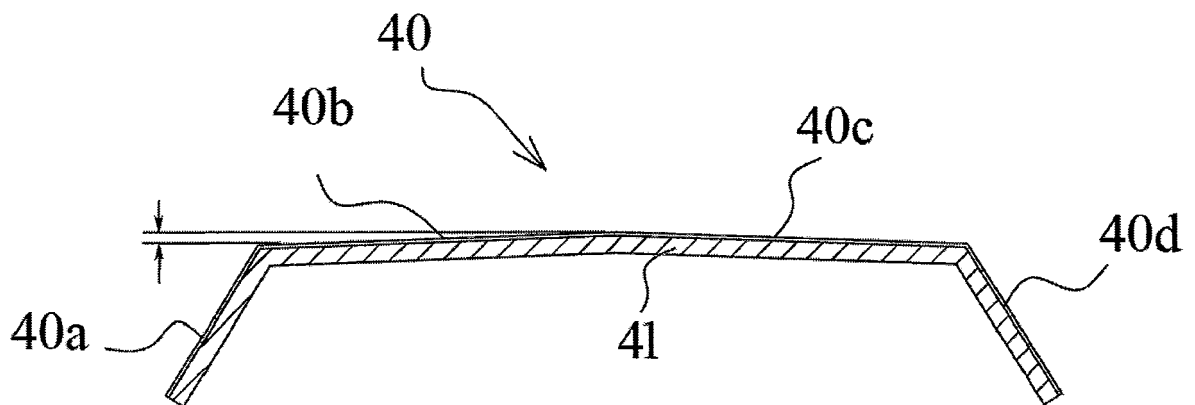


FIG.4

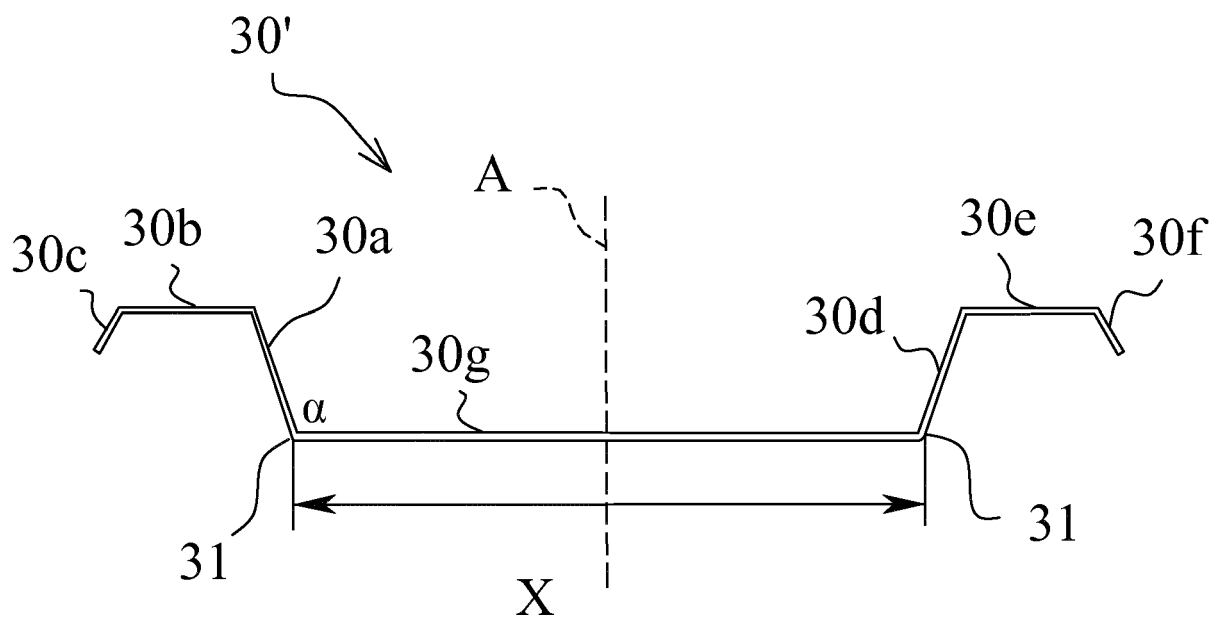
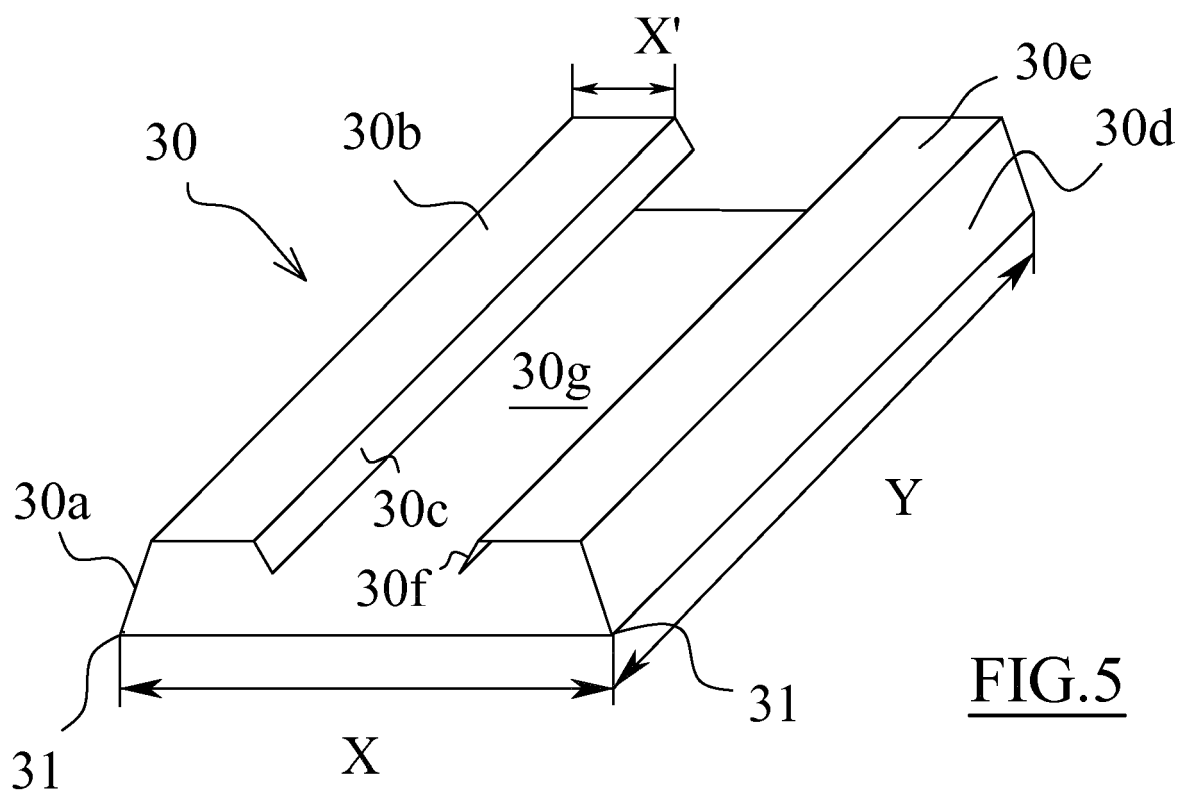


FIG. 6

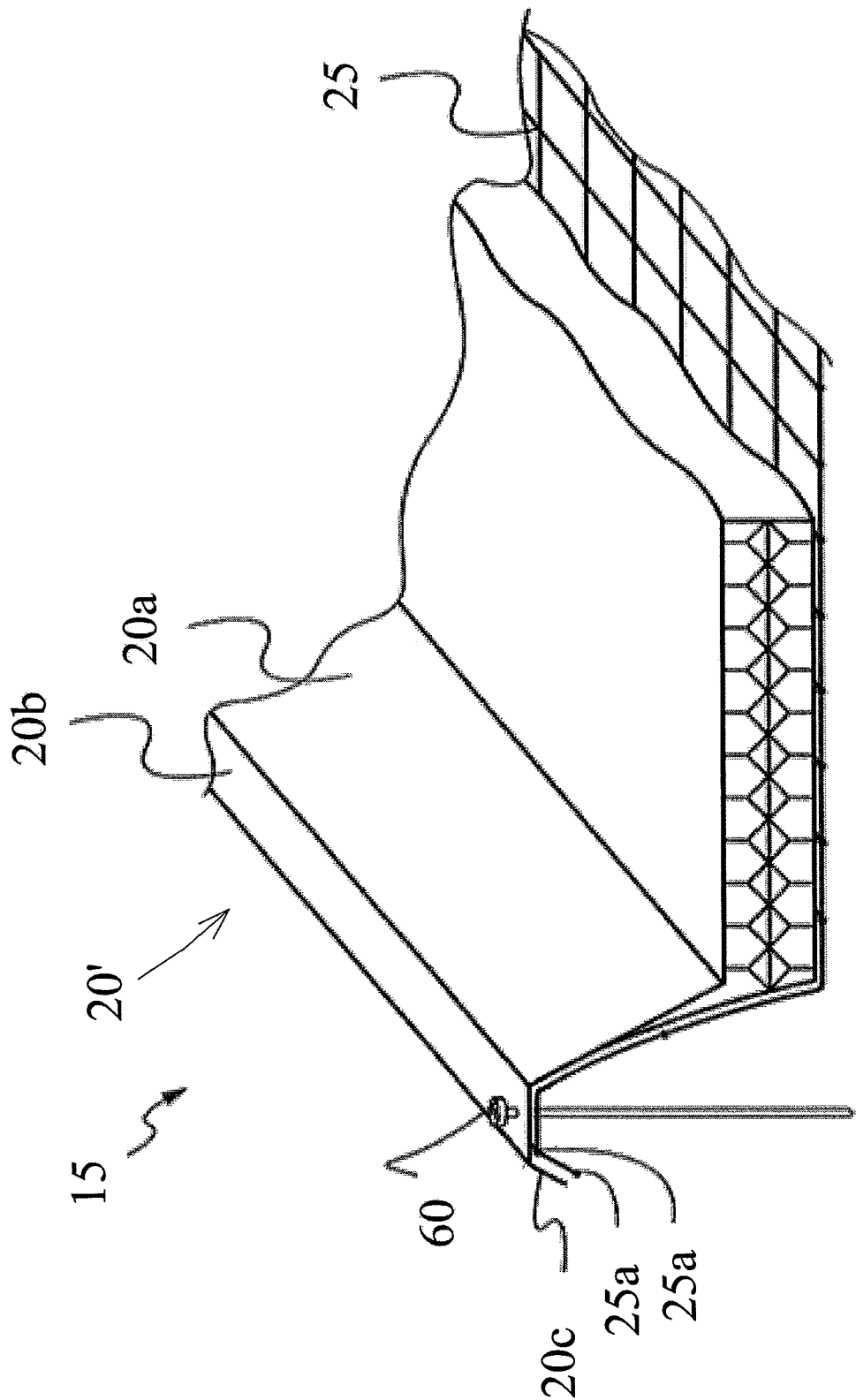


FIG. 7



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