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(54) **Coupling element between PV assembly and carrier frame**

(57) Too large defiections may cause damage to a PV panel. Deflections may be reduced by mounting the PV panel to a carrier frame at specific locations. A coupling element is provided for mounting a photovoltaic assembly to a carrier frame, which coupling element may be provided at different locations behind the PV panel. The coupling element comprises a body, and clamp members protruding at one side of the body for a clamping connection with a heat sink of the PV panel, and a carrier frame connection module at a second side for connection to the carrier frame. The clamp members are provided with gripping members arranged to be inserted into openings of the heat sinks, which openings were originally provided for enabling an air flow through the heat sink.

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Dit octrooi is verleend ongeacht het bijgevoegde resultaat van het onderzoek naar de stand van de techniek en schriftelijke opinie. Het octrooischrift komt overeen met de oorspronkelijk ingediende stukken.

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Title: Coupling element between PV assembly and carrier frame

TECHNICAL FIELD

The various aspects relate to a coupling element for mounting a photovoltaic module to a carrier frame.

BACKGROUND

Photovoltaic (PV) panels are used to convert light into electrical energy. PV panels may be mounted on a carrier frame to form a PV system. A heat sink panel such as the one described in WO2018226091 may be provided with the PV panels for reducing an operating temperature of the PV panels. This reduction in operating temperature may increase the efficiency and/or operational lifetime of the PV panels.

Due to external forces, for example caused by wind or snow, acting on a PV panel, the PV panel may deflect. The stiffness of the PV panel, and the stiffness of the connection of the PV panel to the carrier frame are an important factor in decreasing deflection of the PV panel, which deflection may cause damage to the PV panel and therewith reduce operational performance and lifetime.

For providing stiffness to a PV panel, a circumferential frame or second glass layer on the backside is used. For mounting the PV panel to the carrier frame, the circumferential frame or at least one of the glass layers is or are clamped.

SUMMARY

Clamping the circumferential frame of the PV panel may result in a coupling to the carrier frame with insufficient stiffness which may result in undesirably large deflections of the PV panel. These deflection are caused by external forces on the PV panels due to for example by wind or precipitation, as is discussed in A. J. Beinert et al. “Influence of photovoltaic

module mounting systems on the thermos-mechanical stresses in solar cells by FEM Modelling", EUPVSEC, Munich, 5BV.1.14, 2016.

A stiffness of a PV panel may be defined as the amount of force required to deflect the PV panel. Considering that a typical PV panel is shaped as a substantially flat rectangular plane, deflection of a point on the PV panel may be defined as the distance the point has travelled relative to its position when no force is applied to the PV panel.

It is therefore preferred to provide a coupling element for mounting a PV assembly to a carrier frame which provides a higher stiffness to a PV panel comprised by the PV assembly.

A first aspect provides a coupling element for mounting a photovoltaic assembly to a carrier frame, the photovoltaic assembly provided with a heat sink module comprising a profiled sheet with substantially parallel gutters comprising openings distributed along sidewalls of the gutters, the coupling element comprising a body comprising a photovoltaic assembly side and a carrier frame side opposite to the photovoltaic assembly side, a photovoltaic assembly connection module comprising two clamp members protruding away from the photovoltaic assembly side, the clamp members comprising a gripping member at a distal end of the clamp members, a carrier frame connection module for connecting the coupling element to the carrier frame provided at the carrier frame side of the body, wherein the photovoltaic assembly connection module can be manipulated between a first setting and a second setting, wherein in the second setting a distance between the gripping members of the clamp members is larger than that distance in the first setting.

With the coupling element according to the first aspect, the coupling element may be provided behind or at least partially behind the PV panel of the PV assembly. With this positioning, UV radiation from sunlight will have less impact on the coupling element. This may increase lifetime of

the coupling element as UV radiation may cause degradation of the material comprised by the coupling element.

The coupling element according to the first aspect may allow mounting of the photovoltaic assembly to a carrier frame without the use of bolts, screws, or any additional tools. This may be possible by using the snap fit characteristics of the connection between the coupling element and the PV assembly and/or connection between the coupling element and the carrier frame.

In embodiments of the coupling element, the clamp members may protrude from a photovoltaic assembly side base surface. Alternatively or additionally, the clamp members may be resiliently deformable for moving gripping members towards the body.

The clamp members may be provided opposite to one another at a distance from and substantially parallel to one another.

The clamp members may protrude from the photovoltaic assembly side at an angle relative to a normal vector of the photovoltaic assembly side. This angle may be chosen corresponding to an angle of a surface of the photovoltaic assembly.

The gripping members may extend substantially perpendicular to the protrusion direction of the clamping members. Such an extensions may allow a firmer connection of the coupling element to the photovoltaic assembly.

In embodiments of the coupling element, some or all of the gripping members may extend towards each other. Alternatively or additionally, some or all of the gripping members may extend away from each other.

The carrier frame connection module may comprise a set of carrier frame connection protrusions protruding from the body away from a carrier frame connection side base surface opposite to the photovoltaic

assembly side base surface and wherein the carrier frame connection protrusions are skewed relative to the clamp members.

A second aspect provides an assembly of a coupling element according to any of the preceding claims and a photovoltaic assembly, wherein the photovoltaic assembly is provided with a heat sink module comprising a profiled sheet with substantially parallel gutters, the gutters comprise openings in sidewalls of the gutters for enabling an air flow through the gutters, the openings are arranged to receive at least part of a gripping member of a clamp member of the coupling element, the coupling element is connected to the photovoltaic assembly by virtue of a gripping member of a first clamp member being inserted in an opening of a first gutter and by virtue of a gripping member of a second clamp member being inserted in an opening of a second gutter provided adjacent to the first gutter.

In embodiments of the assembly the opening of the first gutter and the opening of the second gutter face each other. Alternatively, the opening of the first gutter and the opening of the second gutter may face away from each other.

When the coupling element is connected to the photovoltaic assembly, the clamp members may be elastically hinged away from the respective opening in which the gripping member is inserted.

BRIEF DESCRIPTION OF THE FIGURES

The various aspects and embodiments thereof will now be discussed in conjunction with figures. In the figures:

Fig. 1A	shows a general lay-out of a PV system;
Fig. 1B	shows a detailed view of part of an embodiment of the PV system;

Fig. 2A shows an exploded view of an assembly of a coupling element and a PV assembly;

Fig. 2B shows an embodiment of a coupling element;

Figs. 3A, 3B and 3C subsequently show an embodiment of a coupling element being connected to a heat sink; and

Figs. 4A, 4B and 4C subsequently show another embodiment of a coupling element being connected to a heat sink.

DETAILED DESCRIPTION

Fig. 1A shows a general lay-out of a PV system 100, comprising a carrier frame 110 and a PV assembly 120 mounted to the carrier frame 110. Being mounted to the carrier frame 110, the PV assembly 120 is oriented at a certain angle, which angle may be chosen for optimal orientation of the PV assembly 120 relative to the sun. For optimal orientation, said angle may be an angle relative to the surface on which the carrier frame 110 is placed. A plurality of coupling elements 200 connects the PV assembly 120 to the carrier frame 110. The carrier frame 110 comprises girders 112 arranged for connection to the coupling elements 200.

The PV assembly 120 comprises a PV panel 122 arranged to convert solar irradiation into electrical energy, and a heat sink 124 arranged to transfer heat generated by or in the PV panel 122 to the surroundings in order to cool the PV panel 122. The heat sink 124 is arranged to allow an air flow 126 there through, which may increase the effectiveness of the heat sink 124. Preferably, the heat sink 124 comprises a heat conducting material, such as a metal and aluminium in particular. The heat sink 124 may be connected to the PV panel 122 by means of glue or another adhesive.

In the embodiment of the PV system 100 of Fig. 1A, the coupling elements 200 connect to the heat sink 124 at a PV assembly side of the coupling elements 200 and the coupling elements 200 connect to the carrier

frame 110 at a carrier base side of the coupling elements 200 opposite to the PV assembly side. As such, the connection between the carrier frame 110 and the PV panel 122 is established via girders 112, coupling elements 200 and heat sink 124.

Any number of girders 112 and coupling elements 200 may be used in the PV system 100, including only one of each. The number of coupling elements 200 and their position relative to the PV panel 122 may be chosen such that the deflection of the PV panel 122 due to external forces is decreased. Preferably, the deflection is as low as possible to prevent straining the PV panel 122 which may limit the lifespan of the PV panel 122. The deflection of the PV panel may be expressed as the distance a point on the PV panel has been displaced between a situation where no load is applied – and the PV panel is shaped as a substantially flat plane– and a situation wherein at least part of the PV panel is bent out of plane.

Thus, due to the use of coupling elements 200 which connect to the heat sink 124 provided over at least a substantial part of the PV panel 122, the connection between the PV assembly 120 and the carrier frame 110 does not need to be established only at the circumference of the PV panel 122, but may now be established anywhere below the PV panel 122 where heat sinks 124 are provided. As such, a connection with a relatively high stiffness may be established which may decrease undesired deflections of the PV panel 122.

In different embodiments of the carrier frame 110, alternatives to girders may be used for allowing connection by coupling elements 200.

Furthermore, different connection methods may be used for connection the carrier frame 110 and the coupling element 200, such as gluing, welding, screwing, any other connection method or any combination thereof. Even further, all or a number of the coupling elements 200 used may be part of the carrier frame 110, or, alternatively or additionally, part of the heat sink 124.

In the view of Fig. 1A, a side view of the PV system 100 is shown, showing two coupling elements 200, provided at positions *p1* and *p2*. In a practical embodiment, four coupling elements 200 are provided. At the positions *p1* and *p2*, the stiffness of the connection of PV panel 122 to the carrier frame 110 is directly determined by the stiffness of the coupling element 200. As such, the stiffness of the PV panel 122 relative to the carrier frame 110 may be highest at these points. The stiffness of the PV panel 122 may be lowest at a point in the middle between positions *p1* and *p2*, as at this point the distance to the coupling elements 200 is largest. By moving positions *p1* and *p2* relative to each other, the maximum deflection of any point on the PV panel 122 may be optimised.

Fig. 1B shows a detailed view of part of an embodiment of the PV system 100, showing a coupling element 200 connecting a girder 112 of the carrier frame 100 to heat sink 124 of the PV assembly 120. Generally indicated with reference numeral 210 is the carrier frame connection module, which connects the coupling element 200 to the girder 112.

The heat sink 124 is formed out of a profiled, and preferably metal, sheet. The heat sink 124 comprises a first gutter 131 and a second gutter 132, which are provided substantially parallel to one another. Distributed along sidewalls 135 of the gutters are openings 134, arranged to facilitate an air flow through the gutters.

Any number of openings 134 may be provided, and when the openings 134 are preferably spaced apart equidistantly, a coupling element 200 may be provided at different positions along the gutter. Whereas Figure 1B discloses triangular openings, any other shape of the opening may be used. Having the ability to provide coupling elements 200 at different positions along the gutter may allow for a higher stiffness connection of the PV panel 122 to the carrier frame 110, as explained above.

The heat sink's 124 gutters as shown in Fig. 1B are shaped as two-sided triangles, which are connected by straight sheet sections. The

substantially triangular shaped gutters comprise two side walls 135 which together with an imaginary base 136 forms a isosceles triangle.

In the embodiment of Fig. 1B the coupling element 210 is clamped between openings of two neighbouring gutters. In other embodiments, the coupling element 210 may be clamped between openings of two not directly neighbouring gutters when the heat sink 124 comprises three or more substantially parallel gutters.

Fig. 1B shows a coupling element 200 comprising a body 222 comprising a PV assembly side and a carrier base side opposite to the PV assembly side. The PV assembly side is that side of the body 222 facing the PV assembly 120, and the carrier base side is that side of the body 222 facing the girder 112 of the carrier frame 110. A PV assembly connection module is generally indicated with reference numeral 218, and comprises at least two heat sink clamps 220 as clamp members protruding away from the PV assembly side, of which only one heat sink clamp 220 is visible in the view of Fig. 1B.

The heat sink clamp 220 comprises a hook 221 as an implementation of a gripping member at a distal end of the heat sink clamp 220, which hook will be discussed in more detail in the description below. The hook is arranged to be hooked in an opening 134 of one of the gutters. When hooked in the opening 134, the hook blocks a movement of the heat sink 124 in a direction away from the carrier 110.

For connecting the coupling element 200 to the heat sink 124, the PV assembly connection module 218 can be manipulated between a first setting and a second setting, wherein in the second setting a distance between the hooks as gripping members of the heat sink clamps as clamp members is larger than that distance in the first setting. For manipulating the PV assembly connection module 218, the heat sink clamps 220 as clamp members may be resiliently deformable for moving hooks as gripping members towards or away from the body 222. More on the resilient

deformation of the heat sink clamps 220 will be explained in conjunction with Figs. 3A-4C.

The carrier frame connection module 210 comprises a set of carrier frame connection protrusions 225 protruding from the body 222 away from carrier frame connection side base surface 236 which is provided opposite to the PV assembly side base surface. The carrier frame connection protrusions 225 are oriented such that they are aligned with an elongation direction of girder 112. Because the girder 112 is oriented substantially perpendicular to the heat sink 124, the carrier frame connection protrusions 225 are skewed by an angle of substantially 90 degrees relative to the heat sink clamps 220.

Different girders of different PV assemblies may be shaped differently, and according to the shape of the girder, the shape of the carrier frame connection protrusions 225 may be adapted. Furthermore, the carrier frame connection protrusions 225 may clamp around the outside of a girder 112, or alternatively clamp a girder 112 from the inside out.

Fig. 2A shows an exploded view of an assembly 101 of a coupling element 200 and a PV assembly 120, more specifically a heat sink 124 of the PV assembly 120. The coupling element 200 is in Figs. 2A and 2B shown comprising six heat sink clamps 220 as clamp members, divided in two substantially parallel rows of three heat sink clamps 220 as clamp members. Coupling elements 200 comprising any other number of heat sink clamps are envisioned as well.

Provided at a distal end of each clamp member 220 is a hook 221 as an implementation of a gripping member, arranged to grip an opening 134 of one of the gutters. In the embodiment of the assembly 101 as shown in Fig. 2A, the hooks 221 face away from each other, and as such the coupling element 200 is arranged to be coupled to two side walls of the heat sink 124 which face each other.

Fig. 2B shows an embodiment of a coupling element 210, comprising six heat sink clamps 220 as clamp members, each comprising at a distal end a hook 221 as a. The heat sink clamps 220 are in this particular embodiment provided opposite to one another at a distance indicated by *x*. Furthermore, the heat sink clamps 220 are aligned one two lines 227 which are substantially parallel to one another. This provides a symmetry which, combined with an equal spacing between the heat sink clamps 220 along lines 227, allows connection of the coupling element 210 to the heat sink 124 in two ways, which two ways are rotated 180 degrees relative to each other.

The coupling element 210 may be manufactured using injection moulding, milling, any other manufacturing method or any combination thereof. The coupling element 210 may comprise any material such as a plastic, and the material may be chosen such that a desired hinging stiffness of the heat sink clamps 220 is achieved in combination with the shape of the heat sink clamps 220. At least part of the coupling element may be reinforced with glass fibres. The coupling element may be embodied as one single monolithic part.

Figs. 3A, 3B and 3C subsequently show an embodiment of a coupling element 200 being connected to a heat sink 124 of a PV assembly 120. In Fig. 3A, the coupling element 200 is not connected to the heat sink 124, in Fig. 3B, the coupling element 200 is in the process of being connected to the heat sink 124 and Fig. 3C shows the assembly 201 of the coupling element 200 connected to the heat sink 124.

The coupling element 200 as shown in Figs. 3A-3C comprises body 222, a first heat sink clamp 220 as a clamp member with a first hook 221 as a gripping member , and a second heat sink clamp 220'as a clamp member with a second hook 221'as a gripping member, wherein the hooks are provided at a distal end of the respective heat sink clamp they are comprised by. The heat sink clamps 220 protrude from a PV assembly side base surface 232.

In the assembly 101 of Figs. 3A-3C, a first opening 134 comprised by a first gutter 131 faces towards a second opening 134' comprised by a second gutter 132. The first gutter 131 and the second gutter 132 are directly neighbouring gutters as no gutter is provided between the first gutter 131 and the second gutter 132. In other embodiments of the assembly 101 any number of other gutters may be present between the first gutter 131 and the second gutter 132.

As shown in Figs. 3A-3C, in this particular embodiment of the coupling element 200, the hooks 221 extend away from each other. Furthermore, the hooks 221 extend substantially perpendicular to the protrusion direction of the clamping members 220.

The heat sink clamps 220 protrude from the PV assembly side at an angle relative to a normal vector 234 of the PV assembly side. This protrusion angle may correspond to an angle of a sidewall 135 of the gutters, such that a side wall 135 of gutter is oriented substantially parallel to the heat sink clamps 220 when the heat sink clamp220 is not deformed, as shown in Fig. 3A, or only slightly deformed, as shown in Fig. 3C.

A distance between the hook 221 as gripping members is indicated in Figs. 3A-3C respectively as *d*, *d'*, and *d"*. When the coupling element 200 is in the process of being connected to the heat sink 214, as shown in Fig. 3B, the heat sink clamps are resiliently deformed. The deformation results in distance *d'* of Fig. 3B being smaller than distance *d* of Fig. 3A. The distance *d* of Fig. 3A corresponds to a setting wherein to forces are exerted on the heat sink clamps 220 and they are not elastically deformed.

When the coupling element 200 is moved further towards the heat sink 124, as shown in Fig. 3C, the hooks 221 are inserted into the openings 134 by virtue of the elastic energy which deformed the heat sink clamps 220 during the movement of the coupling element 200 towards the heat sink 124 which was shown in Fig. 3B. When inserted into the openings 134, the

distance between the hooks 221 d'' may be smaller than or equal to distance d. When distance d'' is smaller than distance d, the heat sink clamps 220 may be elastically hinged away from the respective opening in which their hook 221 is inserted, and as such a clamping force may be present which presses the hooks 221 into their opening 134.

Figs. 4A, 4B and 4C subsequently show another embodiment of a coupling element 200 being connected to a heat sink 124 of a PV assembly. In Fig. 4A, the coupling element 200 is not connected to the heat sink 124, in Fig. 4B, the coupling element 200 is being connected to the heat sink 124 and Fig. 4C shows the assembly 201 of the coupling element 200 connected to the heat sink 124.

The embodiment of the coupling element 200 as shown in Figs. 4A-C differs from the embodiment of the coupling element 200 as shown in Figs. 3A-3C in that the hooks 221 as gripping members are now extending towards each other. Because of this different orientation of the hooks 221, the hooks 221 are now arranged to be inserted into openings 134 and 134′ which are facing away from each other.

In the setting of Fig. 4A, the distance between the hooks 221 is indicated with d. During the connection of the coupling element 200 to the heat sink 124, the distance between the hooks 221 increases to distance d'. Finally, when the hooks 221 are inserted into the openings 134, the distance between the hooks 221 decreases to d'', which may be larger or equal to distance d.

If distance d'' is larger than distance d, which is the distance between the hooks 221 when no forces are exerted on the heat sink clamps 220, the heat sink clamps 220 may be elastically deformed. This elastic deformation may provide a clamping force which may aid in the connection between the coupling element 200 and the heat sink 124.

In Figs. 3A-4C parts of the coupling element 200 related to connecting with the carrier frame 110 have been omitted for conciseness of the figures.

When the coupling element 200 is connected to the heat sink 124, as shown in Fig. 3C and in Fig. 4C, the PV assembly side base surface 232 from which the heat sink clamps 220 protrude abuts the heat sink 124 when the hooks 221, 221' are inserted into the openings 134, 134'. This abutment substantially prevents further movement of the coupling element 200 towards the PV panel 220. Combined with the hooks 221 substantially restricting movement of the coupling element 200 away from the PV panel 220, movement of the coupling element 200 relative to the PV panel 220 may be substantially prevented. In other words, when the coupling element 200 is connected to the carrier frame 110 and the heat sink 124, the PV assembly 120 is mounted to the carrier frame 110.

Many different shapes are envisioned for the gripping members 221, and the invention is thus not limited to the hook shaped gripping members as shown in the figures. Any gripping member shape which allows at least partial insertion of the gripping member into an opening 134 of the heat sink 124 may be used. Furthermore, any number of gripping members may be used for connecting the coupling element 200 to the heat sink 124 of the PV assembly 120.

In summary, too large deflections may cause damage to a PV panel. Deflections may be reduced by mounting the PV panel to a carrier frame at specific locations. A coupling element is provided for mounting a photovoltaic assembly to a carrier frame, which coupling element may be provided at different locations behind the PV panel. Embodiments of the coupling element comprise a body, and clamp members protruding at one side of the body for a clamping connection with a heat sink of the PV panel, and a carrier frame connection module at a second side for connection to the carrier frame. The clamp members are provided with gripping members

arranged to be inserted into openings of the heat sinks, which openings were originally provided for enabling an air flow through the heat sinks.

In the description above, it will be understood that when an element such as layer, region or substrate is referred to as being "on" or "onto" another element, the element is either directly on the other element, or intervening elements may also be present. Also, it will be understood that the values given in the description above, are given by way of example and that other values may be possible and/or may be strived for.

Furthermore, the invention may also be embodied with less components than provided in the embodiments described here, wherein one component carries out multiple functions. Just as well may the invention be embodied using more elements than depicted in the Figures, wherein functions carried out by one component in the embodiment provided are distributed over multiple components.

It is to be noted that the figures are only schematic representations of embodiments of the invention that are given by way of non-limiting examples. For the purpose of clarity and a concise description, features are described herein as part of the same or separate embodiments, however, it will be appreciated that the scope of the invention may include embodiments having combinations of all or some of the features described. The word 'comprising' does not exclude the presence of other features or steps than those listed in a claim. Furthermore, the words 'a' and 'an' shall not be construed as limited to 'only one', but instead are used to mean 'at least one', and do not exclude a plurality.

A person skilled in the art will readily appreciate that various parameters and values thereof disclosed in the description may be modified and that various embodiments disclosed and/or claimed may be combined without departing from the scope of the invention.

It is stipulated that the reference signs in the claims do not limit the scope of the claims, but are merely inserted to enhance the legibility of the claims.

The various aspects and embodiments thereof may be summarised, in a non-limitative way, by means of the following numbered embodiments:

1. Coupling element for mounting a photovoltaic assembly to a carrier frame, the photovoltaic assembly provided with a heat sink module comprising a profiled sheet with substantially parallel gutters comprising openings distributed along sidewalls of the gutters, the coupling element comprising:

- a body comprising a photovoltaic assembly side and a carrier frame side opposite to the photovoltaic assembly side;
- a photovoltaic assembly connection module comprising two clamp members protruding away from the photovoltaic assembly side, the clamp members comprising a gripping member at a distal end of the clamp members;
- a carrier frame connection module for connecting the coupling element to the carrier frame provided at the carrier frame side of the body;

wherein the photovoltaic assembly connection module can be manipulated between a first setting and a second setting, wherein in the second setting a distance between the gripping members of the clamp members is larger than that distance in the first setting.

2. Coupling element according to embodiment 1, wherein the clamp members protrude from a photovoltaic assembly side base surface.

3. Coupling element according to embodiment 1 or embodiment 2, the clamp members are resiliently deformable for moving gripping members towards the body.

4. Coupling element according to any of the preceding embodiments, wherein the clamp members are provided opposite to one another at a distance from and substantially parallel to one another.

5. Coupling element according to any of the preceding embodiments, wherein the clamp members protrude from the photovoltaic assembly side at an angle relative to a normal vector of the photovoltaic assembly side.

6. Coupling element according to any of the preceding embodiments, wherein the gripping members extend substantially perpendicular to the protrusion direction of the clamping members.

7. Coupling element according to embodiment 6, wherein the gripping members extend towards each other.

8. Coupling element according to embodiment 6, wherein the gripping members extend away from each other.

9. Coupling element according to any of the preceding embodiments, wherein the carrier frame connection module comprises a set of carrier frame connection protrusions protruding from the body away from a carrier frame connection side base surface opposite to the photovoltaic assembly side base surface and wherein the carrier frame connection protrusions are skewed relative to the clamp members.

10. Assembly of a coupling element according to any of the preceding claims and a photovoltaic assembly, wherein:

- the photovoltaic assembly is provided with a heat sink module comprising a profiled sheet with substantially parallel gutters;
- the gutters comprise openings in sidewalls of the gutters for enabling an air flow through the gutters;
- the openings are arranged to receive at least part of a gripping member of a clamp member of the coupling element;
- the coupling element is connected to the photovoltaic assembly by virtue of a gripping member of a first clamp member being inserted in an opening of a first gutter and by virtue of a gripping member of a second

clamp member being inserted in an opening of a second gutter provided adjacent to the first gutter.

11. Assembly according to embodiment 10, wherein the opening of the first gutter and the opening of the second gutter face each other.

12. Assembly according to embodiment 10, wherein the opening of the first gutter and the opening of the second gutter face away from each other.

13. Assembly according to any of the embodiments 10-12, wherein when the coupling element is connected to the photovoltaic assembly, the clamp members are elastically hinged away from the respective opening in which the gripping member is inserted.

Conclusies

1. Koppelelement voor monteren van een fotovoltaïsch samenstel aan een draagframe, het fotovoltaïsche samenstel voorzien van een koelplaatmodule omvattende een profielplaat met in hoofdzaak parallelle goten omvattende openingen verspreid over zijwanden van de goten, het koppelelement omvattende:

- een lichaam omvattende een fotovoltaïsche samenstel-zijde en een draagframezijde tegenover de fotovoltaïsche samenstel-zijde;
- een fotovoltaïsche samenstel-verbindingsmodule omvattende twee klemdelen uitsteken weg van de fotovoltaïsche samenstel-zijde, de klemdelen omvattende een aangrijpdeel aan een distaal uiteinde van de klemdelen;
- een draagframeverbindingsmodule voor verbinden van het koppelelement aan het draagframe voorzien aan de draagframezijde van het lichaam;

waarin de fotovoltaïsche samenstel-verbindingsmodule gemanipuleerd kan worden tussen een eerste instelling en een tweede instelling, waarin in de tweede instellen een afstand tussen de aangrijpdelen van de klemdelen groter is dat die afstand in de eerste instelling.

2. Koppelelement volgens conclusie 1, waarin de klemdelen uitstrekken vanaf een fotovoltaïsche samenstel-zijde-basisoppervlak.

3. Koppelelement volgens conclusie 1 of conclusie 2, waarin de klemdelen veerkrachtig vervormbaar zijn voor bewegen van de aangrijpdelen richting het lichaam.

4. Koppelelement volgens een van de voorgaande conclusies, waarin de klemdelen tegenover elkaar voorzien zijn op een afstand van elkaar en in hoofdzaak parallel ten opzicht van elkaar.

5. Koppelelement volgens een van de voorgaande conclusies, waarin de klemdelen uitsteken vanaf de fotovoltaïsche samenstel-zijde onder een hoek ten opzichte van een normaalvector van de fotovoltaïsche samenstel-zijde.

6. Koppelelement volgens een van de voorgaande conclusies, waarin de aangrijpdelen in hoofdzaak loodrecht uitstrekken ten opzichte van de uitsteekrichting van de klemdelen.

7. Koppelelement volgens conclusie 6, waarin de aangrijpdelen richting elkaar uitstrekken.

8. Koppelelement volgens conclusie 6, waarin de aangrijpdelen van elkaar wegstrekken.

9. Koppelelement volgens een van de voorgaande conclusies, waarin de draagframeverbindingsmodule een set draagframeverbindingsuitsteeksels omvat welk uitsteken vanuit het lichaam weg van een draagframeverbindingszijde-basisoppervlak ten opzichte van het fotovoltaïsche samenstelzijde-basisoppervlak en waarin de draagframeverbindingsuitsteeksels verdraaid zijn ten opzichte van de klemdelen.

10. Samenstel van een koppelelement volgens een van de voorgaande conclusies en een fotovoltaïsche samenstel, waarin:

- het fotovoltaïsche samenstel voorzien is van een koelplaatmodule omvattende een profielplaat met in hoofdzaak parallelle goten;

- de goten openingen omvatten in zijwanden van de goten voor mogelijk maken van een luchtstroom door de goten;
- de opening zijn ingericht om ten minste een deel van een aangrijpdeel van een klemdeel van het koppelelement te ontvangen;
- het koppelelement verbonden in met het fotovoltaïsche samenstel door middel van een aangrijpdeel van een eerste klemdeel zijnde ingebracht in een opening van een eerste goot en door middel van een aangrijpdeel van een tweede klemdeel zijnde ingebracht in een opening van een tweede goot voorzien nabij de eerste goot.

11. Samenstel volgens conclusie 10, waarin de opening van de eerste goot en de opening van de tweede goot op elkaar gericht zijn.

12. Samenstel volgens conclusie 10, waarin de opening van de eerste goot en de opening van de tweede goot van elkaar af gericht zijn.

13. Samenstel volgens een van de conclusies 10-12, waarin wanneer het koppelelement verbonden is aan het fotovoltaïsche samenstel, de klemdelen elastisch gescharnierd zijn weg van de respectievelijke opening waarin het aangrijpdeel ingebracht is.

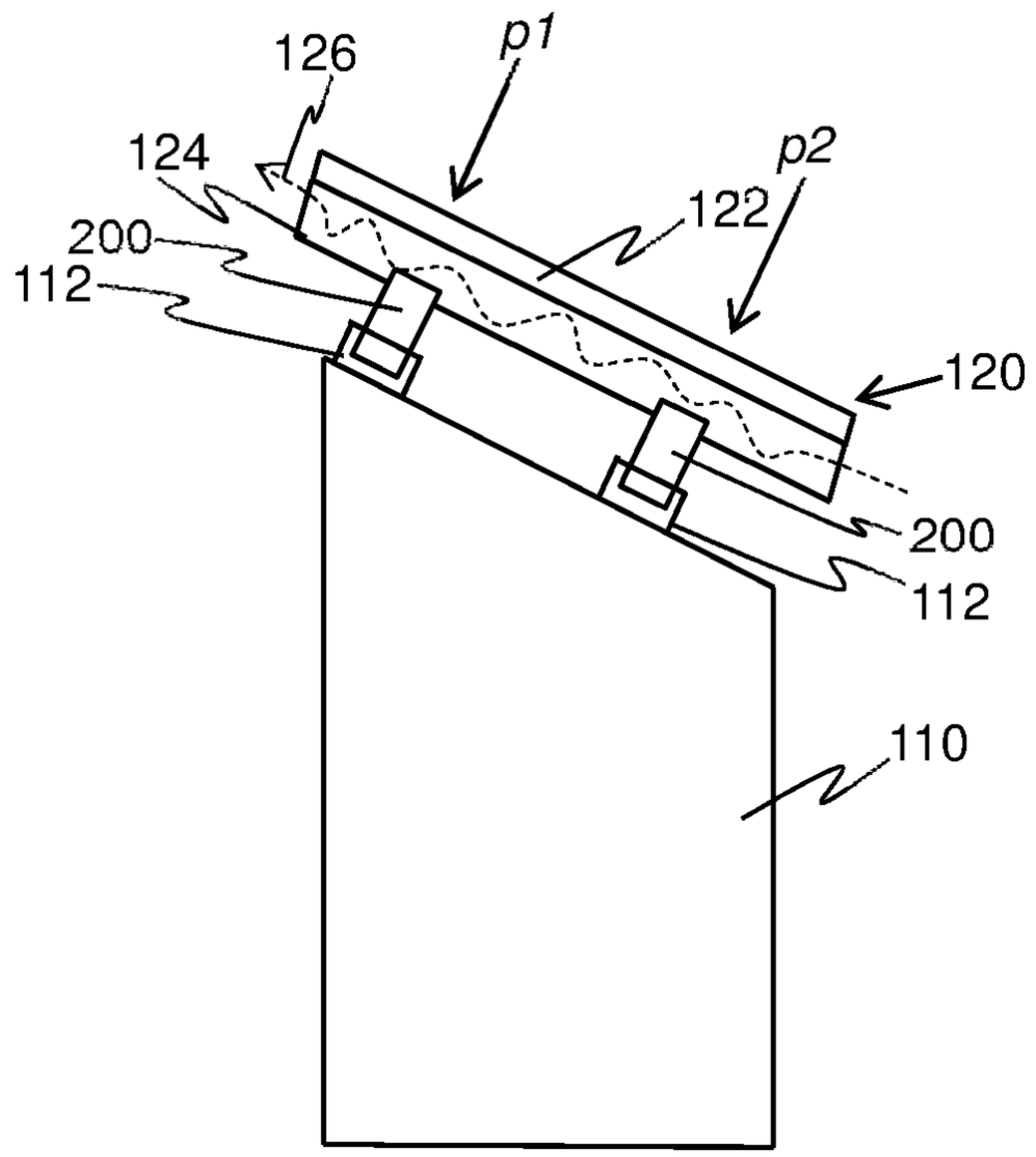
100
126
p1
124
p2
122
200
112
120
200
112
110

FIG 1A

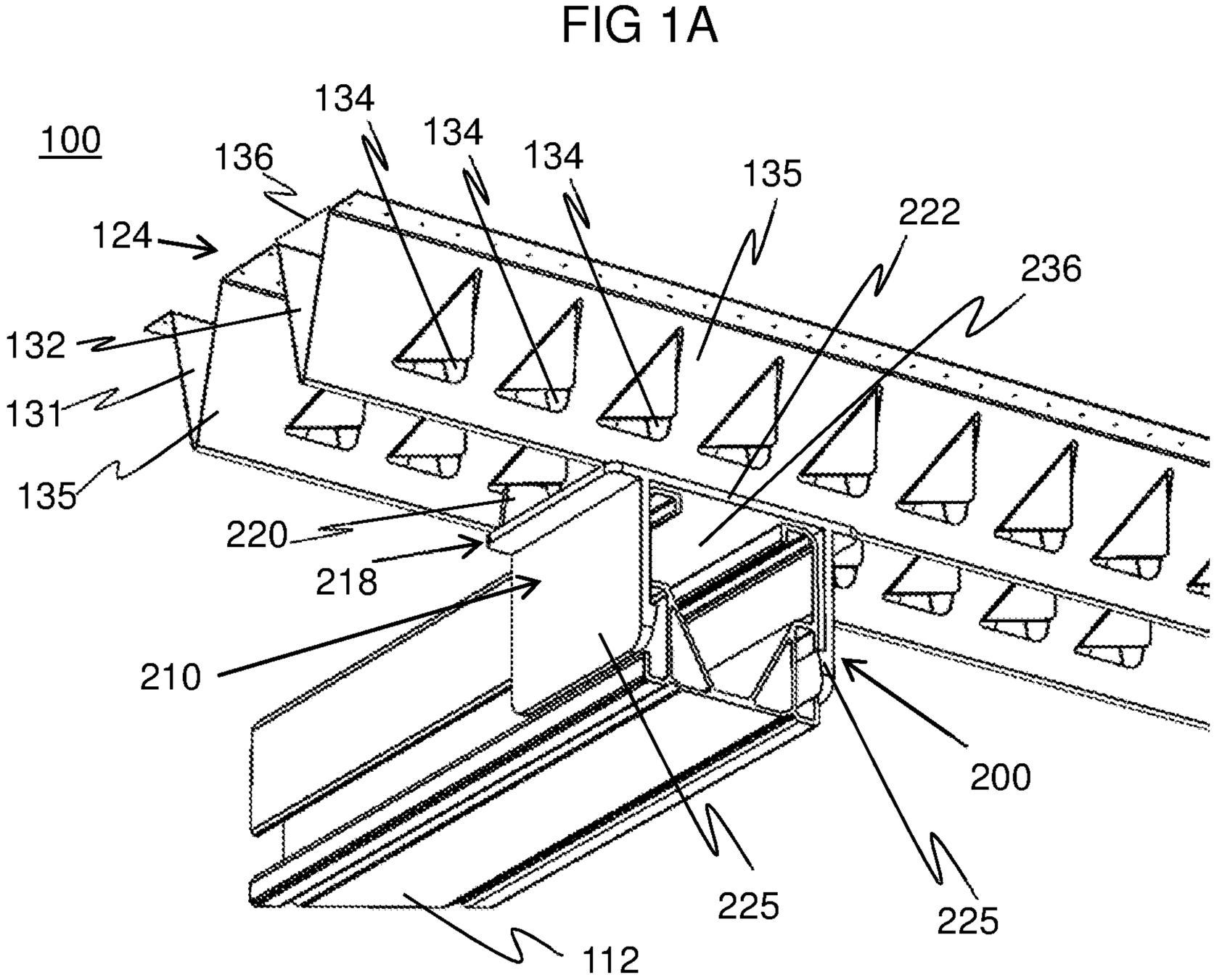
100
134
134
134
136
135
222
236
124
132
131
135
220
218
210
200
225
225
112

FIG 1B

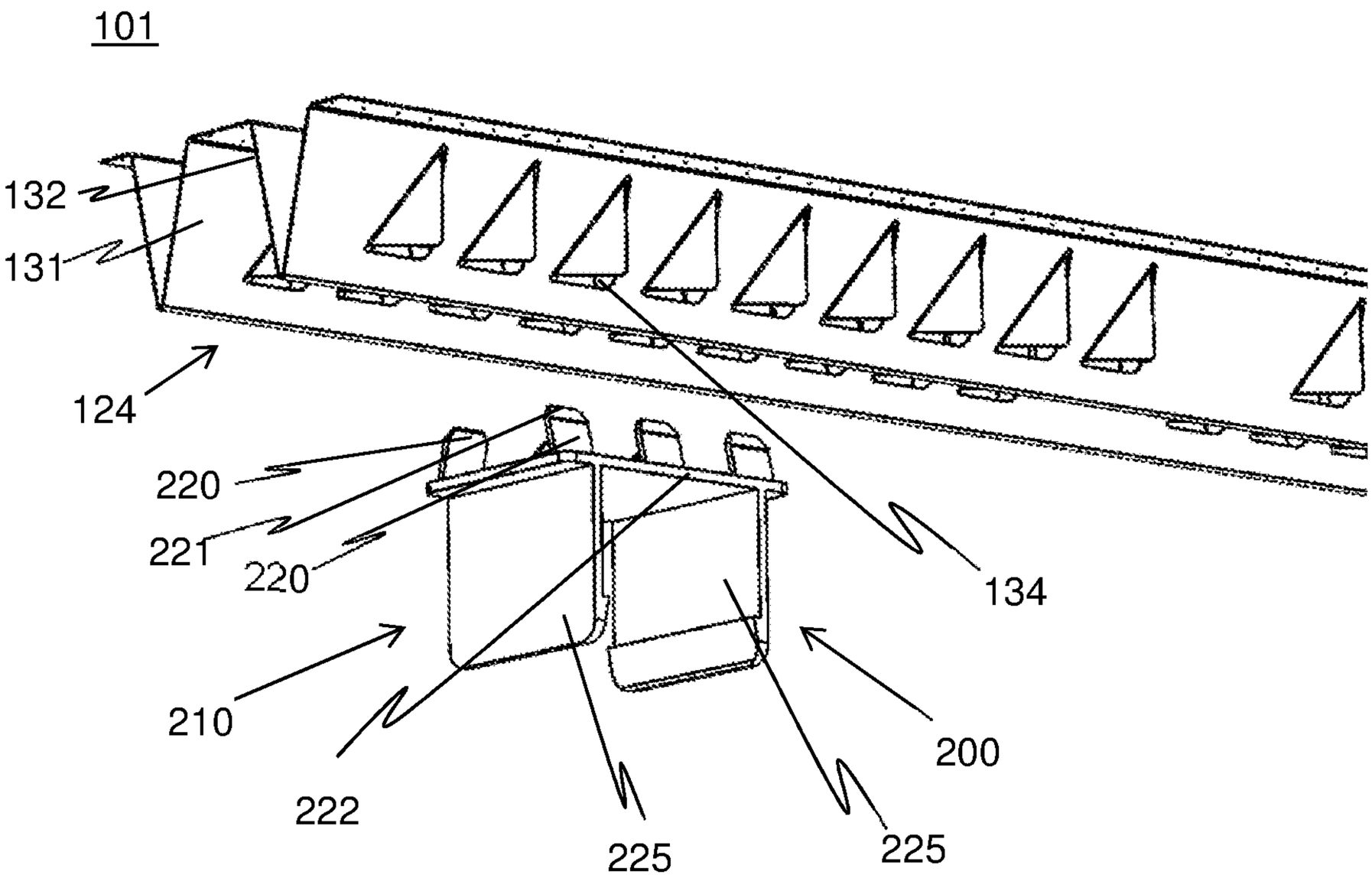
101
132
131
124
220
221
220
134
210
222
225
225
200

FIG 2A

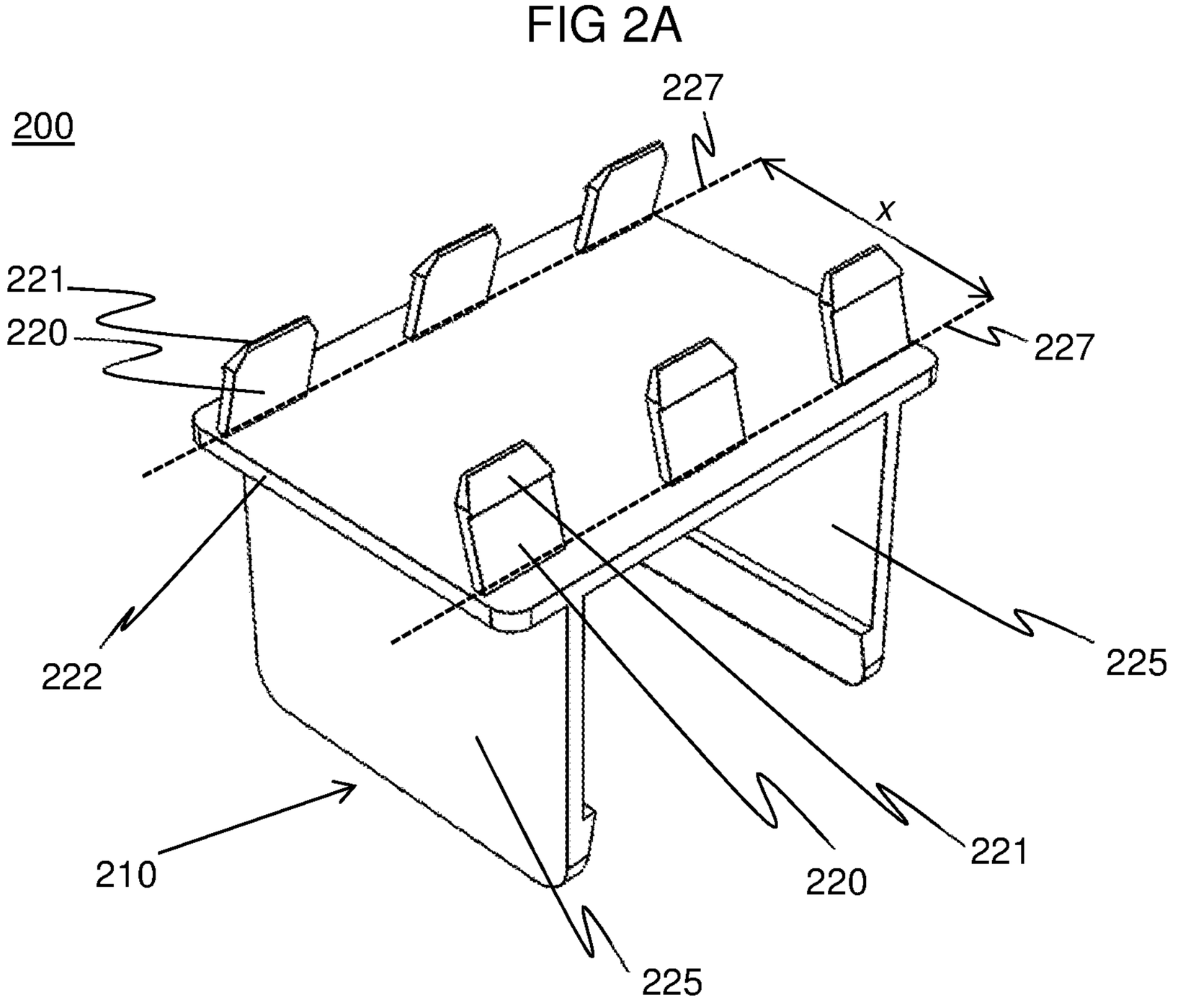
200
227
x
221
220
227
222
225
210
220
221
225

FIG 2B

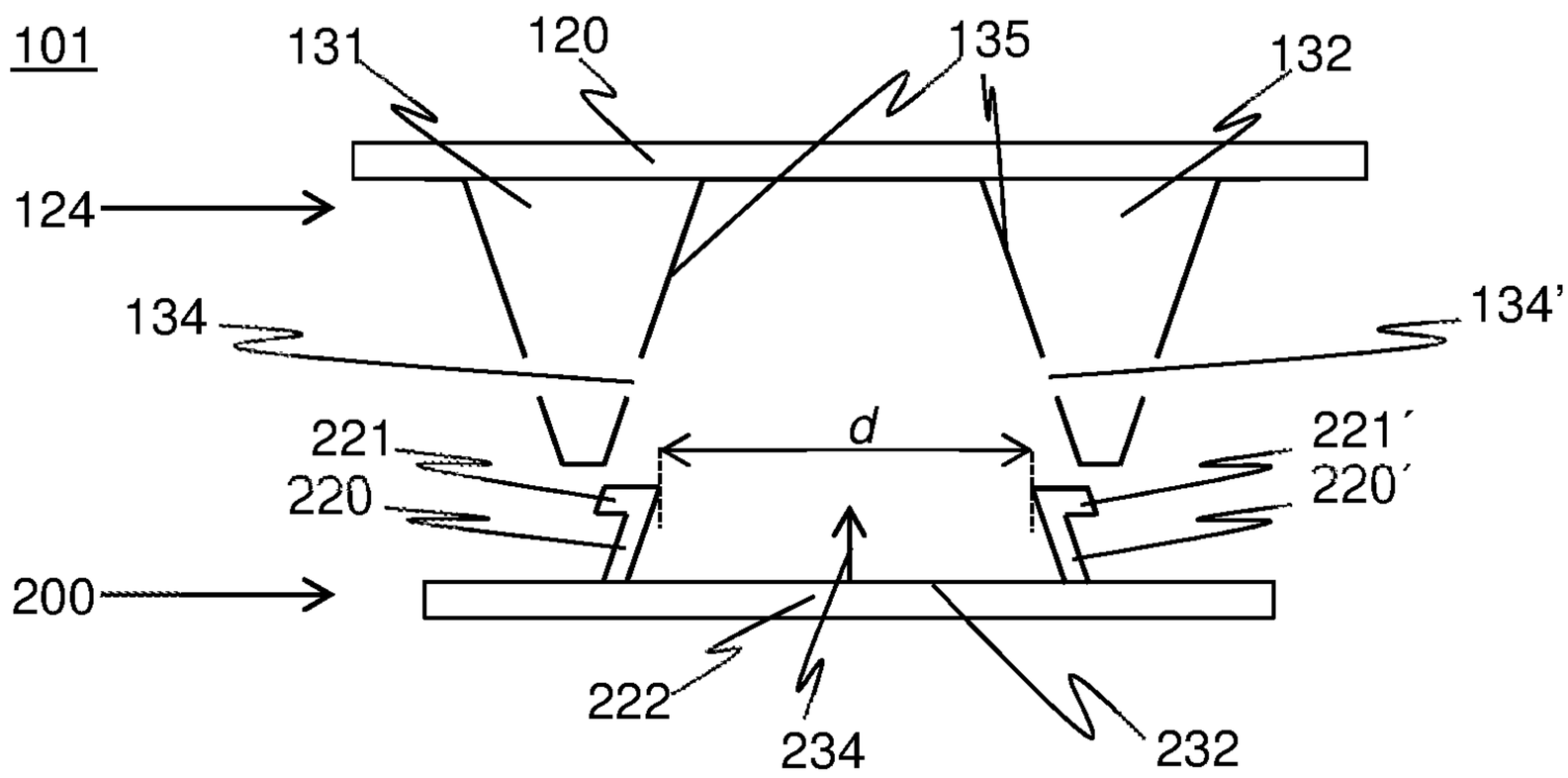

FIG 3A

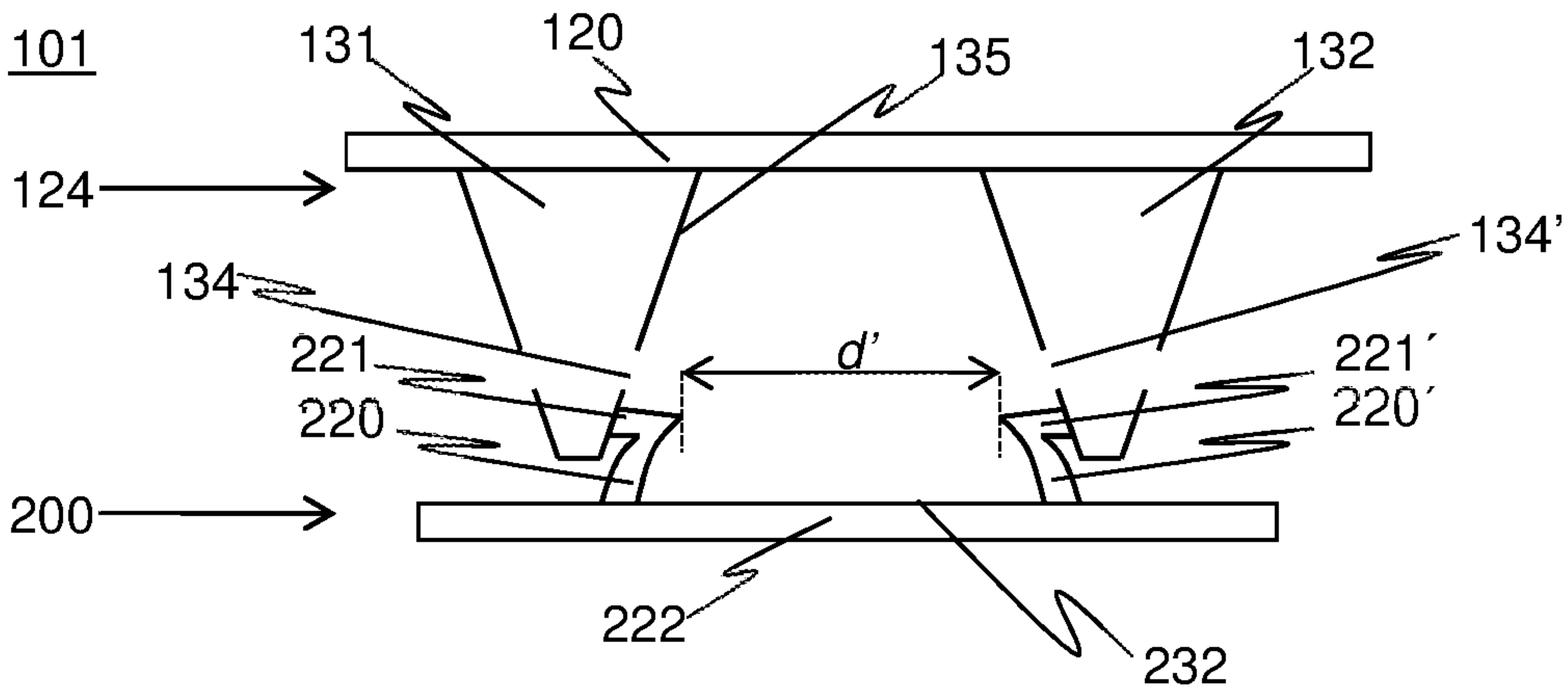

FIG 3B

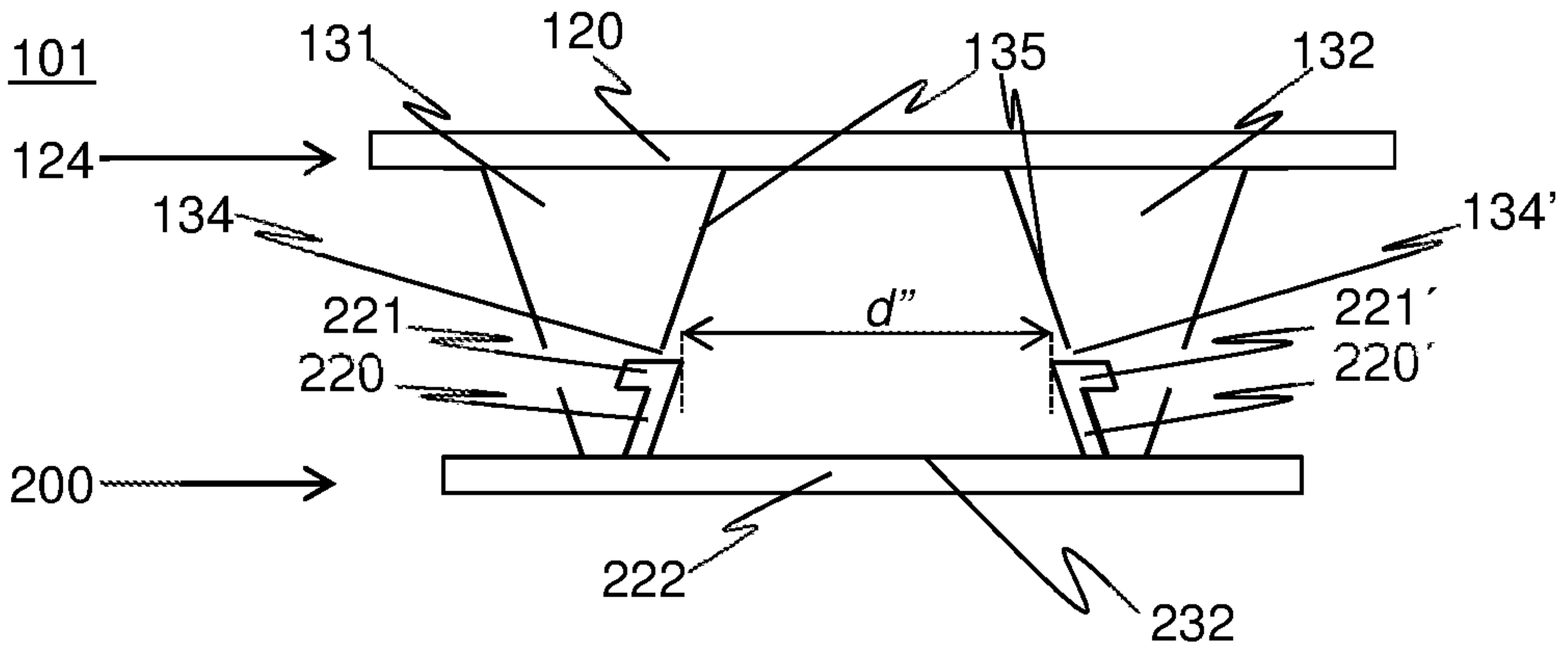

FIG 3C

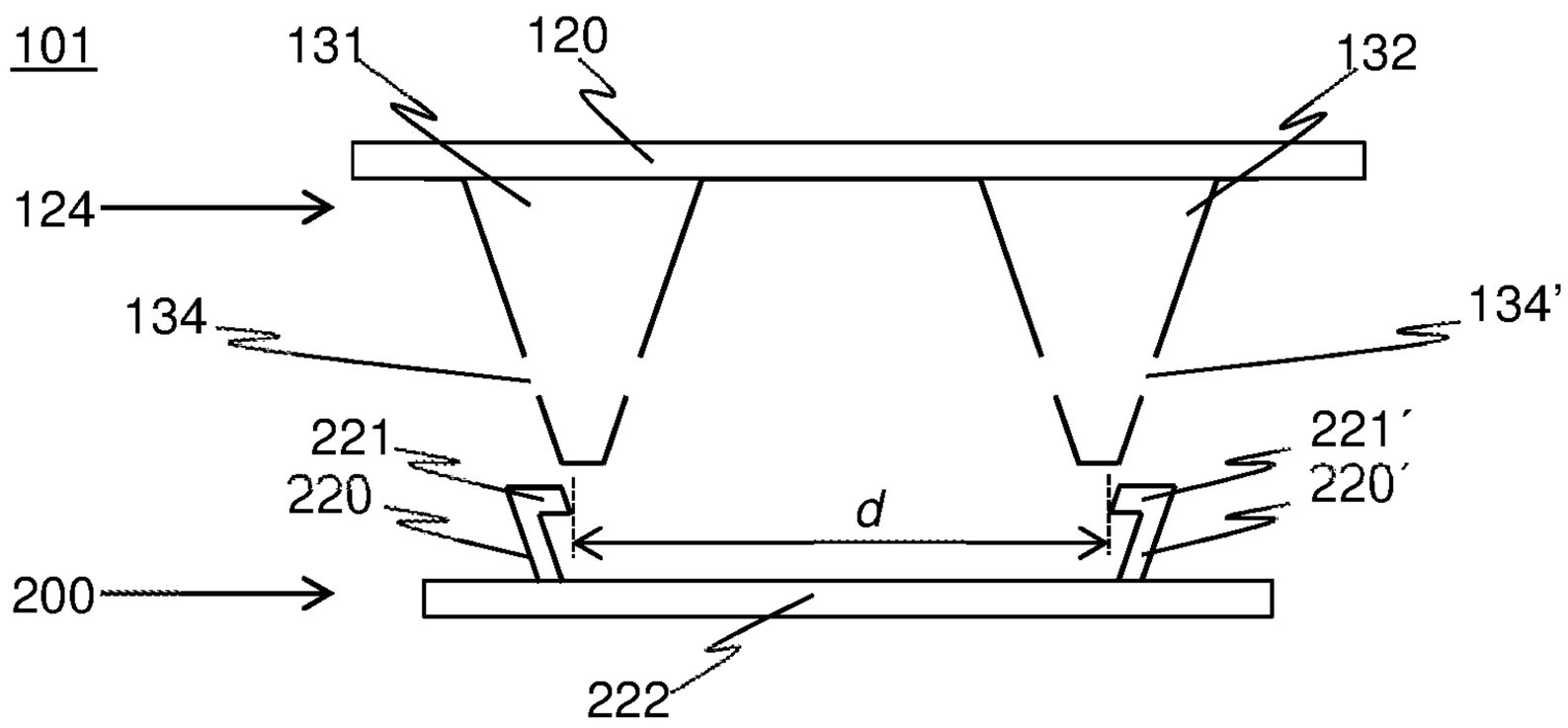

FIG 4A

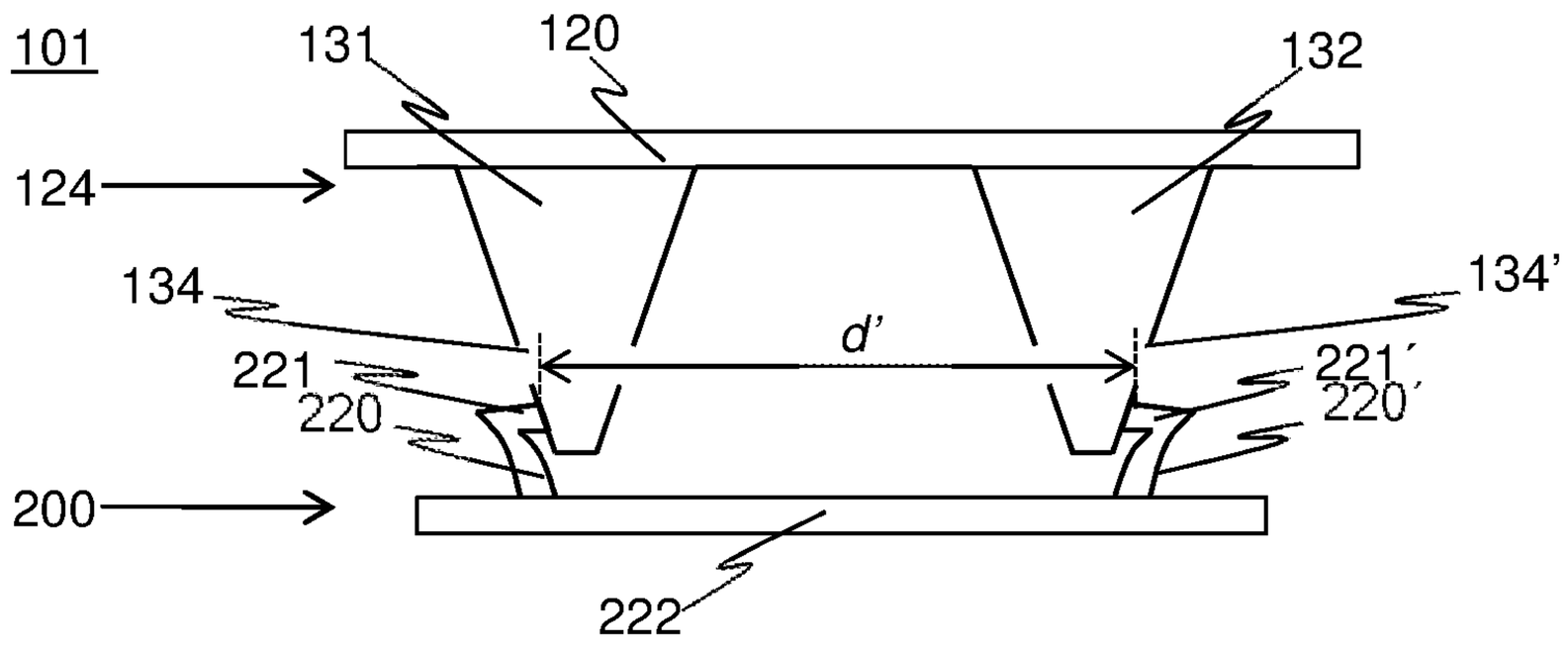

FIG 4B

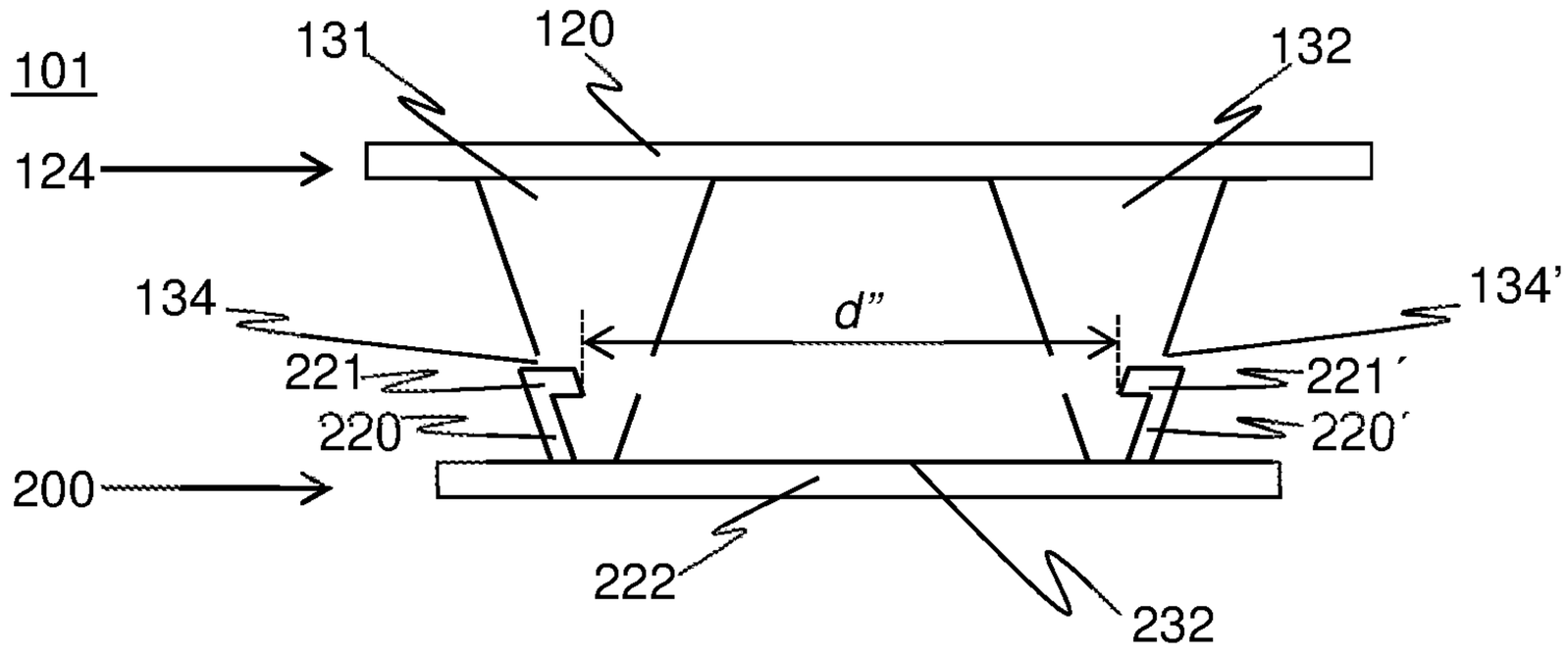

FIG 4C

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE **P123357NL00**
Nederlands aanvraag nr. **2023106**	Indieningsdatum **10-05-2019**
	Ingeroepen voorrangsdatum
Aanvrager (Naam) **OPTIXOLAR Holding B.V.**	
Datum van het verzoek voor een onderzoek van internationaal type **01-06-2019**	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. **SN73813**

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

F24S25/65;H02S20/00

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC	**F24S;H02S**

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III. ☐ **GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES** (opmerkingen op aanvullingsblad)

IV. ☐ **GEBREK AAN EENHEID VAN UITVINDING** (opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2023106

A. CLASSIFICATIE VAN HET ONDERWERP
INV. F24S25/65 H02S20/00
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte miminum documentatie (classificatie gevolgd door classificatiesymbolen)
F24S H02S

Onderzochte andere documentatie dan de mimimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	DE 20 2006 018426 U1 (IDEEMATEC DEUTSCHLAND GMBH [DE]) 8 februari 2007 (2007-02-08)	1-9
Y	* figuren *	10-13

Y,D	WO 2018/226091 A1 (OPTIXOLAR HOLDING B V [NL]) 13 december 2018 (2018-12-13) in de aanvraag genoemd * figuren *	10-13

X	WO 2013/050147 A1 (JUWI R & D RES & DEV GMBH & CO KG [DE]) 11 april 2013 (2013-04-11)	1
A	* figuren *	2-10

A	EP 2 573 486 A2 (REHAU AG & CO [DE]) 27 maart 2013 (2013-03-27) * figuren *	1,10

	-/--	

[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
28 oktober 2019	
Naam en adres van de instantie European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	De bevoegde ambtenaar Ferro Pozo, José

1

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2023106

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A	EP 2 746 696 A2 (RAYMOND A & CIE [FR]) 25 juni 2014 (2014-06-25) * figuren * -----	1,10

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2023106

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
DE 202006018426 U1	08-02-2007	GEEN	
WO 2018226091 A1	13-12-2018	CN 208820741 U	03-05-2019
		WO 2018226091 A1	13-12-2018
WO 2013050147 A1	11-04-2013	DE 102011114935 A1	11-04-2013
		WO 2013050147 A1	11-04-2013
EP 2573486 A2	27-03-2013	DE 102011053774 A1	21-03-2013
		EP 2573486 A2	27-03-2013
EP 2746696 A2	25-06-2014	DE 102012223832 A1	26-06-2014
		EP 2746696 A2	25-06-2014

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
SN73813	10.05.2019		NL2023106
International Patent Classification (IPC) INV. F24S25/65 H02S20/00			
Applicant OPTIXOLAR Holding B.V.			

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☐ Box No. VIII Certain observations on the application

	Examiner
	Ferro Pozo, José

Application number

WRITTEN OPINION

NL2023106

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	10-13
	No:	Claims	1-9
Inventive step	Yes:	Claims	
	No:	Claims	1-13
Industrial applicability	Yes:	Claims	1-13
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1 DE 20 2006 018426 U1 (IDEEMATEC DEUTSCHLAND GMBH [DE]) 8 februari 2007 (2007-02-08)

D2 WO 2018/226091 A1 (OPTIXOLAR HOLDING B V [NL]) 13 december 2018 (2018-12-13)in de aanvraag genoemd

D3 WO 2013/050147 A1 (JUWI R & D RES & DEV GMBH & CO KG [DE]) 11 april 2013 (2013-04-11)

D4 EP 2 573 486 A2 (REHAU AG & CO [DE]) 27 maart 2013 (2013-03-27)

D5 EP 2 746 696 A2 (RAYMOND A & CIE [FR]) 25 juni 2014 (2014-06-25)

Novelty and Inventive step

Claim 1

2 The present application does not meet the requirements of novelty because the subject-matter of claim 1 is not new.

D1 discloses (the references applying to this document):

Coupling element for mounting a photovoltaic assembly to a carrier frame (Paragraph [0001]),

the photovoltaic assembly provided with a heat sink module comprising a profiled sheet with substantially parallel gutters comprising openings distributed along sidewalls of the gutters (not part of subject matter of claim 1),

the coupling element comprising: (-)

- a body comprising a photovoltaic assembly side and a carrier frame side opposite to the photovoltaic assembly side; (figure 5)

- a photovoltaic assembly connection module comprising two clamp members protruding away from the photovoltaic assembly side (ref. 28 on the top),

the clamp members comprising a gripping member at a distal end of the clamp members; (see figure 5)

- a carrier frame connection module for connecting the coupling element to the carrier frame provided at the carrier frame side of the body; wherein (figure 5 lower part)

the photovoltaic assembly connection module can be manipulated between a first setting and a second setting, (see description: " elastische Rastlaschen 11")

wherein in the second setting a distance between the gripping members of the clamp members is larger than that distance in the first setting. (see description: " elastische Rastlaschen 11")

2.1 Therefore the subject-matter of claim 1 is not new.

This search authority would like to point out that since claim 1 is directed to a "Coupling element" the features defining the "photovoltaic assembly" are not part of claim 1 and do not narrow the scope of claim 1. Such "photovoltaic assembly" is part of claim 10 which is treated hereafter. The applicant is kindly draw his attention to the fact that the so called "elastische Rastlaschen 11" in D1 even being only referred to in drawings 1 and 3 as ref. 11, i.e. "elastische Rastlaschen 11" they are further referred as "Rastlaschen" further in the document and they are considered to be of the same nature as it is clear from the drawings.

2.2 The Applicant is brought to the attention that the subject matter of claim 1 is also not new when compared to the disclosure of document D3.

depending claims

2.3 The features of claims 2-10 are merely one of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive step.

re. 2

D1 discloses (the references applying to this document):

the clamp members protrude from a photovoltaic assembly side base surface. (See clap members in figure 13, ref. 33 or figure 5 without ref. in the lower part of the coupling element.)

re. 3

D1 discloses (the references applying to this document):

the clamp members are resiliently deformable for moving gripping members towards the body. (see description: " elastische Rastlaschen 11")

re. 4

D1 discloses (the references applying to this document):

the clamp members are provided opposite to one another at a distance from and substantially parallel to one another. (figure 5)

re. 5-6

All the features of claims 5-6 are disclosed in D1.

re. 7-8

The subject-matter of claims 7-8 does not involve an inventive step. The features of claims 7-8 are merely the two possibilities for engaging the coupling element, the gripping members extending away or towards each other. Depending on the circumstances (the shape of the engaging profile) it is obvious for the skilled person in the art who to provide the orientation of the gripping members.

claim 10

3 Claim 10 comprises the features of the coupling element of the preceding claims. Such coupling is disclosed by D1.

The problem to be solved by claim 2 could be seen as how to improve the cooling down of the pv module.

3.1 Claim 10 discloses a so called "heat sink module" (koelplattmodule).

3.2 Such "heat sink module" is disclosed by D2 by the same applicant with all the characteristics of claim 10.

Therefore these features are described in D2 as providing the same advantages as in the present application. The skilled person would therefore regard it as a normal design option to use the coupling element of D1 to couple the profiles of D2 into a supporting unit.

3.3 Besides this authority would like to remind the applicant that For the skilled person in the art there is no functional interaction between these the features relating to fasten two rails of profiles perpendicular to each other and provide cooling to the PV of structure by means of force circulating air.

other objections

4 Independent claims are not in the two-part form, which in the present case would be appropriate, with those features known in combination from the prior art being placed in the preamble and the remaining features being included in the characterising part.

5 The features of the claims should be provided with reference signs placed in parentheses to increase the intelligibility of the claims. This applies to both the preamble and characterising portion.

6 The relevant background art disclosed in D1 is not mentioned in the description, nor are these documents identified therein.