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(54) **A modular construction element and a protective cap, and a method for assembling a plurality of modular construction elements using the cap**

(57) A modular construction element (1,1' ,36, 37, 44, 45, 46) comprises a base (2) having at least one free edge (7,8) and at least one upstanding web (9,10) at a distance (x,y) from the at least one free edge (7,8) to define an offset (11,12), which provides an abutment face (17,18) for a means (20,21,34) for securing the base on a subjacent surface (27,48,49,50). The modular construction element it combined with a plurality of construction elements in an assembling method in which a protective cap is mounted on the upstanding webs to provide an attractive covering, such as a roofing. In the method the modular construction elements are easy to substitute and assemble without making holes in the modular construction elements.

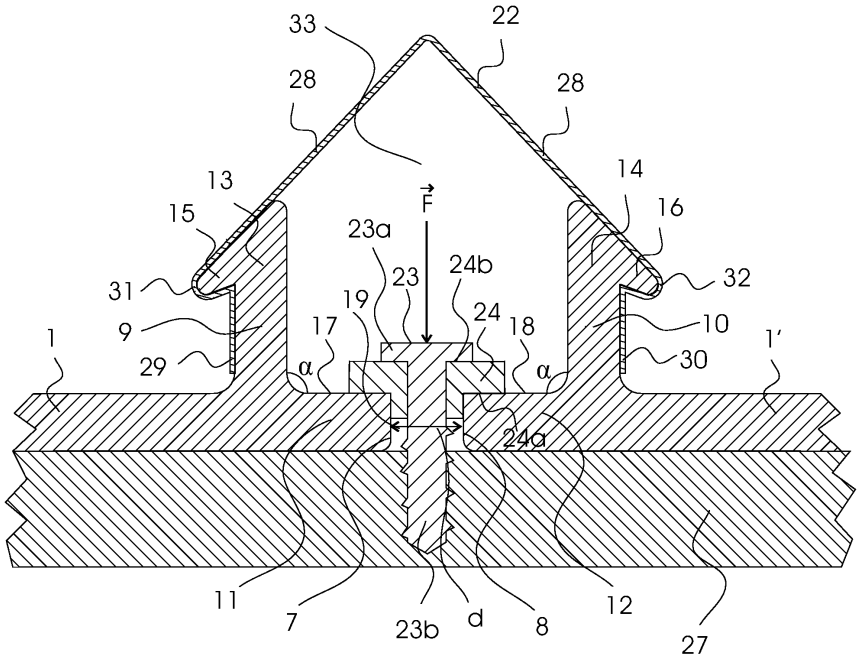


Fig. 3

EP 2 003 261 A1

Description

[0001] The present invention relates to a modular construction element comprising a base having at least one free edge, and at least one upstanding web for assembling two juxtaposed elements.

[0002] The present invention also relates to a method for assembling a plurality of modular construction elements, using securing means and a protective cap for the assembly.

[0003] The modular construction element could e.g. be used in the construction of parts of buildings, such as roofs or walls, but is not limited to these parts of buildings, and could also be used in other types of constructions.

[0004] When constructing these parts of buildings, modular construction elements are positioned next to each other and assembled to form a closed surface for protecting the building from external effects, e.g. environmental effects such as rain and wind.

[0005] In conventional assemblies of modular construction elements, such as boarding or planking, the elements are screwed or nailed to the building.

[0006] Panels for use in roofing or walls may be made from a variety of materials having different physical, mechanical and chemical properties, and the material appropriate for a specific use should be selected carefully. Metal is a workable material but heavy, relatively expensive and deformation resistant. Also, most metals are susceptible to chemical attacks such as corrosion, which will provide a roofing panel or any other visible building element made of metal with a rather unattractive appearance.

[0007] Another known material is wood. Wood is an expensive material, susceptible to rot and must be impregnated or repeatedly painted to preserve appearance and sustained life. Also, if e.g. a plurality of roofing panels is made of wood a huge waste of material is unavoidable, hence wood is an expensive material for use in roofing.

[0008] Also plastic materials may be preferred for some uses because such a material is extrudable and cheap, however plastic is also brittle and often not able so resist mechanical forces.

[0009] Hence there is a need within the art for modular construction elements of a material having a combination of at least most of the beneficial properties of the known materials, and at the same time is void of the adverse properties.

[0010] Recently more sophisticated approaches have been made to provide a fast and easy way of constructing these building parts.

[0011] European patent application no. EP 0 050 462 Al discloses an extruded modular panel unit for the construction of wall sections. The panels have a base and a joining flange provided on both edges of each panel, so that the panels have a L-shaped form at their ends. Two adjacent panels are joined by an U-formed joining member provided with serrations, which engageably matches the serrations on the insides of the joining flanges of the two adjacent panels. The outside of each joining flange is smooth so as to improve the sealing properties of the joint between two adjacent panels.

[0012] European patent application no. EP 0 339 216 A1 discloses a translucent self-supporting enclosure for building structures consisting of a plurality of panels. Each panel has a base portion and end flanges converging towards the inside of the panel. The flanges of two adjacent panels are clamped together by an U-shaped assembly profile, where the flanges of two adjacent panels are in contact with each other.

[0013] Because the known panels for constructing building parts such as roofings or walls are abutting each other in close proximity or with actual contact the only manner in which a panel can be securely fixed to the building is by penetrating the panel by some kind of attachment means, such as screws. This is however not acceptable, because holes allows entrance of dirt and humidity to the building.

[0014] However, the conventional panels described above must be positioned in a very precise manner for fixation to a building or any other subjacent surface. Since the panels are positioned adjacent to each other without a clearance there is a great risk that the constant stress, strain fatigue and strain release at bendings or joinings in response to the environmental impact will cause damage to the panels.

[0015] Also, if screws are used for fixation of a panel to a building, which screws go through holes in the panel, considerable stress, strain fatigue and strain release can arise especially at the areas around the screws.

[0016] In a first aspect according to the present invention a modular construction element is provided that avoids the need for penetrating the modular construction element with attachment means, while still securely fixing modular construction elements to the building or a subjacent surface to form a closed surface for protecting the building from external effects.

[0017] In a second aspect according to the present invention is provided a modular construction element of a material having a combination of at least most of the beneficial properties of the known materials, such as plastic, wood or metal, and at the same time is void of the adverse properties of these materials.

[0018] In a third aspect according to the present invention a modular construction element is provided which is less susceptible to damages due to stress and strain than conventional elements.

[0019] In a fourth aspect according to the present invention a modular construction element is provided that do not require the same kind of precision of the mutual position of two adjacent modular construction element when they are assembled and fixed to a subjacent surface, as with the known panels.

[0020] The novel and unique features by means of which this is obtained according to the present invention is the fact that the at least one web is upstanding from the base at a distance from the at least one free edge to

define an offset, said offset provides an abutment face for a means for securing the base on a subjacent surface.

[0021] Such a modular construction element can be securely fixed to a subjacent surface, e.g. on a building, without penetrating the modular construction element. The means for securing the modular construction element to the subjacent surface will rest on the abutment face on the offset thereby applying a downwards force on the modular construction element in the direction towards the subjacent surface and firmly fixing the element onto the subjacent surface.

[0022] In a preferred embodiment according to the present invention the at least one upstanding web of a modular construction element can have a free end provided with at least one first means for detachable attachment of a protective cap, so that when two juxtaposed oppositely facing modular construction elements are assembled for use, e.g. as a roofing, the cap may advantageously serve as a shielding to prevent e.g. humidity and dirt from depositing around the securing means. Furthermore, the cap may also serve for enclosing the clearance between the elements in an easy and feasible manner. The protective cap may also provide a ventilation channel for ventilation of moisture away from the area around the securing means and the subjacent surface.

[0023] Advantageously the protective cap can be made of a flexible material, so that at least a part of the protective cap exhibits elastic properties.

[0024] Advantageously the angle between the at least one upstanding web and the offset can be about 90° or more, so that the protective cap can be snapped over the modular construction elements in an easy and rapid manner. When the angle is more than 90° the further advantage is obtained that the upstanding webs inherently will be forced against the insides of the mounted protective cap and thereby enhance securing of said protective cap.

[0025] Preferably the modular construction element can be made by extrusion. Extrusion is an expedient manufacturing process for creating long objects of a fixed cross-sectional profile, such as the construction elements according to the present invention. The elements can be made from a continuous band, which subsequently is cut into appropriate lengths corresponding to the length of an element, or the individual elements can be repeatedly produced as many shorter pieces by semi-continuous extrusion. An extruded element can be modelled in one single procedure and many different materials can be extruded without wasting feedstock, however the length of a premade modular construction element can quite as well be adjusted according to need, e.g. by cutting at the construction site.

[0026] In one preferred embodiments according to the present invention the modular construction element can be made by extrusion of a cellulose polymer composite (CPC).

[0027] Generally, composite materials are engineered materials made from two or more constituent materials with significantly different physical or chemical properties and which remain separate and distinct within the finished structure.

[0028] In a cellulose polymer composite product the one material is cellulose that has been broken down into its component fibres and afterward typically mixed with the other material which may be resins and/or synthetic fibre(s), such as polyvinyl chloride (PVC), polyethylene (PE), polypropylene (PP), acrylonitrile butadiene styrene (ABS), or nylon. Advantageously the mixture can also comprise one or more additives such as e.g. a coupling agent that improves the compatibility between the mixture components, lubricants, colorants, heat stabilizers, and photostabilizers. The resulting mixture can be moulded or extruded into a complex form, to obtain a strong and coherent material or product with exceptional physical, mechanical and chemical properties. The source of cellulose can e.g. be wood, paper, rice husks, hemp, hay or grass.

[0029] Cellulose polymer composites are typically similar to aluminium in dimensional stability, looks and feels like natural wood, is paintable and stainable, is resistance to rot and heat, has low moisture absorption, has density strength higher than normal wood, has lower costs, and has superior flexural strength.

[0030] By adding a colorant as an additive to the cellulose polymer composite a modular construction element can be provided with any preferred coloured appearance and can even be made colorfast.

[0031] By adding a photostabilizer as an additive to the cellulose polymer composite a modular construction element can be provided that protects the modular construction element from detrimental and destructive effects of ultra violet light from the sun in an easy and inexpensive manner.

[0032] It is preferred that the cellulose polymer composite can have low moisture content (e.g. well below 1 %), which inhibits subsequent moisture absorption and growth of e.g. moss, fungus or other similar unwanted deposits during use of a modular construction element made from this material.

[0033] Suitable cellulose polymer composites are commercially obtainable from various manufacturers, e.g. from Liberty Diversified Industries, 5600 North Highway 169, New Hope, MN 55428-3096, USA.

[0034] These advantageous properties are utilized in order to produce the superior modular construction elements according to the present invention used for construction of e.g. roofs or walls on buildings.

[0035] According to the present invention a plurality of modular construction elements can be assembled using a method in which the following steps are carried out.

[0036] In a first step a modular construction element number i having a first free edge and a first offset is arranged on a subjacent surface.

[0037] Next a subsequent modular construction element number i+1 having a second free edge and a second offset are arranged on the subjacent surface with

the second free edge facing the first free edge and defining a space between the free edges of the juxtaposed elements number i and i+1, said space serves for accommodation of a first part of a means for securing the elements to the subjacent surface, said means having a second part resting on the abutment faces of the offsets.

[0038] Then element number i and element number i+1 are bridged to each other and secured to the subjacent surface by the means for securing the elements to the subjacent surface, and finally step b and c is repeated until a sufficiently large structure is obtained.

[0039] This method of assembling a plurality of modular construction elements, where the elements can be secured to the subjacent surface using screws and optionally washers, without penetrating the elements, has the advantage that the mutual spacing of two juxtaposed elements does not have to be as precise as in the known methods of assembling conventional panels. The clearance between the elements provided by the offset and the securing means resting on the abutment face of the offset allows the elements to respond to external forces by absorbing impacts e.g. by moving both slightly to and from each other and lengthwise.

[0040] According to the present invention a protective cap can be mounted on the upstanding webs of two juxtaposed modular construction elements. Preferably, the protective cap is detachably mounted to embrace the opposing upstanding webs, thereby protecting the securing means and the subjacent surface. The protective cap can e.g. be detachably mounted on the juxtaposed elements by vertical snapping or by sliding the cap lengthwise in over the upstanding webs.

[0041] The overall assembly protects the building against external effects by forming a closed surface while still providing ventilation of moisture from the construction itself through the space created between the two juxtaposed elements and the related mounted protective cap.

[0042] The protective cap can advantageously have a neck part extending into a head part via at least one second means for engaging the at least one first means for detachable attachment of the protective cap on the upstanding web, said at least one second means can have a shape which is complementary to the shape of the at least one first means, so that a more tight attachment of the protective cap to the upstanding webs is obtained, and also a further protection of the securing means and the subjacent surface is obtained.

[0043] The head part is the part of the protective cap that is most exposed to external effects and it is therefore important that the shape of the head part is chosen in a way that offers a high protection against external effects.

[0044] In a preferred embodiment according to the present invention the head part of the protective cap can have a cross-sectional profile with a pointed, flat or arched shape. Preferably the profile is selected so that e.g. rain and snow will not accumulate on top of the cap, however in some embodiments it is preferred that the height of the entire structure is kept as low as possible, and in such a case a flat-headed cap is chosen.

[0045] In cases where a visual inspection of the means for securing the elements to the subjacent surface without disassembling any parts of the assembly it is preferred that at least the head part of the protective cap can be transparent.

[0046] The invention will be explained in greater detail below, describing only exemplary embodiments with reference to the drawing, in which

Fig. 1 is a perspective, fractional view of a modular construction element according to the present invention,

fig. 2 is a perspective, exploded, fractional view of two juxtaposed modular construction elements, and a protective cap according to the present invention, shown together with two screws for use as securing means,

fig. 3 is a sectional view taken along line III-III of fig. 2, where the components shown in figure 2 are assembled and secured to a subjacent surface according to a first embodiment of the present invention,

fig. 4 corresponds substantially to fig. 3, but with a different securing means according to a second embodiment of the present invention,

fig. 5A-5C are sectional, fractional views of alternative embodiments for modular construction elements according to the present invention illustrating different possible shapes of the upstanding web,

fig. 6A-6C are sectional views of alternative embodiments for a protective cap according to the present invention, and

fig. 7 is a simplified perspective view of three modular construction elements secured to a section of a roof of a building according to the present invention.

[0047] The present invention is described below under the assumption that the modular construction element has a flat base with two upstanding webs. However, the present invention is not limited to this specific shape of the base or that two webs are standing up from the base. The base can have other modified shapes, such as a corrugated or serrated or arched upper side and a flat bottom side. The number of upstanding webs could e.g. be only one, which is appropriate if e.g. the modular construction element constitute an end element and therefore is bridged to only one other juxtaposed modular construction element.

[0048] The modular construction element is in fig. 1 designated in general by the reference numeral 1.

[0049] Fig. 1 shows a fragment of a modular construction element 1 having a base 2. The base 2 has a bottom

side 3, an upper side 4, two opposing short free edges 5,6 and two opposing long free edges 7,8. Two upstanding webs 9,10 are standing up from the upper side 4 of the base 2 at distances from the free edges 7,8, respectively, and define two offsets 11,12. Each web 9,10 has a free end 13,14 which provides a first means 15,16 for coupling with a protective cap (not shown), as will be described in further detail with reference to a.o. fig. 3. The offsets 11,12 has upper sides 17,18 defining abutment faces 17,18 respectively, The distance x from the upstanding web 9 to the free edge 7 and the distance y from the upstanding web 10 to the free edge 8 need not be of equal sizes.

[0050] In a preferred embodiment according to the present invention, which is suitable for a sloping roofing on e.g. a storehouse, the length L_{short} of the short free edges 5,6 is about 0,3 to 2,0 meter, the length L_{Long} of the long free edges 7,8 is about 1 to 25 meter, and the thickness h of the base 2 is e.g. about 6 mm - 100 mm. The height H of the upstanding webs 9,10 can e.g. be about 3 cm but can also be much higher such as e.g. 6 or 10 cm. It is to be noted, that the present invention is not limited to these dimensions. In another embodiment (not shown) where the upper side of the base is arched, the suitable thickness of the base could be about 6 mm at the middle part and about 12 mm at the long free edges.

[0051] Fig. 2 shows in an exploded view two juxtaposed modular construction elements 1,1', which for illustrative purposes only are shown to be rather short. Any suitable length L_{long} is foreseen within the scope of the present invention. In use the modular construction elements 1,1' are arranged with the at least one free edge 7 of an element 1 facing the at least one free edge 8 of subsequent element 1', to define a space 19 of a distance d between the two free edges 7,8. The space 19 serves for accommodation of two securing means 20,21, each consisting of a first part 23,25 and a second part 24,26. A protective cap 22 is shown ready for engaging the upstanding webs 9,10.

[0052] The present invention is not limited to the use of two securing means, as indicated in fig. 2, in the assembly of two juxtaposed elements. It is within the common general knowledge of a person skilled in the art that any number of securing means can be used depending on the circumstances such as e.g. the nature of the subjacent surface into which the securing means are to be anchored, the degree of securing or legal requirements.

[0053] Fig. 3 shows the components of fig. 2 in assembled state secured to a subjacent surface 27. The elements 1,1' are arranged on the subjacent surface 27 with the free edges 7,8 at a mutual distance d. The first part 23 of the securing means 20 is a screw with a head 23a and a neck 23b. The neck 23b is passed through a T-shaped washer 24, which constitutes the second part 24 of the securing means 20, and is screwed into the subjacent surface 27. The lower side 24a of the washer 24 rests at least partly on the abutment faces 17,18 of the offsets 11,12, and the upper side 24b abuts the head 23a of the screw 23. The width or diameter of the washer 24 as well as the width or diameter of the head 23a is larger than the width d of the space 19, so that the head 23a of the screw 23 and the washer 24 bridge the offsets 11,12 of the elements 1,1' to fix the two elements 1,1' to the subjacent surface 27 without using holes as with conventional means. The elements are forceable held in intimate and firm contact with the subjacent surface by the down force F applied by the screw 23 in the direction towards the subjacent surface 27.

[0054] The washer 24 can e.g. be made of a weather resistant rubber. A rubber washer is both compressable and yieldable to a certain degree, and by using a washer made of rubber the mutual distance d between the elements 1,1' do not need to be as accurate as in the known methods.

[0055] The protective cap 22 has a head part 28 that extends into two longitudinal neck parts 29,30 via protrusions 31,32, which are shaped complementary to the shape of the free ends 13,14 of the upstanding webs 9,10 to accommodate said free ends 13,14 in engaging relationship. The free ends 13,14 are shaped as barbs with hooks, which faces away from the offsets 11,12.

[0056] In the assembled state the protective cap 22 is mounted over the upstandings webs 9,10, the protrusions 31,32 encloses the barbs 15,16, and the head part 28 encloses a ventilation channel 33, which prevents moisture and dirt from the surroundings to deposit.

[0057] For many construction purposes the preferred angle α between the upstanding webs 9,10 and the offsets 11,12 of the elements 1,1' is chosen to be approximately 90°.

[0058] However, within the scope of the present invention the angle α can be chosen to be larger than 90°, in which case the opposing neck parts 29,30 must be forceably clamped on the upstanding webs 9,10, which due to the larger angle α are pressed against each other by the neck parts 29,30 during mounting. After mounting of the protective cap 22 the upstanding webs 9,10 will try to revert to their starting angle to a degree defined and allowed by the neck parts 29,30. The upstanding webs 9,10 then exert a pressing force on the neck parts 29,30 to provide a further aid for firm holding of the cap 22 on top of the upstanding webs 9,10.

[0059] When assembled the offsets 11,12 of the two juxtaposed elements 1,1' facilitates a secured fixation of the elements 1,1' to the subjacent surface 27 without penetrating the elements 1,1' with any attachment means.

[0060] The assembled structure appears as a closed surface protecting the subjacent surface 27 as well as the securing means 20 against external effects.

[0061] Fig. 4 shows a second embodiment of the present invention that corresponds to the embodiment shown in fig. 3 except that the securing means 34 is one single unit. The head part 35 of the securing means 34 has a width or diameter larger than the distance d between the long free edges 7,8 of the elements 1,1' and

in this embodiment the downwards force F on the abutment faces 17,18 is applied directly by the head part 35 and not via a washer as in the embodiments shown in fig. 3. In the second embodiment it is simpler and faster to secure modular construction elements to a subjacent surface.

[0062] Fig. 5a-5c show in sectional, fragmentary views three alternative modular construction elements 1,36,37 with alternative embodiments of the first means 15,38,39 on the upstanding web.

[0063] The first means 15 shown in fig. 5a is a tapered barb 15. The free pointed end of the barb 15 is constituted by the longitudinal free end 13 of the longitudinal upstanding web 9 and a hook part 15a points towards the base 2 in the direction towards the centre of the modular construction element 1 to provide a breast or hook for clamping with the protective cap (not shown). It is especially easy to mount the protective cap on this tapered embodiment of the first means.

[0064] Fig. 5b shows a modified first means 38 on the upstanding web. The modified first means is a rounded breast 38 protruding towards the centre of the modular construction element 36 parallel to the base 2. This modified first means is particular easy to detach from the upstanding web.

[0065] Yet a further embodiment of the first means 39 on the upstanding web is shown in fig. 5c. This embodiment corresponds substantially to the embodiment shown in fig. 5a, but is provided with a further barb 15a beneath the barb 15a, which terminates in the free end 13. These further embodiments provides a superior securing of a cap to opposing upstanding webs, and may be preferred for application in which firm securing has a very high priority.

[0066] When two juxtaposed elements 1,36,37 are assembled as previously mentioned with one of these kinds of first means 15,38,39 shown in fig. 5a-5c the protective cap encloses both upstanding webs 9 and thereby protects the subjacent surface (not shown) and the securing means.

[0067] The protrusions on a mating cap must have shapes complementary to the shapes of the first means 15,38,39, however the present invention is not limited to the shapes of the first means 15,38,39 as shown in fig. 5a-5c, as long as the shapes of the first means and the corresponding second means on the protective cap are providing a way for detachable attachment of a protective cap on the upstanding web. Hence the first and the corresponding second means need not be completely complementary.

[0068] Fig. 6a-6c shows three protective caps 22,40,41 for alternative embodiments of protective caps with different head parts 28,42,43, but with the same shape of the protrusions 31,32. As seen in fig 6a the shape of the head part 28 is pointed, in fig. 6b the shape of the head part 42 is flat, and in fig. 6c the shape of the head part 43 is arched. The present invention is not limited to the shapes of the head parts 28,42,43 as shown in fig. 6a-6c, as long as the shape of the head part provides a protection of the securing means and the subjacent surface against external effects.

[0069] The term subjacent surface refers to some kind of structure onto which the modular construction elements can be fixed, this could e.g. be lathes on a roof, a flat surface such as a wall or other kinds of structures.

[0070] Fig. 7 provides an overview of three modular construction elements 44,45,46 assembled to each other on a roof of a building 47. In the case shown the subjacent surface is roof lathes 48,49,50 into which the securing means (not shown) is secured, to hereby bridge the adjacent elements together and fixing the elements to the building 47 in a manner that protects anything beneath the modular constructions elements and protective cap from access from undesired matter. Additionally the ventilation channels below the protective caps provide a way of ventilating the area around the lathes 48,49,50. Normally the roof also comprises rafters (not shown) below the roof lathes 48,49,50.

[0071] The end element 44 need only have one upstanding web (not shown) at the long free edge facing the juxtaposed element 45 for the purpose of mounting a protective cap (not shown) on the shown elements 44 and 45.

[0072] It is to be noted that in a complete assembly the juxtaposed modular construction elements would extend from one end to the other of a roof. Furthermore, the number of lathes and the distance between and thereby the kind and the number of securing means could very well be different than shown in fig. 7. Any variation and combination are intended within the scope of the present invention.

[0073] When assembling a roof with modular construction elements, such as indicated in fig. 7, the roof ridge can be provided with a roof ridge cap, so that the upper end of the modular construction elements are encapsulated by the roof ridge cap to further protect the building from external effects and access of e.g. rain and snow.

[0074] Especially in situations where the area of the bottom side of a modular construction element is larger than the area of the subjacent surface, then the upstanding webs provide a higher flexural strength to the modular construction elements than if the elements had no upstanding webs. The assembly shown in fig. 7 where the subjacent surface is roof lathes is one example of such a situation.

[0075] The dimensions of the modular construction elements, e.g. the height of the upstanding webs, as shown in the figures are chosen as an example, and do not limit the present invention to any of the shown dimensions.

Claims

1. A modular construction element (1, 1', 36, 37, 44, 45, 46) comprising a base (2) having at least one free edge (7,8), and at least one upstanding web

(9,10) for assembling of two juxtaposed elements, **characterized in that** the at least one web (9,10) is upstanding from the base (2) at a distance (x,y) from the at least one free edge (7,8) to define an offset (11,12), said offset provides an abutment face (17,18) for a means (20,21,34) for securing the base on a subjacent surface (27,48,49,50).

2. A modular construction element (1, 1', 36, 37, 44, 45, 46) according to claim 1 **characterized in that** the at least one upstanding web (9,10) has a free end (13,14) provided with at least one first means (15,16,38,39) for detachable attachment of a protective cap (22,40,41).

3. A modular construction element (1,1', 36,37,44,45,46) according to any of the preceding claims 1 or 2, **characterized in that** the angle (α) between the at least one upstanding web (9,10) and the offset (11,12) is about 90° or more.

4. A modular construction element (1, 1', 36, 37, 44, 45, 46) according to any of the preceding claims 1, 2 or 3, **characterized in that** the modular construction element is made by extrusion.

5. A modular construction element (1, 1', 36, 37, 44, 45, 46) according to any of the preceding claims 1 - 4, **characterized in that** the modular construction element is made of a cellulose polymer composite.

6. A method for assembling a plurality of modular construction elements (1, 1', 36, 37, 44, 45, 46) according to any of the preceding claims 1 - 5 **characterized in that** the method comprises that

a. a modular construction element number i having a first free edge (7) and a first offset (11) is arranged on a subjacent surface (27,48,49,50),
b. a subsequent modular construction element number i+1 having a second free edge (8) and a second offset (12) are arranged on the subjacent surface with the second free edge (8) facing the first free edge (7) and defining a space (19) between the free edges (7,8) of the juxtaposed elements number i and i+1, said space (19) serves for accommodation of at least a part of a first part (23,25) of a means (20,21,34) for securing the elements to the subjacent surface, said means (20,21,34) having a second part (24,26) resting on the abutment faces (17,18) of the offsets (11,12),
c. element number i and element number i+1 are bridged to each other by the means (20,21,34) for securing the elements to the subjacent surface, and
d. step b and c is repeated.

7. A method according to claim 6 **characterized in that** a protective cap (22,40,41) is mounted on the upstanding webs (9,10) of two juxtaposed modular construction elements (1, 1', 36, 37, 44, 45, 46).

8. An assembly comprising a plurality of modular construction elements (1, 1', 36, 37, 44, 45, 46) according to any of preceding claims 1 - 5 assembled using the method according to any of the claim 6 or 7.

9. A protective cap (22,40,41) for an assembly according to claim 8, **characterized in that** the protective cap has a neck part (29,30) extending into a head part (28,42,43) via at least one second means (31,32) for engaging the at least one first means (15,16,38,39) for detachable attachment of the protective cap on the upstanding web (9,10), said at least one second means (31,32) has a shape which is complementary to the shape of the at least one first means (15, 16, 38, 39).

10. A protective cap (22,40,41) for an assembly according to claim 9, **characterized in that** the head part (28,42,43) has a cross-sectional profile having a pointed, flat or arched shape.

11. A protective cap (22,40,41) for an assembly according to claim 9, **characterized in that** at least the head part (28,42,43) of the protective cap is transparent.

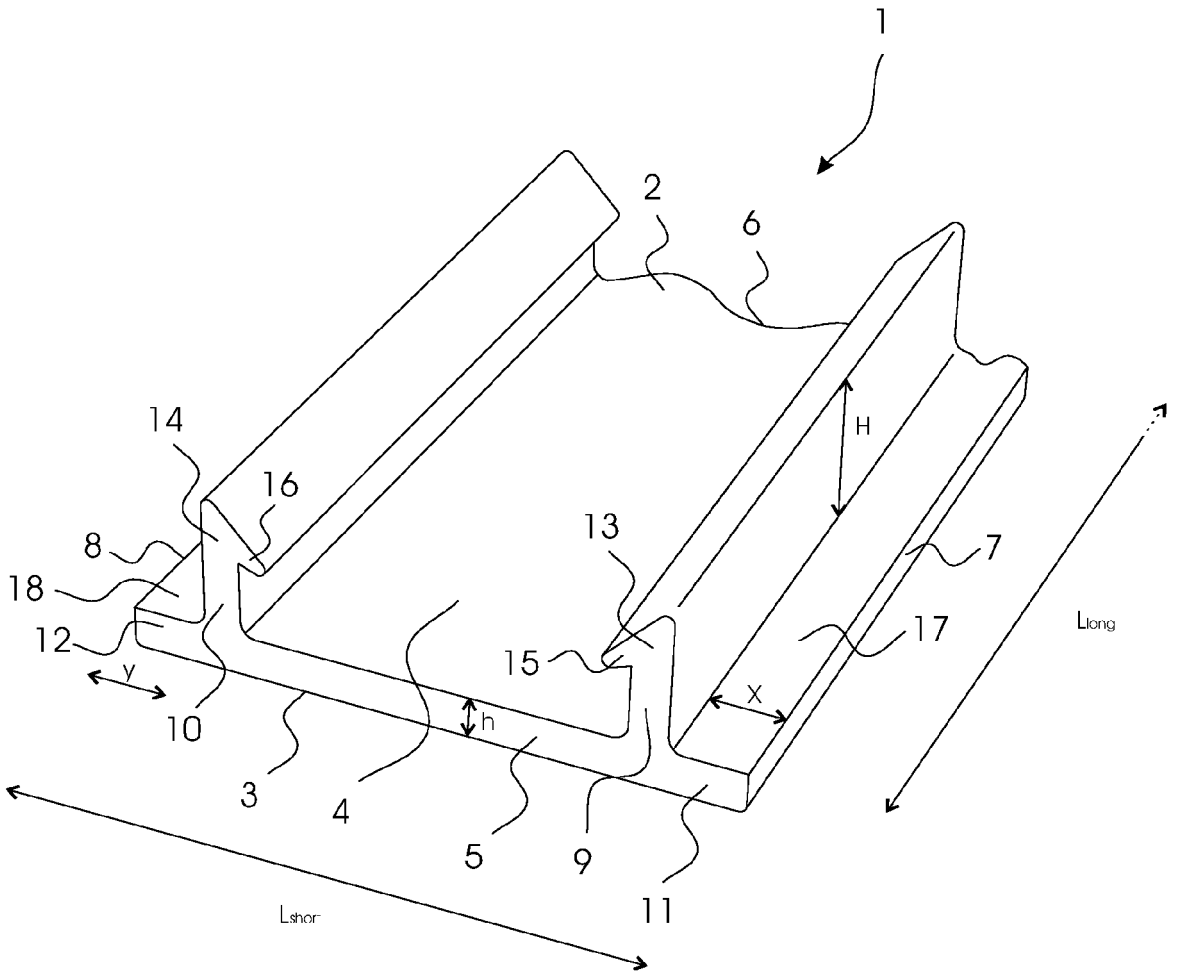


Fig 1

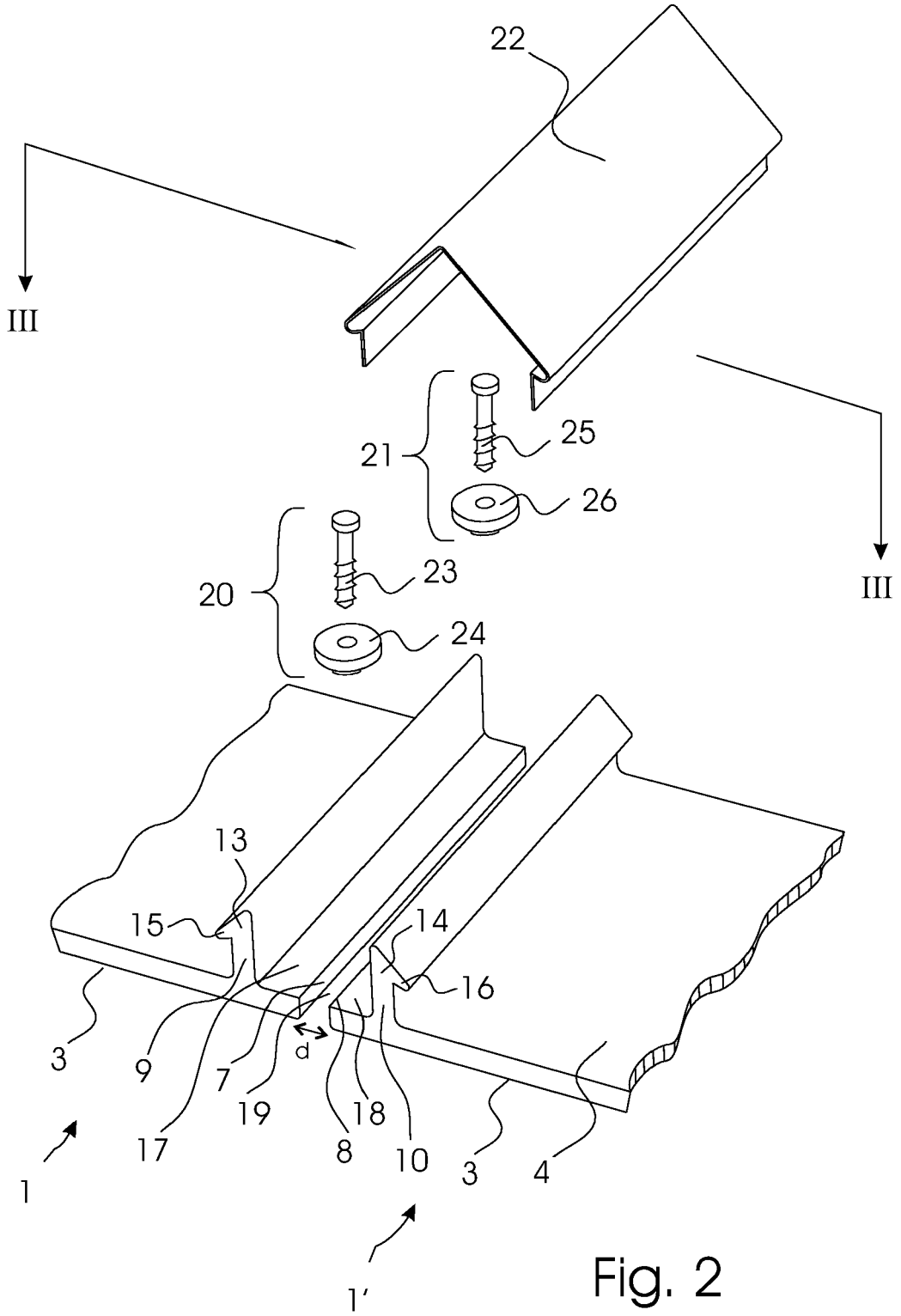
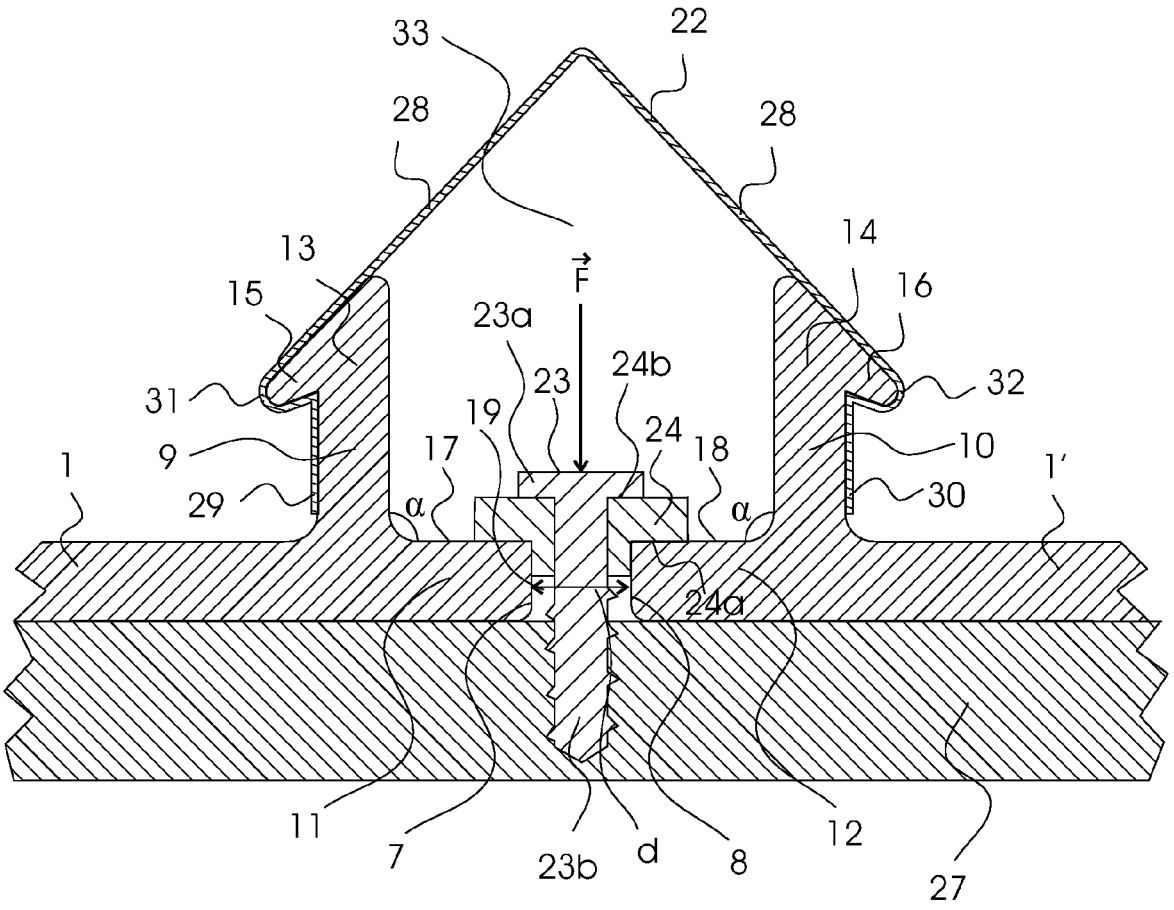


Fig. 2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24
32
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29
α
α
30
1'
24a
11
7
23b
d
8
12
27

Fig. 3

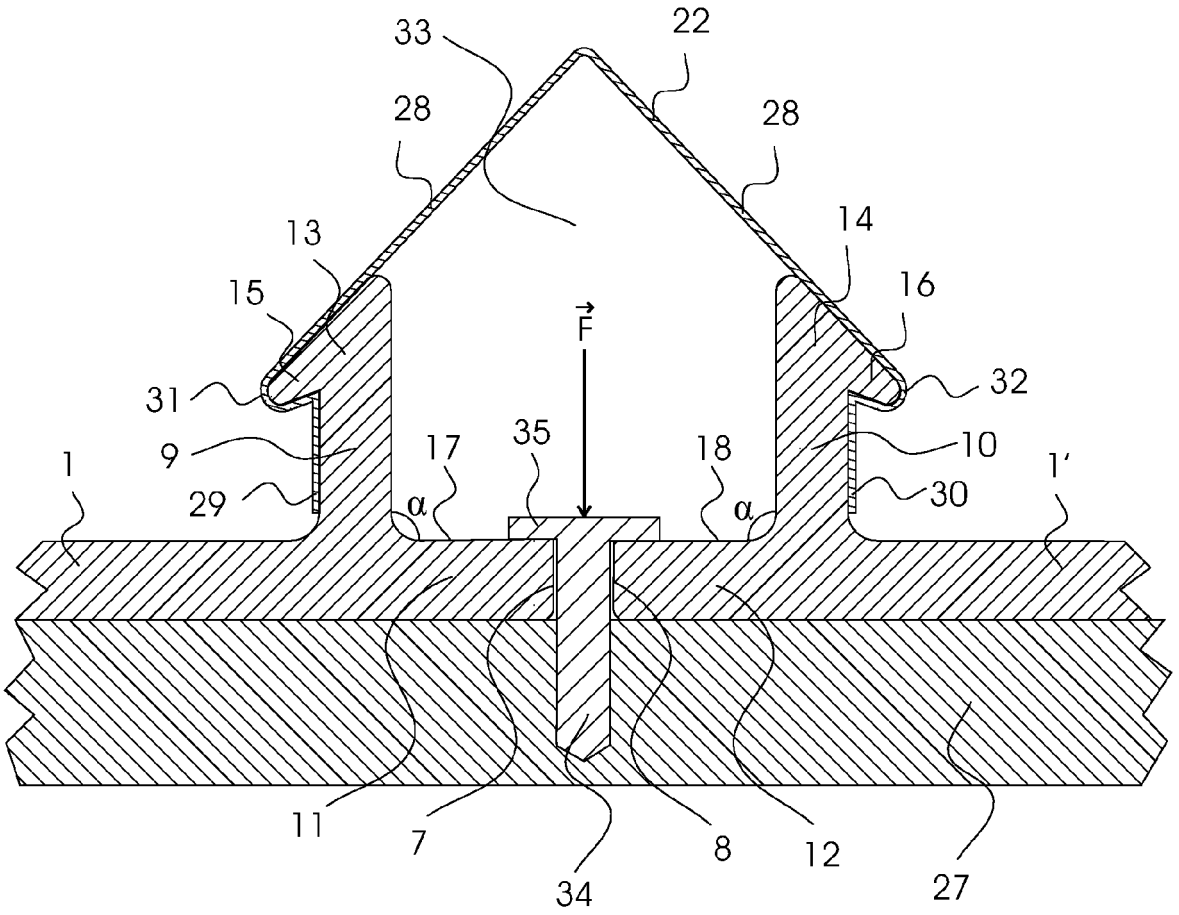

Fig. 4

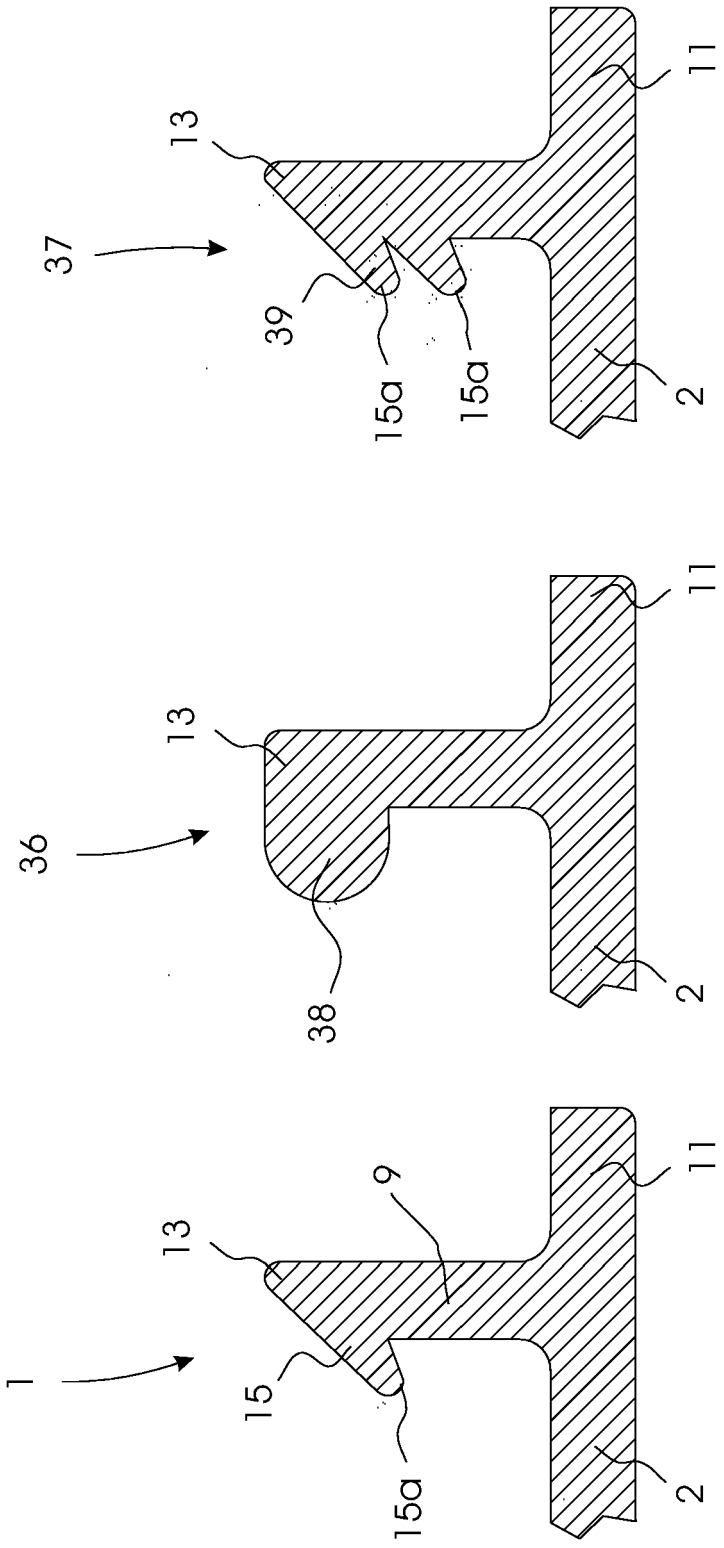

Fig 5a

Fig 5b

Fig 5c

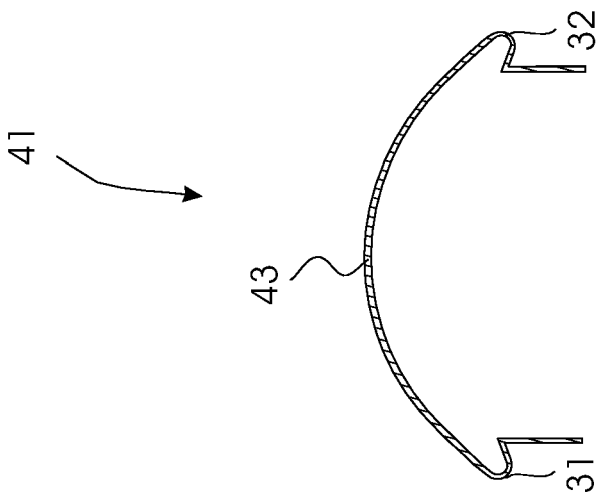

Fig 6c

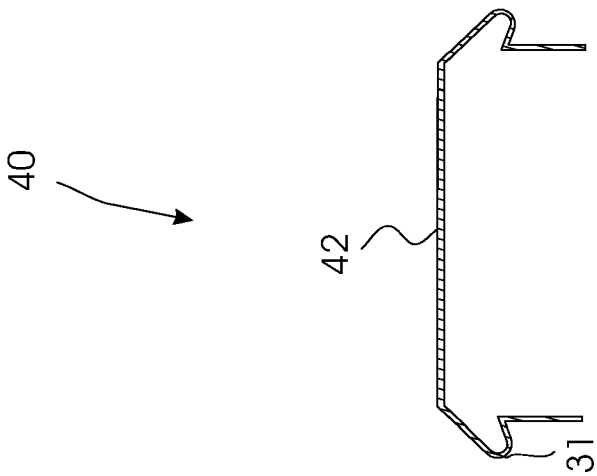

Fig 6b

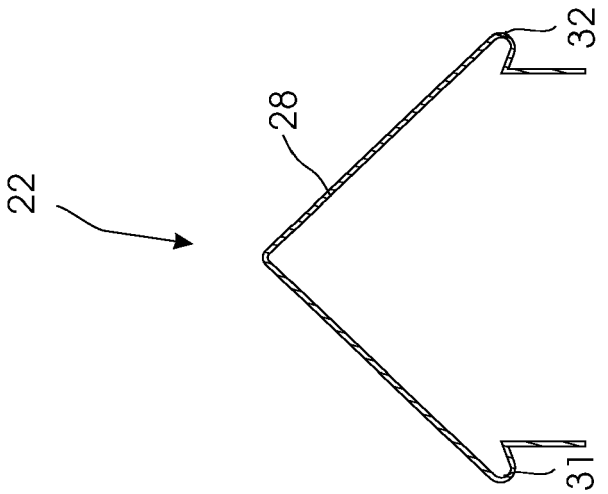

Fig 6a

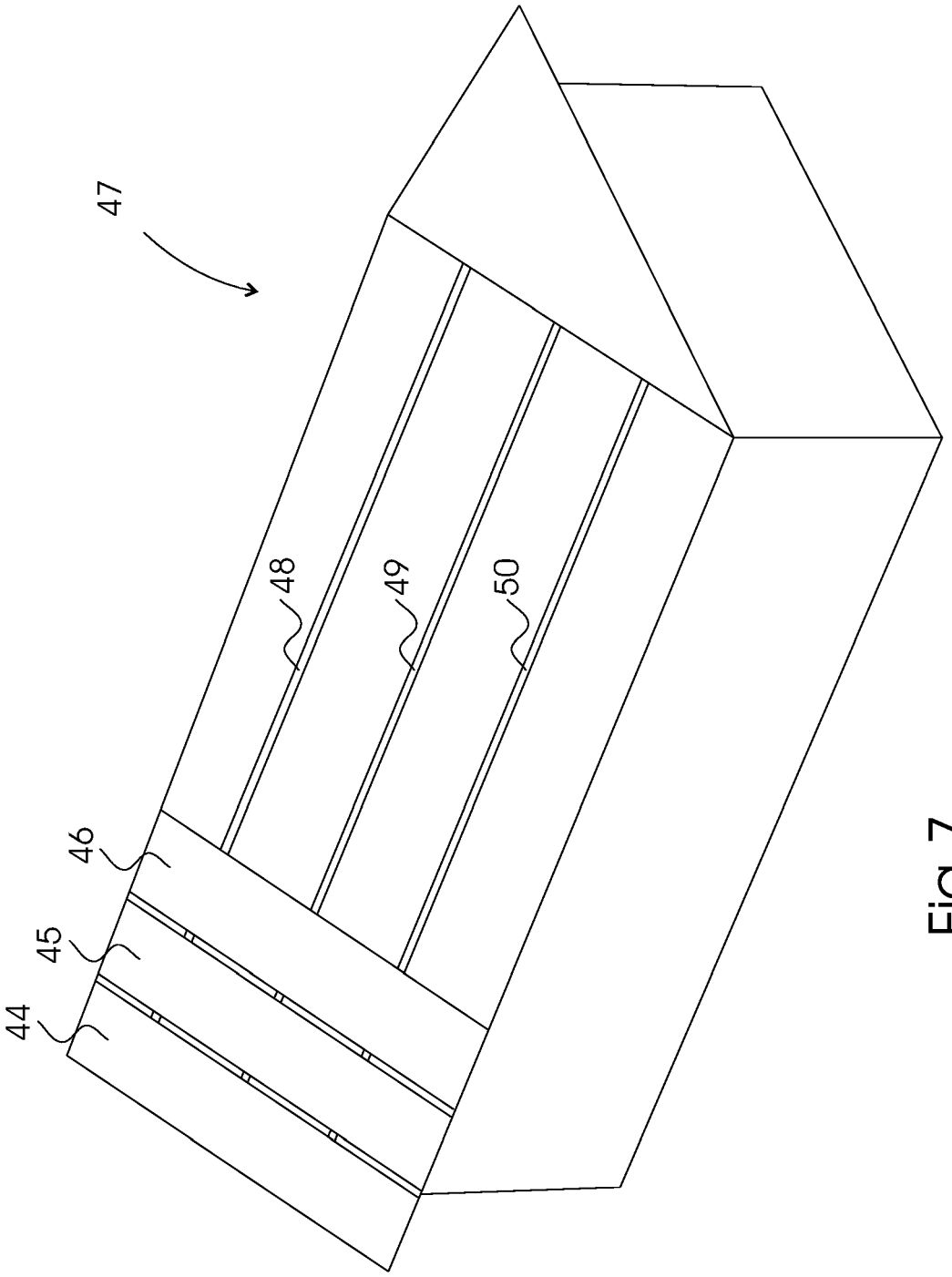

Fig 7

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Application Number
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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
Munich	25 October 2007	Vratsanou, Violandi

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