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(54) **Title**: MODULAR ROOFING TILE ELEMENT WITH INTEGRATED PHOTOVOLTAIC MODULE AND RELATIVE LAYING METHOD

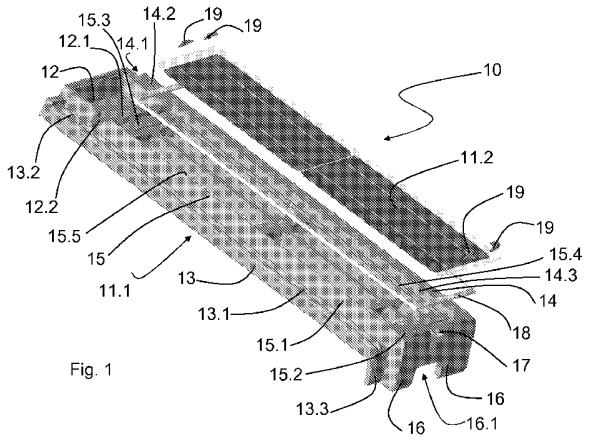

Fig. 1

(57) **Abstract**: The invention relates Io a modular roofing tile clement with integrated photovoltaic module, comprising u support structure (11.1) and a photovoltaic module (11,2), wherein the perimeter part (12, 13, 14, 16) of said support structure (11.1) is shaped like the perimeter of a conventional tile to allow it to he modularly connected to other similar modular roofing elements (10), wherein said perimeter part (12, 13, 14, 16) comprises a first (14) and a second (13) longitudinal flaps and a lower transverse edge (15.2), wherein in an upper region of each of said longitudinal flaps (13, 14) there are respective first (13.2) and second (14.2) through holes, and wherein in a median region of said transverse edge (15.2) there is a third through hole (17) so that. v\ hen two first modular elements (10.3, 10.4) are placed bide by side, said first flap (14) is superimposed on said second flap (13) and, when a third modular element (10.1) is superimposed on said two first modular elements (10.3, 10.4), said first, second and third holes (17, 13.2, 14.2) are axially aligned with one another.

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MODULAR ROOFING TILE ELEMENT WITH INTEGRATED PHOTOVOLTAIC MODULE AND RELATIVE LAYING METHOD

DESCRIPTION

The present invention relates to a modular roofing tile element with integrated photovoltaic module. The invention also relates to a method for laying a plurality of said elements.

Modular roofing tile elements with integrated photovoltaic module are known in the art. However, such known modular elements suffer from some drawbacks which considerably reduce their usefulness and performance.

One first drawback is that the photovoltaic module carried by such elements is not positioned on top of the structure, but is placed under mouldings or raised parts of the structure itself. Under solar irradiation, such an arrangement causes a shadow to be cast on small areas of the photovoltaic module. A significant reduction in the efficiency of the whole plant thus occurs due to the considerable performance losses undergone by the single module when even just one cell is totally or partially shaded.

Another drawback of said known modular elements is that they do not allow for a proper ventilation of the photovoltaic module, which is thus subjected to overheating when in operation, leading to performance decay.

Moreover, the known modular elements are sometimes made of materials which are at least partly non-recyclable, relatively heavy and not very strong mechanically.

On the other hand, the known modular elements feature an optimal dimensional ratio between the support structure and the respective photovoltaic module, which maximises the module's energetic efficiency.

Yet, said known modular elements often do not allow for an easy and stable installation.

It should also be noted that such known modular elements often require relatively complex work to ensure a secure assembly of said parts.

For example, international patent application no. WO 2008/137966 describes a modular roofing tile element with integrated photovoltaic module which can be used in combination with other similar elements for the purpose of building a roofing.

However, such elements are secured to a roof batten only at their upper edge, thus leaving the lower edge free. Therefore, should any extreme atmospheric events occur, said elements might detach from the roof and become dangerous should they ever fall down to the ground.

It is also very difficult to secure these elements in such a manner as to obtain a uniform geometrical design of the roof, since the installer does not have at his disposal an accurate reference system for securing the modular elements in a geometrically precise way.

The present invention aims at overcoming the above-mentioned drawbacks.

It is an object of the invention to provide a modular roofing tile element with integrated photovoltaic module wherein said module is substantially unaffected by any shading caused, under solar irradiation, by parts of the module's support structure.

It is another object of the invention to provide a modular roofing element as defined above which ensures an adequate thermal exchange when the photovoltaic module is in operation.

It is a further object of the invention to provide a modular element as defined above which is made of recyclable materials having a low environmental impact.

It is a further object of the invention to provide a modular element as defined above which is light and has a high mechanical strength.

It is a further object of the invention to provide a modular element as defined above which can be installed easily and securely.

It is a further object of the invention to provide a modular element as defined above which has an optimal dimensional ratio between the support structure and the integrated photovoltaic module, so as to maximise the energetic efficiency per surface unit of the roofing made up of a plurality of modular elements.

It is a further object of the invention to provide a method for producing a modular roofing tile element with integrated photovoltaic module which allows to assemble the support structure and the photovoltaic module in a manner such as to obtain a substantially monolithic unit.

It is also an object of the invention to provide a method for laying a plurality of modular elements which ensures an easy, safe and stable installation.

It is yet another object of the invention to provide a modular roofing tile element with integrated photovoltaic module which can be interfaced to any traditional tile having a similar linear profile at its lateral ends, like that of most tiles currently available on the market.

In view of such objects, the present invention provides a modular roofing tile element with integrated photovoltaic module whose main feature is set out in claim 1.

The main feature of the method according to the invention is set out in claim 11.

Further advantageous features are set out in dependent claims.

The aforesaid claims are understood as being integrally included herein.

The present invention will become more apparent from the following detailed description

referring to the annexed drawings, which are supplied by way of non-limiting example, wherein:

Fig. 1 is an exploded perspective view of a modular roofing tile element of the plain type with integrated photovoltaic module according to one example of embodiment of the present invention;

Fig. 2 is a top view of the modular element of Fig. 1;

Fig. 3 is a sectional view along line A-A of Fig. 2;

Fig. 4 is a perspective top view of the modular element of Fig. 1 without the photovoltaic module;

Fig. 5A is a top view of the modular element without the photovoltaic module according to Fig. 4;

Fig. 5B is the same view of Fig. 5A, rotated by 90 degrees in the drawing plane;

Fig. 6 is a longitudinal side elevation view of the modular element of Fig. 5A;

Figs. 7 and 8 are longitudinal sectional views along lines B-B and C-C of Fig. 5A, respectively;

Figs. 9 and 10 are cross-sectional views along lines D-D and E-E of Fig. 5B, respectively;

Fig. 11 is a bottom view of the modular element of Fig. 4;

Fig. 12 is a cross side elevation view of the modular element of Fig. 11;

Fig. 13 is a top view in a different scale of a photovoltaic module integrated in the modular element of Fig. 1 with a superimposed protective glass sheet;

Fig. 14 is a cross-sectional view along line F-F of Fig. 13;

Figs. 15 and 16 respectively show elevation and sectional views along line G-G, in a bigger scale, of an elastic mounting clamp for securing the photovoltaic module to the support structure in the modular element according to Fig. 1;

Fig. 17 is a schematic exploded perspective view which illustrates the installation, with respect to a roof framework batten, of four modular plain tile elements with respective integrated photovoltaic modules according to the invention;

Fig.18 is a sectional view along line H-H of Fig. 17;

Fig. 19 is a view of a roof comprising a plurality of modular elements according to the invention.

Example of embodiment of the invention

With reference to Figs. 1 to 16, a modular roofing tile element with integrated photovoltaic module according to one example of embodiment of the invention is designated as a whole by

reference numeral 10. Said modular element 10 is, by way of example, of the plain type and essentially comprises a support structure 11.1 and a photovoltaic module 11.2 securely assembled together, as will be described more in detail hereafter. For the purposes of the present invention, said photovoltaic module is considered to be formed by a Tedlar base, an Evatane encapsulant, and photovoltaic cells. Said photovoltaic module 11.2 is covered on top by a glass sheet 20, consisting of a low iron content, highly transparent tempered glass, as will be described more in detail below.

Said support structure 11.1 is manufactured by moulding a plastic material, and its outer perimeter is shaped like a traditional plain tile.

In particular, said tile-shaped support structure 11.1 comprises (when viewed in the installed position), at its upper longitudinal end, a rectangular tray 12 protruding upwards and extending for a substantial portion of the width of the structure 11.1; a first continuous longitudinal flap 13 with a flat surface arranged alongside the base of said tray 12 and having, on its upper face, a continuous raised longitudinal bead 13.1; a second continuous longitudinal flap 14 with a flat surface, arranged alongside the top of said tray 12 on the side opposite to the first flap 13. Said flaps 13, 14 are essentially parallel to each other, but lie, as aforesaid, in respective planes at different heights so that, when two modular elements 10 are placed side by side, as will be described more in detail hereafter, the flap 14 is superimposed on the flap 13. Furthermore, said upper flap 14 has, in a region at its upper longitudinal end, an L-shaped notch 14.1 and an elongated through hole 14.2 near said notch. Said underlying flap 13 has, in an upper region thereof, an elongated through hole 13.2 transversally aligned with said elongated hole 14.2.

According to the invention, the remaining and substantial part of said support structure 11.1 comprises an integral raised flat frame 15 essentially rectangular in shape, the top of which lies in the plane of said upper flap 14. Said flat frame 15 is formed by the inner transverse wall 12.1 of the tray 12, a continuous longitudinal relief 15.1 jutting out from and running along said first flap 13, the corresponding longitudinal portion 14.3 of said upper flat flap 14, and a raised lower transverse edge 15.2 at the lower end, opposite to said transverse wall 12.1 of the tray 12. From said raised transverse edge 15.2 two opposed integral transverse teeth 16 extend which are separated by a recess 16.1, whereas the corresponding end of the continuous longitudinal flap 13 is also bent to form a tooth 13.3 lower than and set back relative to said teeth 16. Between said teeth 16, in a median region of said transverse edge 15.2, there is a through hole 17 having an essentially vertical axis 17. The tray 12 communicates, through a

notch 12.2, with the channel formed on the flap 13 between the bead 13.1 and the longitudinal relief 15.1 of the frame 15, so as to allow for rain-water drainage. When it is raining, the notch 12.2 advantageously prevents the water from being drained from the higher modular elements 10 onto the lower modular elements 10, which might cause damage to the respective photovoltaic module 11.2. In this manner, each modular element 10 only has to drain the water that falls onto it, instead of also having to drain the water of the upstream modular elements 10.

Within said raised frame 15 and along the sides thereof there are respective lowered integral steps: 15.3 (transversal) and 15.4 (longitudinal), in which a continuous rectangular groove 15.5 is formed. Said rectangular groove 15.5 is intended for housing, as will be described more in detail below, a corresponding continuous layer of fireproof silicone-based glue 18. Said photovoltaic module 11.2, onto which a protective glass sheet 20 is applied at the level of the top of said raised frame 15, fitting to measure within said frame 15, is placed over said continuous glue layer 18, resting on the steps 15.3 and 15.4. In the transverse edges or sides 12.1 and 15.2 of the raised frame 15, on the inner faces thereof, two respective pairs of vertical recesses 12.10 and 15.20 are formed which house the vertical branches 19.1 of respective elastic metal mounting clamps 19 shaped essentially like an upside-down "L" (Figs. 1, 15 and 16), which, through their horizontal branch 19.2, secure said protective glass sheet 20 housed inside said raised frame 15. As can be seen, in the vertical branch 19.1 of said clamps 19 two elastic tabs 19.3 are obtained by shearing, which open outwards and rest elastically against said frame 15, whereas the horizontal branch 19.2 thereof is slightly curved to adhere elastically to said sheet 20.

In order to stiffen said support structure 11.1, a median longitudinal member 15.6 and a median cross member 15.7 are provided, in one body, inside the frame 15 and substantially in the plane of the lowered steps 15.3, 15.4.

<u>On-site installation (Figs. 17, 18)</u>.

Fig. 17 illustrates the on-site layout of four modular tile elements 10 according to the invention, arranged side by side in pairs and overlapping each other. Said modular elements are designated herein by reference numerals 10.1, 10.2, 10.3 and 10.4, respectively. The elements 10.1, 10.3 are respectively placed alongside the elements 10.2, 10.4, so that the upper flaps 14 of the former two are respectively superimposed on the lower flaps 13 of the latter. In addition, the contiguous teeth 16 of the two side-by-side elements 10.1, 10.2, which lie higher in the installed position, occupy the tray 12 of the element 10.4, while the recess

16.1 of the element 10.1 receives the longitudinal flap superimposed on the underlying flap 13 of the element, said elements 10.3 e 10.4 being arranged side by side and being lower when installed. With such an arrangement, the through hole 17 of the upper modular element 10.1 comes to match, in the axial direction, the hole 14.2 of the flap 14 of the modular element 10.3 and the hole 13.2 of the flap 13 of the modular element 10.4, respectively. Therefore, as schematically shown in Fig. 18, by means of a single fastening means V, e.g. a self-tapping screw, engaging said holes 17, 14.2, 13.2 in a through manner, it is possible to attain a solid and secure fastening of the three modular elements 10.1, 10.3, 10.4 with respect to the batten L of a roof framework (not shown any further).

The above-described layout leads said modular elements 10.1 10.2 10.3 10.4 assembled on site to have their respective photovoltaic modules 11.2 positioned substantially at the top of the corresponding flat frames 15, so that they can receive the solar radiation without any shading, for the whole time of irradiation.

In this regard, it must be stressed that, as shown in detail in Figs. 13 and 14, the protective glass sheet 20 takes up all the useful area delimited by the flat frame 15, whereas the corresponding underlying photovoltaic module 11.2 is perimetrically set back relative to said sheet, and therefore also to the frame 15. This measure allows to compensate, in order to exploit the solar irradiation optimally, for the slight depth in which the photovoltaic module 11.2 is located with respect to the top of the frame 15, due to the presence of the protective sheet 20.

Fig. 19 illustrates a roof which can be obtained by using the modular elements 10 according to the invention.

Method for producing the modular roofing tile element with integrated photovoltaic module according to the invention.

The photovoltaic module 11.2 (formed by a Tedlar base, an Evatane encapsulant, and photovoltaic cells) is first assembled together with said protective glass 20.

The support structure 11.1 is produced as a monolithic body by injecting molten thermoplastic resin into a corresponding steel mould.

The support structure 11.1 thus produced is picked up by a robot at a temperature between 75°C and 90°C and is positioned on a dedicated base.

The layer of fireproof silicone-based glue 18 is then applied by a robot into the continuous rectangular groove 15.5. Subsequently the assembly consisting of the photovoltaic module and the protective glass is picked up by a robot and inserted with the Tedlar back part into the

frame 15, resting on the steps 15.3, 15.4 where the layer of silicone-based glue 18 was applied, so that the external surface of the protective glass 20 is flush with the top of said frame 15. The elastic clamps 19 are then inserted into the corresponding seats 12.10 and 15.20 of the frame 15, so that they stably engage said protective glass 20.

This provides a solid and secure threefold fastening of the photovoltaic module 11.2 with sheet 20 with respect to the support structure 11.1, namely of the physical, chemical and mechanical types, by means of the physiological post-moulding shrinkage of the thermoplastic resin, by means of the layer of fireproof silicone-based glue 18 and by means of the elastic clamps 19, respectively.

All of the above-described steps are carried out within approx. ten seconds, so that the whole process takes place while the support structure 11.1 is still hot.

Advantages of the invention

The modular roofing tile element with integrated photovoltaic module according to the invention allows to prevent any shading of the photovoltaic module caused by the structure of the element itself. In fact, the photovoltaic module 11.2 is inserted in the frame 15 in such a way that no raised regions of the support structure stay above the module surface. To be on the safe side, the perimeter of the photovoltaic module 11.2 is set back relative to that of the protective glass 20 superimposed on and contained within said frame 15. In addition, it must be stressed that the photovoltaic module 11.2 is electrically connected to a bypass diode to ensure that it can be excluded from the plant (for each modular element 10) in the event of accidental shading.

When in operation, the modular element 10 also ensures adequate ventilation of the photovoltaic module 11.2, due to the fact that the module itself is perimetrically supported by the lowered steps 15.3, 15.4 of the frame 15, by the median longitudinal member 15.6 and by the median cross member 15.7, while wide aeration openings are provided under said module 11.2 between said support parts. As is apparent from the above description, the modular element 10 is so designed as to promote thermal exchange, so that the photovoltaic module will never reach in operation temperature values which may jeopardise its energetic efficiency.

The materials used for manufacturing the modular element 10 are recyclable and therefore have a low environmental impact.

The modular element 10 is light and features a high mechanical strength.

It can also be easily and securely installed on site, as previously explained. In fact, unlike

prior-art methods for laying modular roofing tile elements with integrated photovoltaic module, these modular elements can be installed by one person without requiring the presence of an electrician.

The fastening system according to the invention allows to make a roofing comprising modular elements with any slope, unlike the normal terracotta tiles, for which a minimum slope of approx. 20 % and a maximum slope of approx. 40 % are specified.

In addition, the dimensional ratio between the frame 15 of the support structure 11.1 and the integrated photovoltaic module 11.2 is optimal, thus allowing said module to include, for instance, two photovoltaic cells in order to attain the best energetic efficiency per surface unit of the roofing made up of modular elements 10.

Furthermore, as previously explained, the method according to the invention allows to assemble the support structure and the photovoltaic module in a manner such as to easily, quickly and safely obtain a substantially monolithic unit.

Of course, many changes may be made to what has been described and illustrated herein without however departing from the scope of the present industrial invention and from the protection domain thereof.

It follows that, for example, although the above description and the annexed drawings illustrate an integral raised flat frame 15, the top of which lies substantially in the plane of the highest area (top of the flap 14 and of the transverse edge 15.2) of the perimeter part of said support structure 11.1, the top of that very same frame may also, as an alternative, be arranged above the highest area of said perimeter part.

CLAIMS

1. A modular roofing tile element with integrated photovoltaic module, comprising a support structure (11.1) and a photovoltaic module (11.2), wherein the perimeter part (12, 13, 14, 16) of said support structure (11.1) is shaped like the perimeter of a conventional tile to allow it to be modularly connected to other similar modular roofing elements (10), characterised in that said perimeter part (12, 13, 14, 16) comprises a first (14) and a second (13) longitudinal flaps essentially parallel to each other and lying in respective planes at different heights, and further comprises a lower transverse edge (15.2), wherein in an upper region of each of said longitudinal flaps (13, 14) there are respective first (13.2) and second (14.2) through holes substantially aligned transversally with each other, and wherein in a median region of said transverse edge (15.2) there is a third through hole (17) so that, when two first modular elements (10.3, 10.4) are placed side by side, said first flap (14) is superimposed on said second flap (13) and, when a third modular element (10.1) is superimposed on said two first modular elements (10.3, 10.4), said first, second and third holes (17, 13.2, 14.2) are axially aligned with one another, thus allowing said three modular elements (10.1, 10.3, 10.4) to be solidly and securely fastened, with a single fastening means (V) which engages said first, second and third holes (17, 14.2, 13.2) in a through manner, with respect to a batten (L) of a roof framework.

2. A modular element according to claim 1, wherein said element comprises, inside said perimeter part (12, 13, 14, 16), an integral raised flat frame (15) essentially rectangular in shape, the top of which lies in the plane of the highest area (14, 15.2) of said perimeter part of said support structure (11.1), or above it.

3. A modular element according to claim 2, wherein in said raised frame (15) and along the sides thereof there are lowered integral steps (15.3, 15.4) in which a continuous groove (15.5) is formed wherein a corresponding layer of adhesive substance (18) can be deposited.

4. A modular element according to claim 3, wherein said photovoltaic module (11.2) can be superimposed on said steps (15.3, 15.4) and on said layer of adhesive substance (18).

5. A modular element according to claim 4, wherein on said photovoltaic module (11.2) a protective glass sheet (20) can be applied which is arranged substantially at the level of the top of said raised frame (15) and housed therein.

6. A modular element according to claim 5, wherein substantially vertical recesses (12.10, 15.20) are formed on the inner faces of opposite sides (12.1, 15.2) of said raised frame (15), which house corresponding vertical branches (19.1) of respective elastic mounting clamps

(19) shaped essentially like an upside-down "L", which, through their horizontal branch (19.2), secure said protective sheet (20) housed inside said raised frame (15).

7. A modular element according to claim 6, wherein in a vertical branch (19.1) of said clamps (19) at least one elastic tab (19.3) is produced which opens outwards and rests elastically against said frame (15), while a horizontal branch (19.2) thereof is slightly curved to adhere elastically to said sheet (20).

8. A modular element according to one or more of claims 3 to 7, wherein, in order to stiffen said support structure (11.1), at least one longitudinal member (15.6) and a cross member (15.7) are provided, in one body, inside said frame (15) and substantially in the plane of said lowered steps (15.3, 15.4), which delimit therebetween wide ventilation openings for ventilating said photovoltaic module (11.2).

9. A modular element according to one or more of claims 2 to 8, wherein said first longitudinal flap (14) has an upper face substantially at the level of the top of said raised frame (15) or lower, and said second longitudinal flap (13) is opposed to said first longitudinal flap (14) and is located at a lower level, whereas said raised transverse edge (15.2) comprises an upper face which is substantially at the level of the top of said raised frame (15) or lower.

10. A modular element according to one or more of claims 5 to 9, wherein said protective glass sheet (20) covers the whole useful area delimited by said raised flat frame (15), while the perimeter of the corresponding underlying photovoltaic module (11.2) is set back with respect to said protective sheet (20) so as to compensate, in order to exploit the solar radiation optimally, for the slight depth in which said photovoltaic module (11.2) is located with respect to the top of said frame (15), due to the presence of said protective sheet (20).

11. A modular element according to claim 2, wherein said support structure (11.1) comprises a tray (12) that communicates, through a notch (12.2), with a channel formed on said second longitudinal flap (13) between a bead (13.1) and a longitudinal relief (15.1) of said raised flat frame (15).

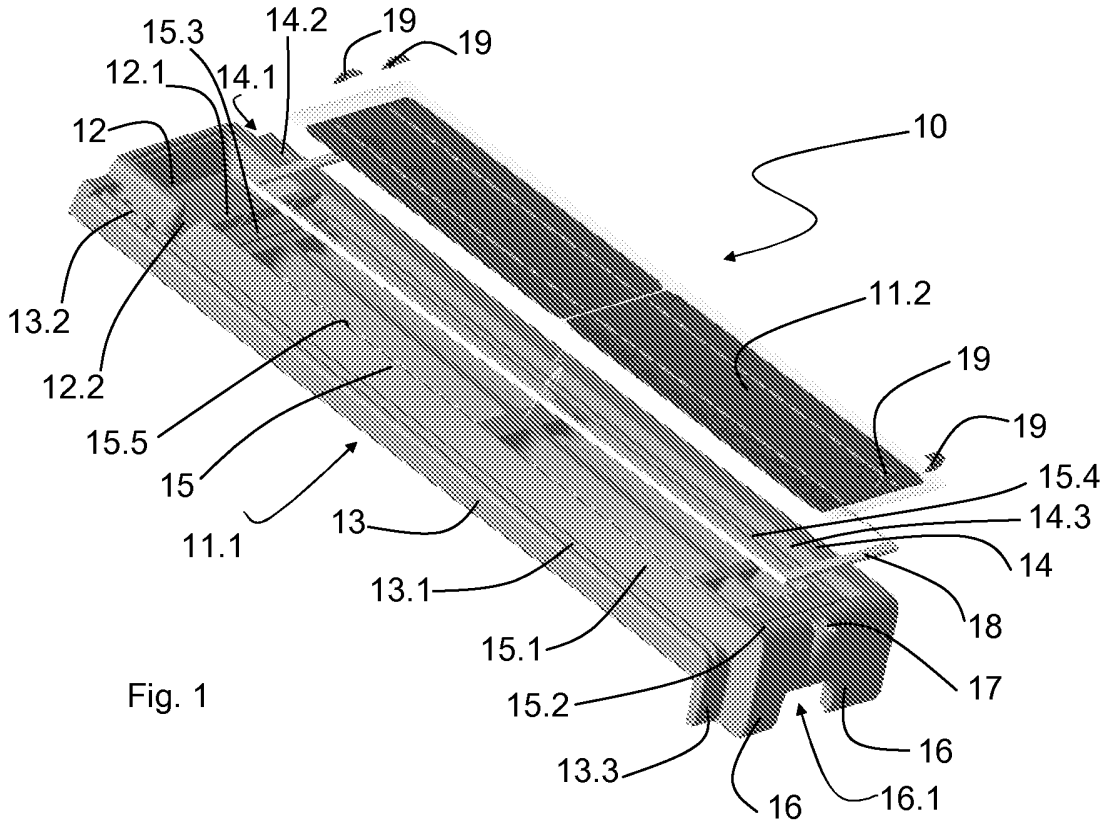
12. A method for laying modular roofing tile elements with integrated photovoltaic module on a roof, characterised by comprising the steps of:

- prearranging three modular elements, each of said elements comprising a support structure (11.1) and a photovoltaic module (11.2), wherein the perimeter part (12, 13, 14, 16) of said support structure (11.1) is shaped like the perimeter of a conventional tile to allow it to be modularly connected to other similar modular roofing elements (10) and comprises a first (14)

and a second (13) longitudinal flaps essentially parallel to each other and lying in respective planes at different heights, and further comprises a lower transverse edge (15.2), wherein in an upper region of each of said longitudinal flaps (13, 14) there are respective first (13.2) and second (14.2) through holes substantially aligned transversally with each other, and wherein in a median region of said lower transverse edge (15.2) there is a third through hole (17);

- placing a first and a second modular elements side by side, so that a second flap (13) of said first modular element overlaps a first flap (14) of said second modular element;

- superimposing a third modular element (10.1) on said two first modular elements (10.3, 10.4), so that a second through hole of said first element, a first through hole of said second element and a third through hole of said third element (17, 13.2, 14.2) are axially aligned with one another, thus allowing said three modular elements (10.1, 10.3, 10.4) to be securely fastened, with a single fastening means (V) which engages said first, second and third holes (17, 14.2, 13.2) in a through manner, with respect to a batten (L) of a roof framework.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15.1
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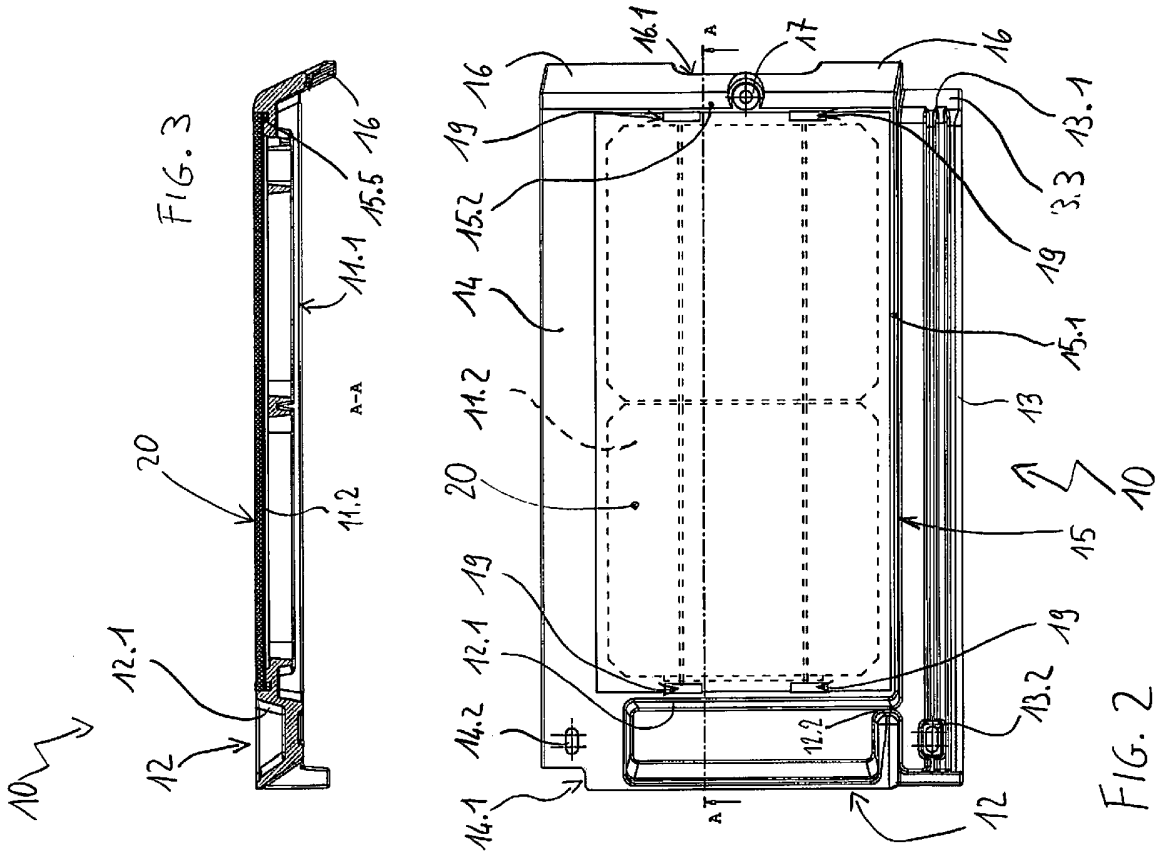
13.3
16
16.1

Fig. 1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A-A
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FIG. 3
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12.1
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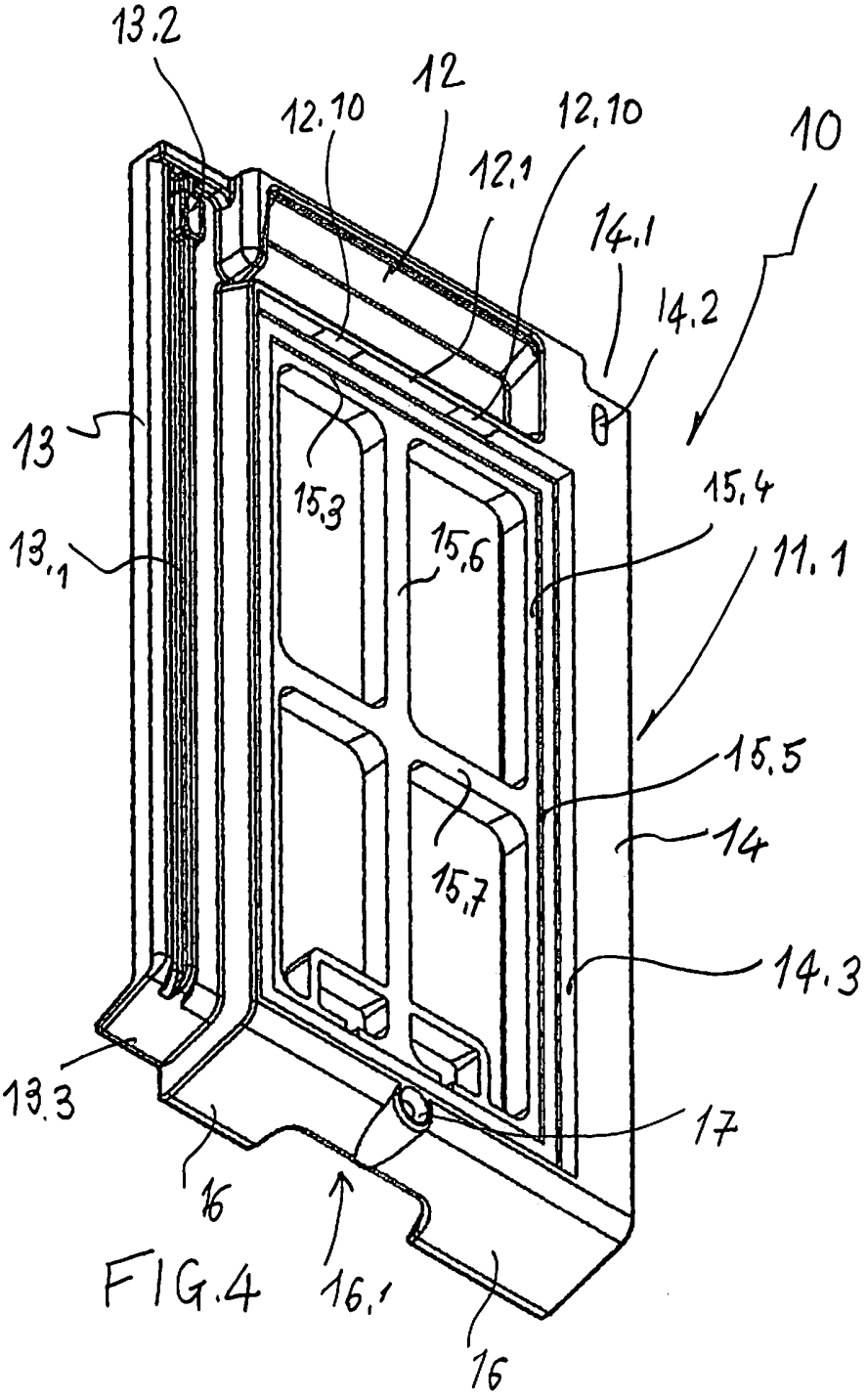
FIG. 2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17
16
16.1
16

FIG.4

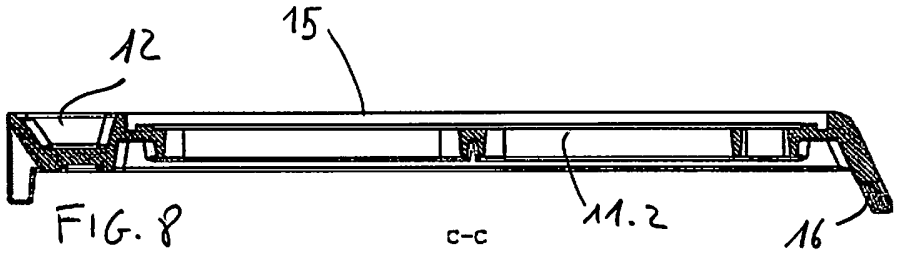


FIG. 8

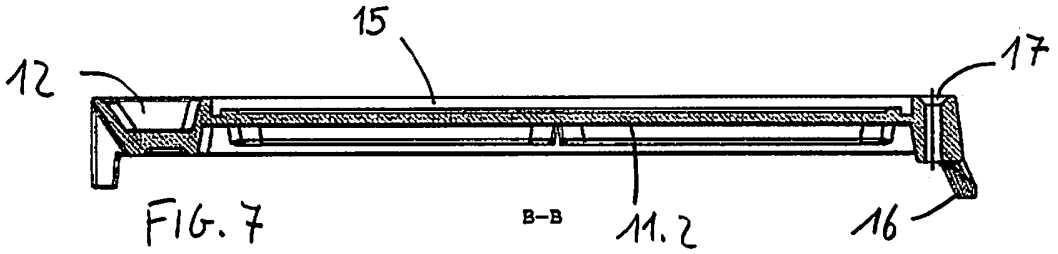


FIG. 7

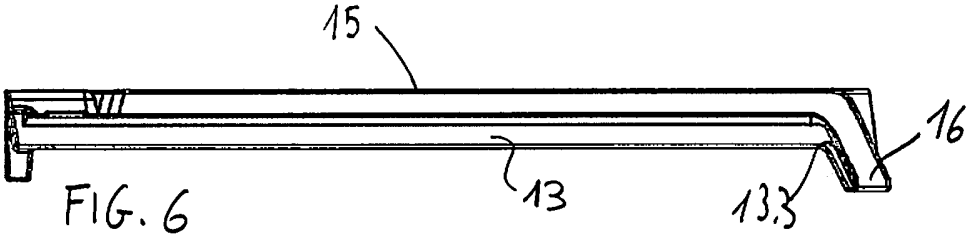


FIG. 6

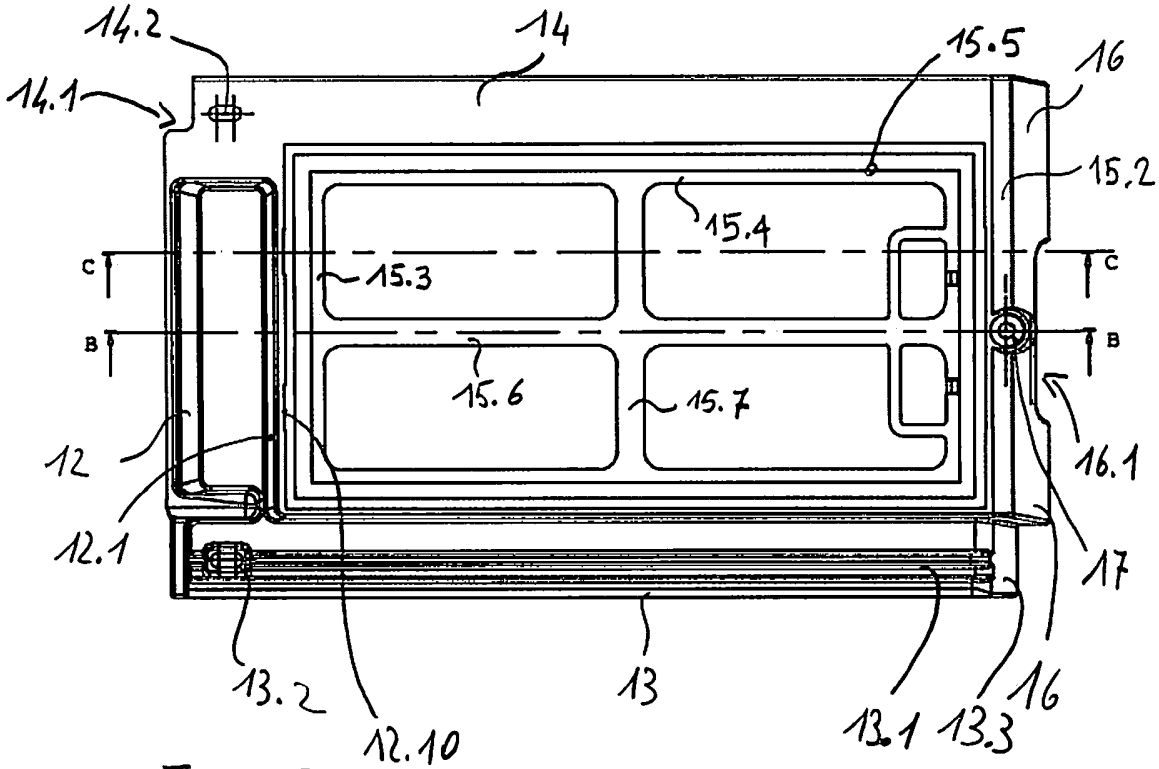


FIG. 5A

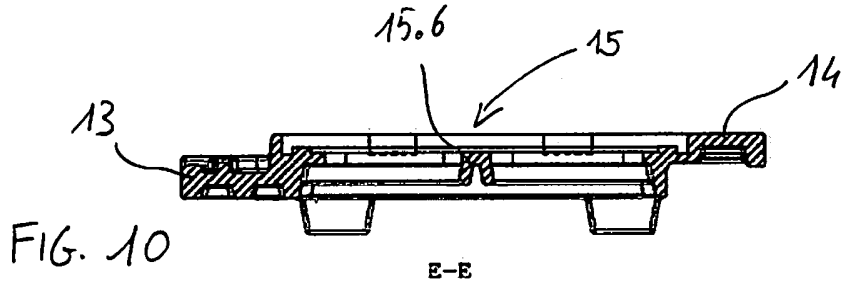


FIG. 10

E–E

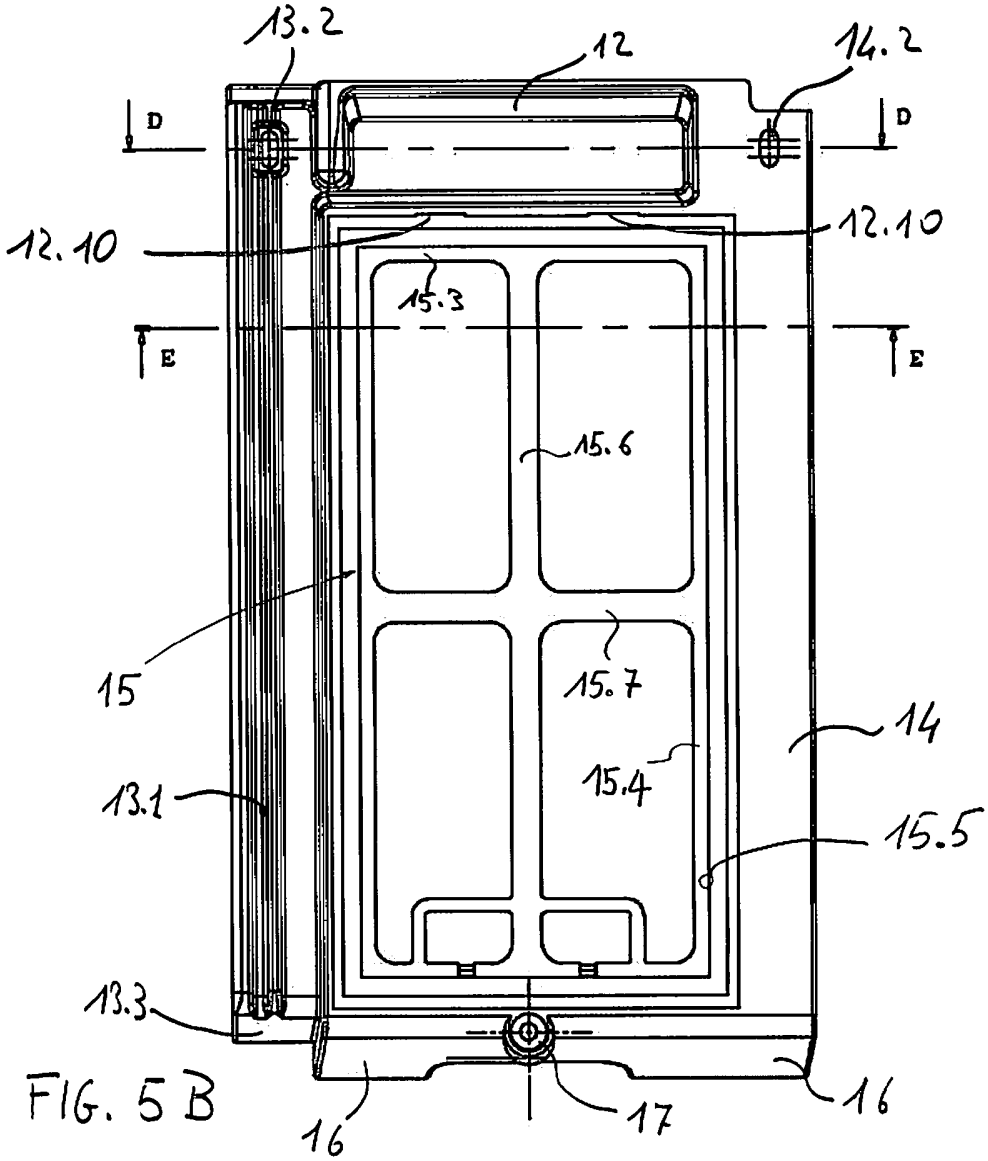


FIG. 5B

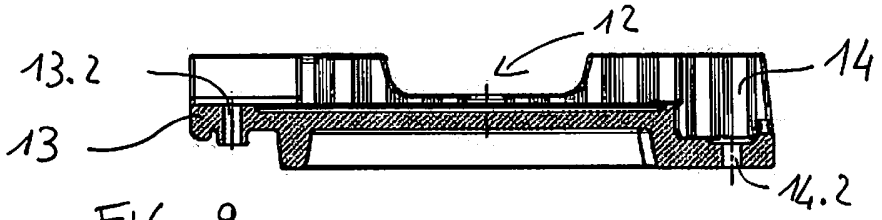


FIG. 9

D–D

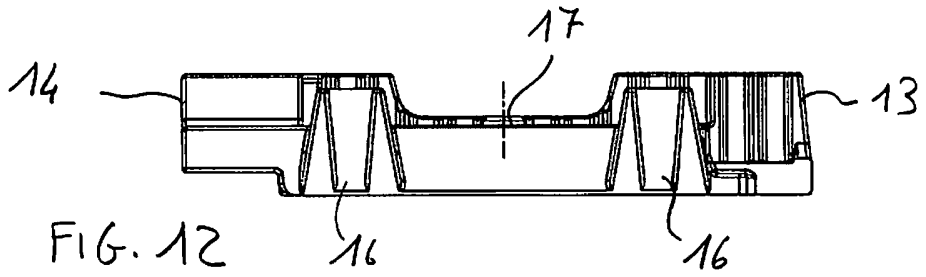


FIG. 12

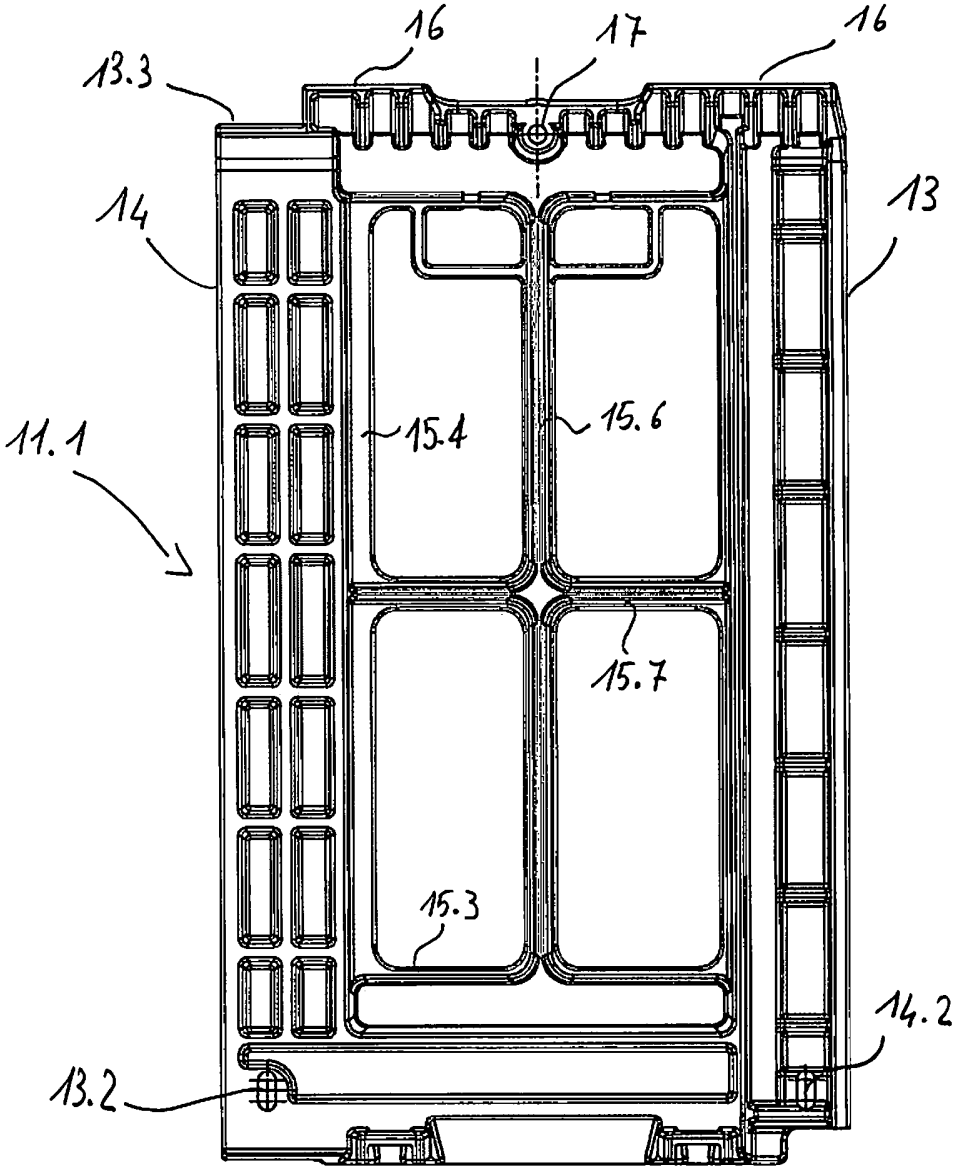


FIG. 11

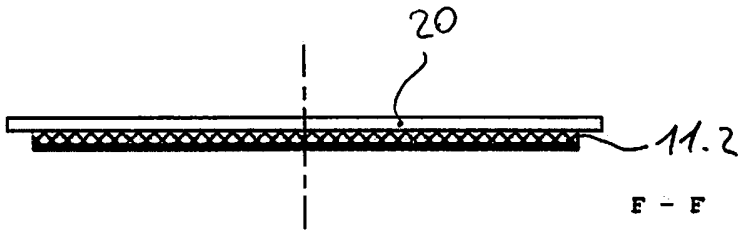


FIG. 14

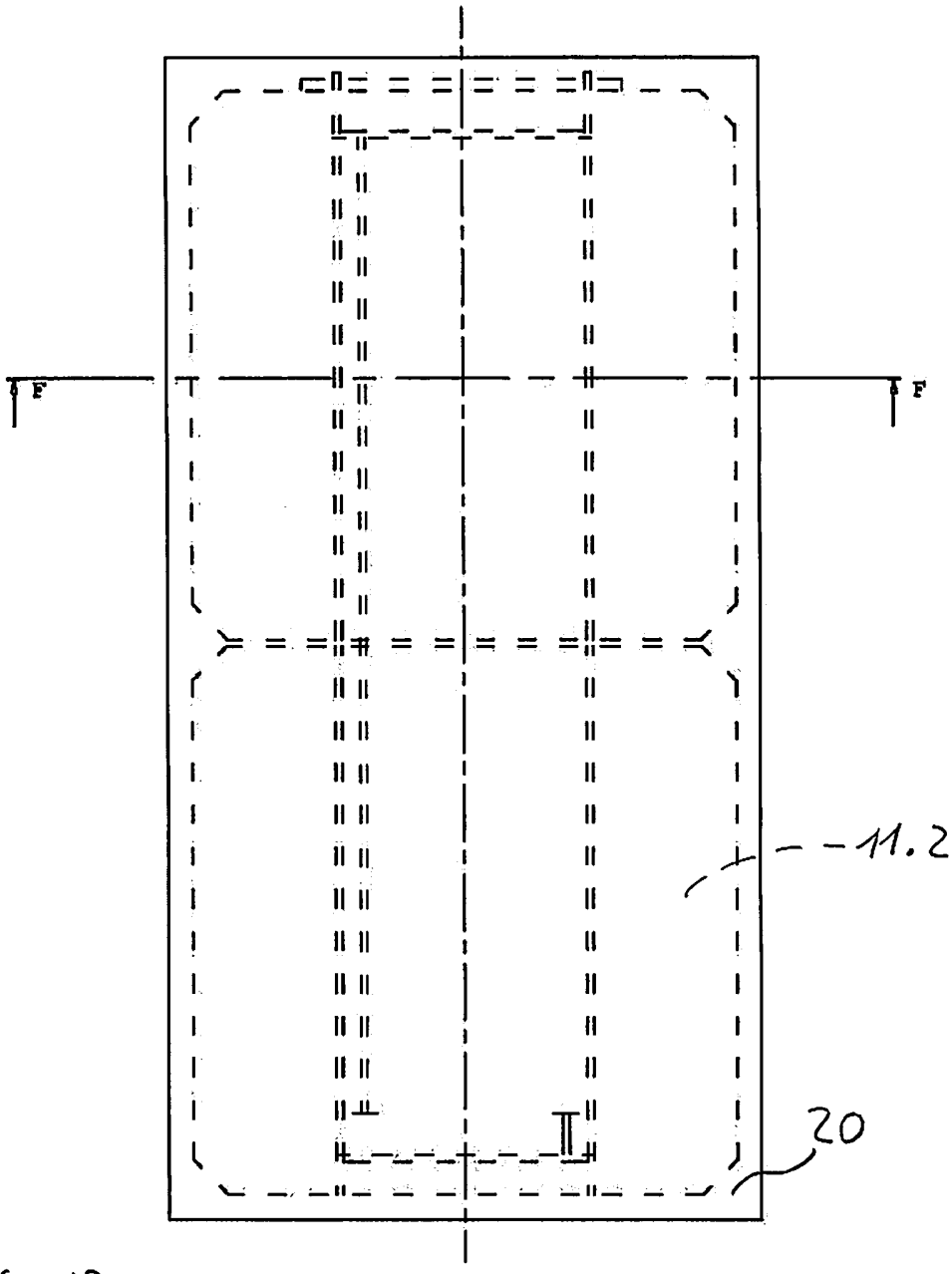


FIG. 13

FIG. 15

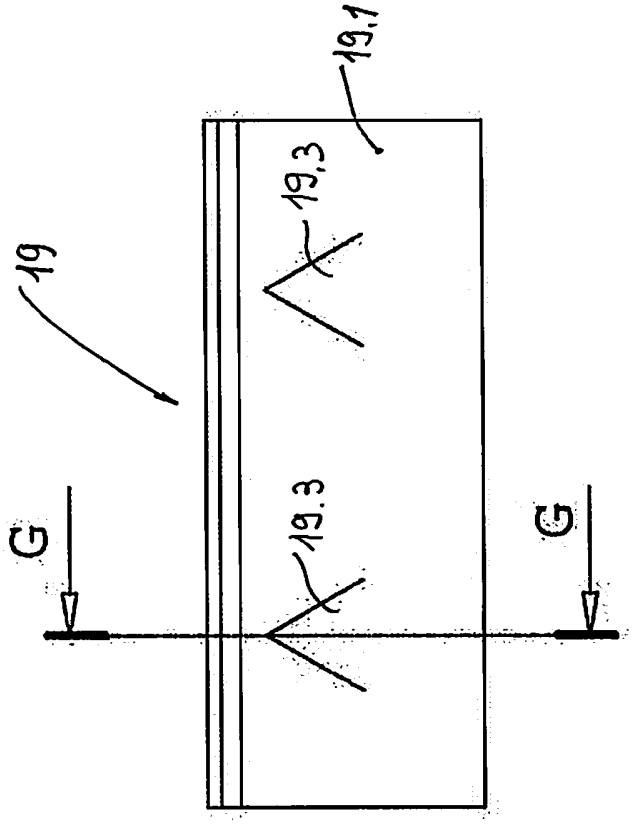
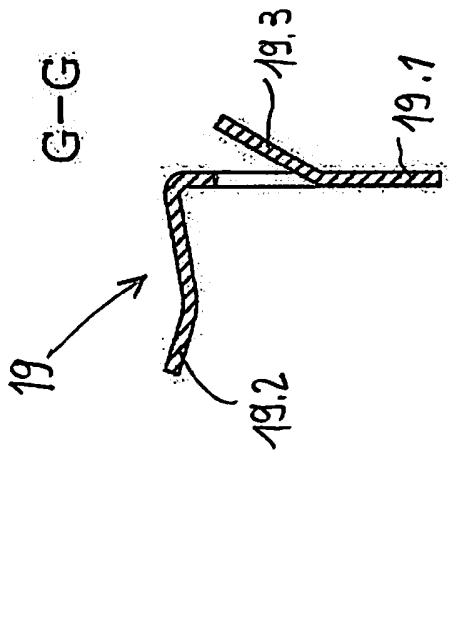


FIG. 16



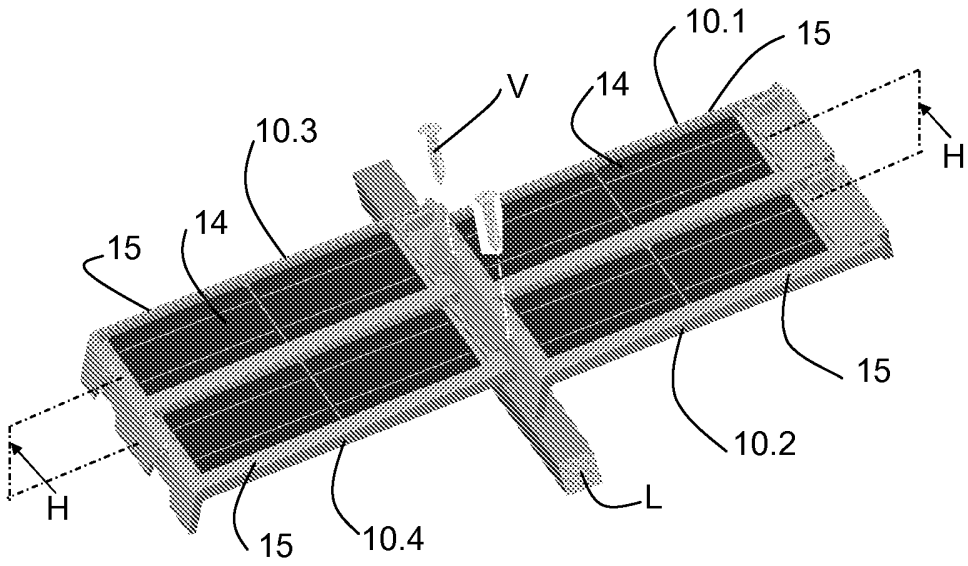


Fig. 17

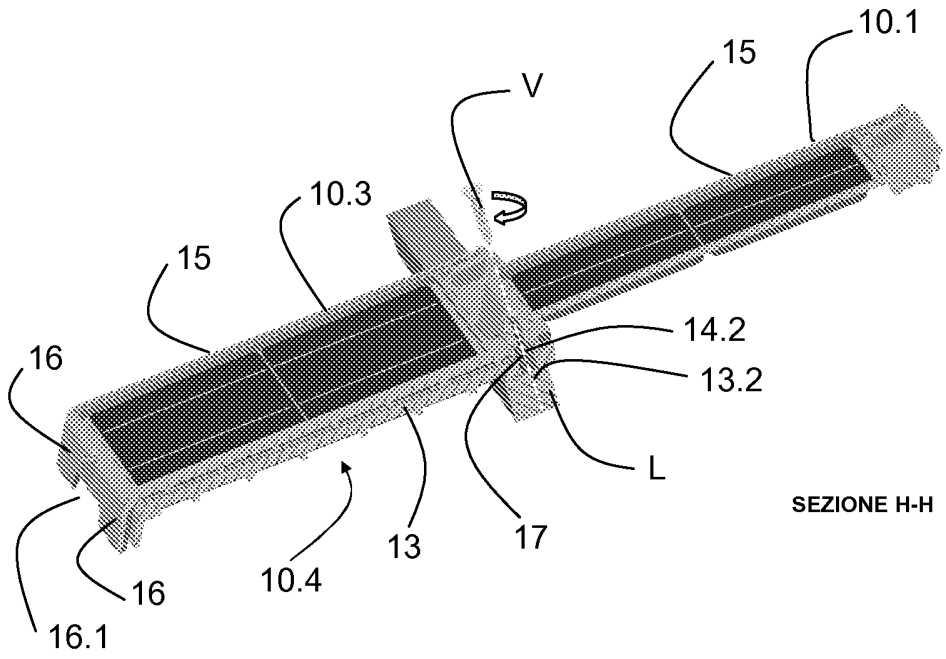


Fig. 18

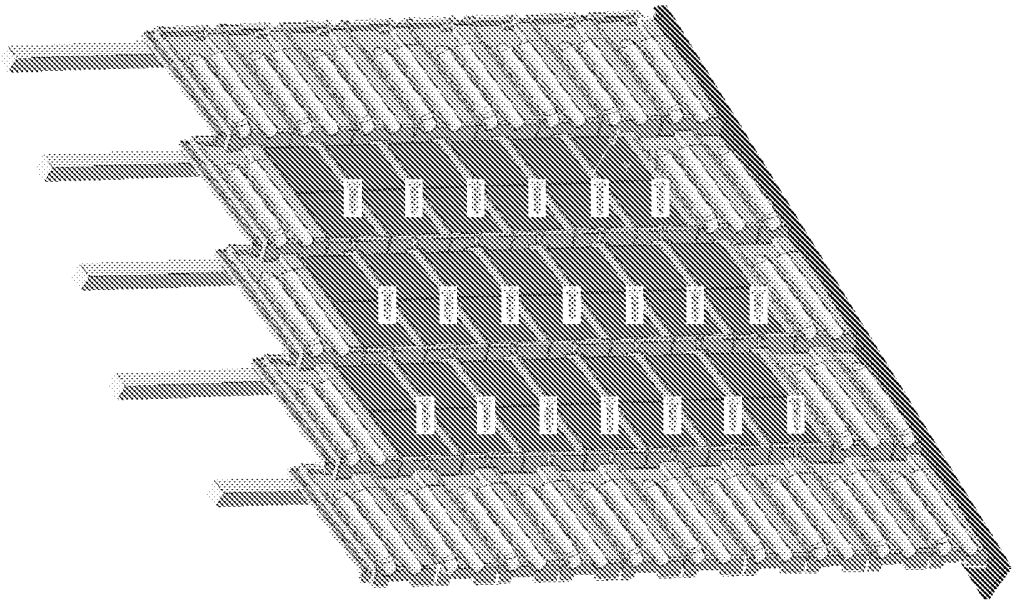


Fig. 19

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2010/054767

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01L31/048
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2008/137966 A2 (STANCEL ROBERT [US]; ROSCHEISEN MARTIN R [US]; SAGER BRIAN M [US]; ADR) 13 November 2008 (2008-11-13) figure 13	1-5,9-12 6-8
X	WO 00/30184 A1 (US SOLAR ROOF [US]; RODRIGUEZ PAUL R [US]) 25 May 2000 (2000-05-25) page 5, line 20 - line 21; figure 3	1-5,9,10
Y	JP 2000 226908 A (SEKISUI CHEMICAL CO LTD; SHARP KK) 15 August 2000 (2000-08-15) figure 2	6,7
Y	WO 2006/082399 A1 (POWERTILE LTD [GB]; MUCCI PETER [GB]) 10 August 2006 (2006-08-10) figure 4	8

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 December 2010	05/01/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Rosello Garcia, M

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2010/054767

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		EP 1849190 A1	31-10-2007