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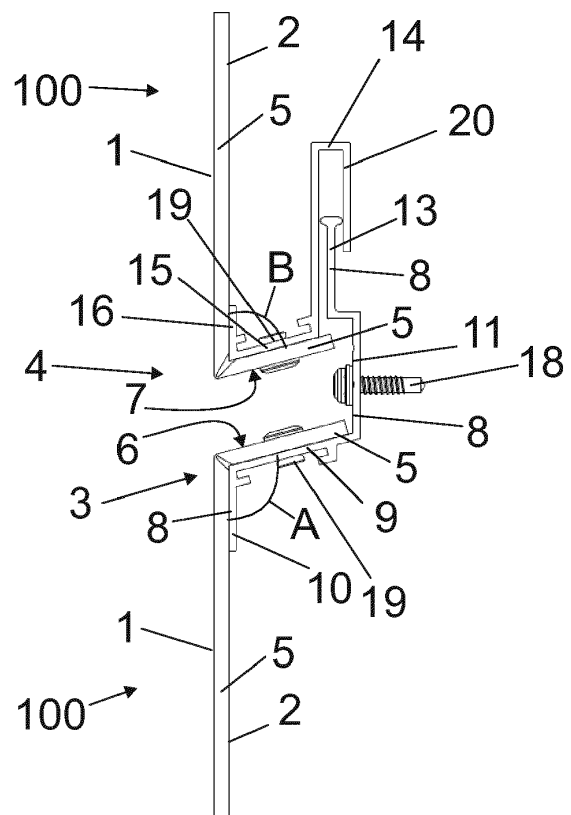
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(54) **SANDWICH-STRUCTURED COMPOSITE PANEL**

(57) A sandwich-structured composite panel (100), comprising a first face skin (1) of sheet metal, a second face skin (2) of sheet metal, and a core (5) arranged between the first face skin and the second face skin. The panel comprises an upper edge (3), comprising an upper edge skin (6) construed from the sheet metal establishing the first face skin (1), and an upper attachment element (8) arranged in the upper edge (3). The upper attachment element (8) comprises a fixing surface (9), and the façade surface of the panel (100) is arranged in a first angle (A) in relation to the upper edge skin (6) and the fixing surface (9), wherein said first angle (A) is more than 90°.



**Fig. 1**

## Description

### BACKGROUND

[0001] The invention relates to a sandwich-structured composite panel.

[0002] It is known to use composite panels in buildings and constructions as a façade cladding panel element. Horizontal joints between the composite panels are susceptible to get dirty and retain moisture. This may cause the appearance of the joint or the whole façade to become untidy, and even reduce the life span of the composite panels.

### BRIEF DESCRIPTION

[0003] Viewed from a first aspect, there can be provided a sandwich-structured composite panel, comprising a first face skin of sheet metal, providing the façade surface of the panel, a second face skin of sheet metal, providing the back surface of the panel, and a core arranged between the first face skin and the second face skin, the first and second face skins being attached to the core, an upper edge, comprising an upper edge skin construed from the sheet metal establishing the first face skin, a lower edge, comprising a lower edge skin construed from the sheet metal establishing the first face skin, an upper attachment element arranged in the upper edge, wherein the upper attachment element comprises a first fixing surface, the first fixing surface being attached to the second face skin of sheet metal, wherein the façade surface of the panel is arranged in a first angle in relation to the upper edge skin and the first fixing surface, and wherein said first angle is more than 90°.

[0004] Thereby a composite panel that reduces cumulation of dirt and moisture in the horizontal joint between the composite panels may be achieved.

[0005] The arrangement is characterised by what is stated in the independent claim. Some other embodiments are characterised by what is stated in the other claims. Inventive embodiments are also disclosed in the specification and drawings of this patent application. The inventive content of the patent application may also be defined in other ways than defined in the following claims. The inventive content may also be formed of several separate inventions, especially if the invention is examined in the light of expressed or implicit sub-tasks or in view of obtained benefits or benefit groups. Some of the definitions contained in the following claims may then be unnecessary in view of the separate inventive ideas. Features of the different embodiments of the invention may, within the scope of the basic inventive idea, be applied to other embodiments.

[0006] In one embodiment, the first angle is 91° - 150°. An advantage is that cumulation of dirt and moisture may be effectively reduced.

[0007] In one embodiment, the first angle is 95° - 135°. An advantage is that cumulation of dirt and moisture may

be effectively reduced, and manufacturing of the panel is simple to realize.

[0008] In one embodiment, the first angle is 100° - 115°. An advantage is that cumulation of dirt and moisture may be effectively reduced, and the appearance of the panel is close to rectangular prism.

[0009] In one embodiment, the upper attachment element comprises a second fixing surface attached to the second face skin in the upper edge, the second fixing surface being arranged in the first angle in relation to the first fixing surface. An advantage is that a very stable structure of the composite panel may be achieved.

[0010] In one embodiment, the upper attachment element comprises an attachment surface arranged parallel to the second face skin for fastening the composite panel to a support structure. An advantage is that the panel may be attached easily to the support structure.

[0011] In one embodiment, the upper attachment element comprises an upper extension for attaching another composite panel above the composite panel. An advantage is that a simple structure for attaching panels may be achieved.

[0012] In one embodiment, the composite panel comprises a lower attachment element arranged in the lower edge, said lower attachment element comprising a third fixing surface attached to the second face skin in the lower edge, wherein the façade surface of the panel is arranged in a second angle in relation to the lower edge skin and the third fixing surface, wherein the second angle is less than 90°. An advantage is that running of water behind the panel may be reduced or even prevented.

[0013] In one embodiment, the lower attachment element comprises a fourth fixing surface attached to the second face skin and arranged in the second angle in relation to the third fixing surface. An advantage is that a very stable structure of the composite panel may be achieved.

[0014] In one embodiment, the second angle is selected so that the lower edge skin is at least substantially parallel with the upper edge skin. An advantage is that a narrow joint between the panels may be created.

[0015] In one embodiment, the attachment element is a profile, the length of which is about the width of the composite panel. An advantage is that a very good support for the panel may be achieved.

[0016] In one embodiment, the attachment element is an extruded aluminum profile. An advantage is that precise attachment elements may be manufactured.

[0017] In one embodiment, the face skin comprises aluminium.

An advantage is that the skin is light.

[0018] In one embodiment, the face skin comprises at least one of the following materials: copper, brass, titanium, steel, such as stainless steel. An advantage is that the appearance of the skin may be customized.

[0019] In one embodiment, the core comprises a cell configuration. An advantage is that the core and thus the panel may have a light but sturdy structure.

[0020] In one embodiment, the cell configuration comprises aluminium. An advantage is that the core is light.

[0021] In one embodiment, the core comprises polymer material, such as polyethylene. An advantage is that the core is light.

[0022] In one embodiment, the core is made of polymer, such as polyethylene, filled with at least one mineral filler. An advantage is that a core being low-cost and having tailored properties regarding e.g. fire resistance may be achieved.

## BRIEF DESCRIPTION OF FIGURES

[0023] Some embodiments illustrating the present disclosure are described in more detail in the attached drawings, in which

Figure 1 is a schematic side view of details of two composite panels in partial cross-section,

Figure 2 is a schematic side view of details of the two composite panels shown in Figure 1,

Figure 3 is another schematic side view of details of the two composite panels shown in Figure 1,

Figure 4 is another schematic side view of the two composite panels shown in Figure 1, and

Figure 5 is a schematic perspective view of a composite panel.

[0024] In the figures, some embodiments are shown simplified for the sake of clarity. Similar parts are marked with the same reference numbers in the figures.

## DETAILED DESCRIPTION

[0025] **Figure 1** is a schematic side view of details of two composite panels in partial cross-section, **Figure 2** is a schematic side view of details of the two composite panels shown in Figure 1, **Figure 3** is another schematic side view of details of the two composite panels shown in Figure 1, and **Figure 4** is another schematic side view of the two composite panels shown in Figure 1.

[0026] The sandwich-structured composite panel 100 ("panel") may be used in building envelope, such as exterior walls and roofs of buildings. The panel 100 has typically a shape of quadrangle, such as quadrature or rectangle.

[0027] The panel 100 comprises a first face skin 1 of sheet metal, providing the façade surface of the panel 100, a second face skin 2 of sheet metal, providing the back surface of the panel 100, and a core 5 that is arranged between the first face skin and the second face skin such that the first and second face skins 1, 2 are attached to the core 3.

[0028] In an embodiment, the face skin 1, 2 comprises

aluminium. In some other embodiments, the face skin 1, 2 comprises at least one of the following materials: copper, brass, titanzink, steel, such as stainless steel. Typically, the first face skin 1 is made of same material as the second face skin 2, but not necessarily.

[0029] In an embodiment, the core 5 comprises a cell configuration, such as honeycomb structure. The material of the cell configuration may be e.g. aluminium or polymer.

10 [0030] In an embodiment, the core 5 comprises polymer material, e.g. polyolefin, such as polyethylene. The polymer material may be filled with at least one mineral filler. In another embodiment, the material of the core 5 is at least substantially mineral material or ceramics.

15 [0031] The panel 100 comprises an upper edge 3 that comprises an upper edge skin 6 construed from the sheet metal establishing the first face skin 1. In an embodiment, the upper edge is made by cutting or milling a groove 17 in the second face skin 2 and the core 3, and then bending the panel 100 in a desired shape.

20 [0032] The panel 100 further comprises a lower edge 4, comprising a lower edge skin 7 construed from the sheet metal establishing the first face skin 1, and preferably made as the upper edge 3.

25 [0033] An upper attachment element 8 is arranged in the upper edge 3 of the panel. The upper attachment element 8 comprises a first 9 of said fixing surfaces is attached to the second face skin 2 in the upper edge 3. The first fixing surface 9 is in a first angle A, that is more than 90°, in relation to the façade surface of the panel 100.

30 [0034] In an embodiment, the upper attachment element 8 further comprises a second fixing surface 10 that is attached to the second face skin 2 behind of and thus parallel to the façade surface of the panel.

35 [0035] In Figures, the second fixing surface 10 is attached to the upper edge 3 by rivets 19. Additionally or alternatively, the attachment may be realized by screws, gluing etc. Additionally, the first fixing surface 9 may be attached to the panel by similar means.

40 [0036] In an embodiment, the first angle A is selected in range of 91° - 150°. In an embodiment, the first angle A is selected in range of 100° - 135°. In a still another embodiment, the first angle A is selected in range of 100° - 115°. In an embodiment, the first angle A is 105°.

45 [0037] In an embodiment, the upper attachment element 8 comprises an attachment surface 11 that is arranged parallel to the second face skin 2 for fastening the panel 100 to a support structure 12. In the embodiment shown in Figures, the panel is fastened by screws 18, however another fastening means may also be used.

50 [0038] In an embodiment, the panel 100 comprises a lower attachment element 14 that is arranged in the lower edge 4. The lower attachment element 14 may comprise a third fixing surface 15 attached to the lower edge 3 of the panel.

55 [0039] The third fixing surface 15 is arranged in a second angle B in relation to the façade surface of the panel 100. In an embodiment, the second angle B is less than

90°.

**[0040]** In an embodiment, the second angle B is selected so that the lower edge skin 7 is at least substantially parallel with the upper edge skin 6.

**[0041]** In an embodiment, the lower attachment element 14 comprises also a fourth fixing surface 16 that is attached to the second face skin 2. The fourth fixing surface 16 is arranged in the second angle B in relation to the third fixing surface 15.

In an embodiment, the upper attachment element 8 comprises an upper extension 13 for attaching another panel above the panel 100. In the embodiment shown in Figures, the lower attachment element 14 comprises a groove-like counterpart 20 that receives the upper extension 13 of the panel arranged beneath. The groove-like shape allows the upper extension 13 to move therein, thus dimensional changes of the panels 100 caused by e.g. temperature variations do not cause stresses to the fastening of the panels. The structure of the attachment elements 8, 14 makes it also possible to adjust the width of the joint 23 between the panels. In an embodiment, the width of the joint 23 may be selected in range of 5 mm - 35 mm.

**[0042]** Figure 5 is a schematic perspective view of a composite panel.

**[0043]** In an embodiment, for instance as shown in Figure 5, the attachment element 8, 14 is a profile element, the length of which is about the width of the panel 100.

**[0044]** In another embodiment, at least one of the attachment elements 8, 14 comprises plurality of attachment elements arranged to the respective edge 3, 4 and spaced apart from each other.

**[0045]** In an embodiment, the attachment element 8, 14 is an extruded aluminum profile.

**[0046]** At least one of side edges of the panel 100 may be provided with a side skin 21. In an embodiment, the side skin 21 is construed from the first skin 1 that is bent in a desired shape. In another embodiment, the side skin 21 is construed from a separate element that is attached to the structure of the panel 100.

**[0047]** In an embodiment, the side skins 21 are attached to the attachment element(s) 8, 14 by cover plates 22. In an embodiment, the cover plates 22 are not fixed stationary to the attachment element (s) 8, 14, but they may move or glide in a slot 24 (best seen in Fig. 3) in direction of the profile. Thus, problems caused by thermal expansions may be eluded.

**[0048]** The invention is not limited solely to the embodiments described above, but instead many variations are possible within the scope of the inventive concept defined by the claims below. Within the scope of the inventive concept the attributes of different embodiments and applications can be used in conjunction with or replace the attributes of another embodiment or application.

**[0049]** The drawings and the related description are only intended to illustrate the idea of the invention. The invention may vary in detail within the scope of the inventive idea defined in the following claims.

## REFERENCE SYMBOLS

### [0050]

|    |     |                          |
|----|-----|--------------------------|
| 5  | 1   | first face skin          |
|    | 2   | second face skin         |
|    | 3   | upper edge               |
|    | 4   | lower edge               |
|    | 5   | core                     |
| 10 | 6   | upper edge skin          |
|    | 7   | lower edge skin          |
|    | 8   | upper attachment element |
|    | 9   | first fixing surface     |
|    | 10  | second fixing surface    |
| 15 | 11  | attachment surface       |
|    | 12  | support structure        |
|    | 13  | upper extension          |
|    | 14  | lower attachment element |
|    | 15  | third fixing surface     |
| 20 | 16  | fourth fixing surface    |
|    | 17  | groove                   |
|    | 18  | screw                    |
|    | 19  | rivet                    |
|    | 20  | counterpart              |
| 25 | 21  | side skin                |
|    | 22  | cover plate              |
|    | 23  | joint                    |
|    | 24  | slot                     |
| 30 | 100 | composite panel          |
|    | A   | first angle              |
|    | B   | second angle             |

## Claims

1. A sandwich-structured composite panel (100), comprising
  - a first face skin (1) of sheet metal, providing the façade surface of the panel (100),
  - a second face skin (2) of sheet metal, providing the back surface of the panel (100), and
  - a core (5) arranged between the first face skin and the second face skin, the first and second face skins being attached to the core,
  - an upper edge (3), comprising an upper edge skin (6) construed from the sheet metal establishing the first face skin (1),
  - a lower edge (4), comprising a lower edge skin (7) construed from the sheet metal establishing the first face skin (1),
  - an upper attachment element (8) arranged in the upper edge (3), wherein
  - the upper attachment element (8) comprises a first fixing surface (9),
  - the first fixing surface (9) being attached to the

- second face skin (2) of sheet metal, wherein  
 - the facade surface of the panel (100) is arranged in a first angle (A) in relation to the upper edge skin (6) and the first fixing surface (9), and wherein  
 - said first angle (A) is more than 90°.
2. The composite panel as claimed in claim 1, wherein the first angle (A) is 91° - 150°, preferably 95° - 135°, more preferably 100° - 115°.
  3. The composite panel as claimed in claim 1 or 2, wherein the upper attachment element (8) comprises an attachment surface (11) arranged parallel to the second face skin (2) for fastening the composite panel (100) to a support structure (12).
  4. The composite panel as claimed in any of the preceding claims, wherein the upper attachment element (8) comprises a second fixing surface (10) attached to the second face skin (2) in the upper edge (3), the second fixing surface (10) being arranged in the first angle (A) in relation to the first fixing surface (9).
  5. The composite panel as claimed in any of the preceding claims, wherein the upper attachment element (8) comprises an upper extension (13) for attaching another composite panel (100) above the composite panel (100).
  6. The composite panel as claimed in any of the preceding claims, comprising a lower attachment element (14) arranged in the lower edge (4), said lower attachment element (14) comprising,
    - a third fixing surface (15) attached to the second face skin (2) in the lower edge (3), wherein
    - the facade surface of the panel (100) is arranged in a second angle (B) in relation to the lower edge skin (7) and the third fixing surface (15), wherein
    - the second angle (B) is less than 90°.
  7. The composite panel as claimed in claim 6, wherein the lower attachment element (14) comprises a fourth fixing surface (16) attached to the second face skin and arranged in the second angle (B) in relation to the third fixing surface (15).
  8. The composite panel as claimed in claim 6 or 7, wherein the second angle (B) is selected so that the lower edge skin (7) is at least substantially parallel with the upper edge skin (6).
  9. The composite panel as claimed in any of the preceding claims, wherein the attachment element (8, 14) is a profile, the length of which is about the width
- of the composite panel (100).
10. The composite panel as claimed in any of the preceding claims, wherein the attachment element (8, 14) is an extruded aluminum profile.
  11. The composite panel as claimed in any of the preceding claims, wherein the face skin (1, 2) comprises aluminium.
  12. The composite panel as claimed in any of the preceding claims, wherein the face skin (1, 2) comprises at least one of the following materials: copper, brass, titanzink, steel, such as stainless steel.
  13. The composite panel as claimed in any of the preceding claims, wherein the core (5) comprises a cell configuration.
  14. The composite panel as claimed in claim 11, wherein the cell configuration comprises aluminium.
  15. The composite panel as claimed in any of the preceding claims, wherein the core (5) comprises polymer material, such as polyethylene, optionally filled with at least one mineral filler.

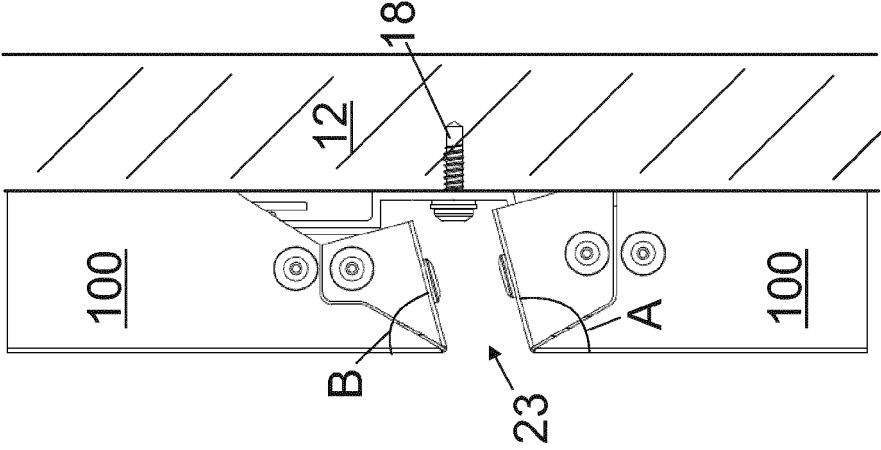


Fig. 4

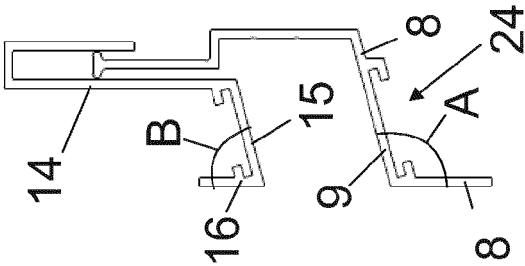


Fig. 3

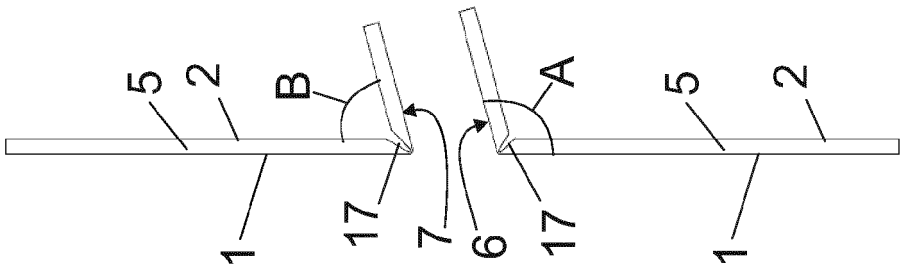


Fig. 2

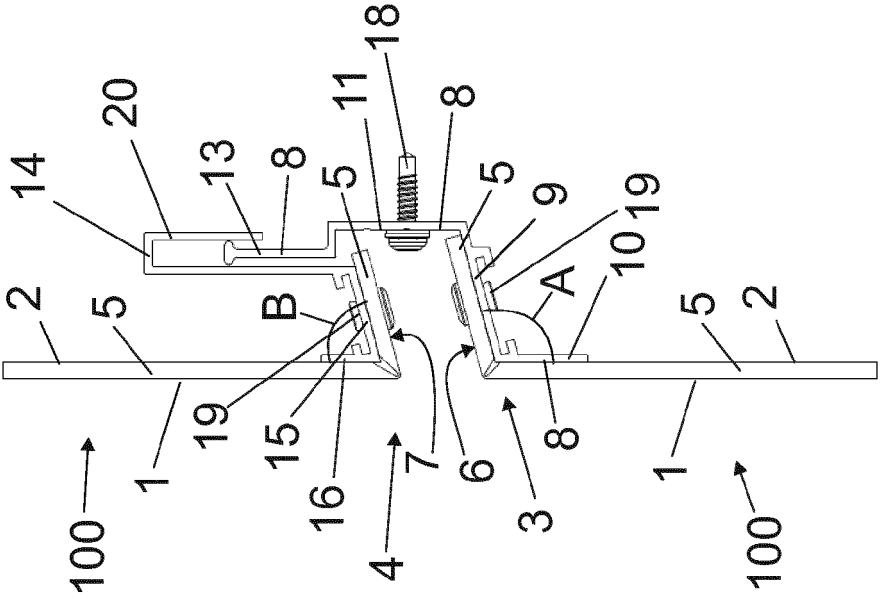


Fig. 1

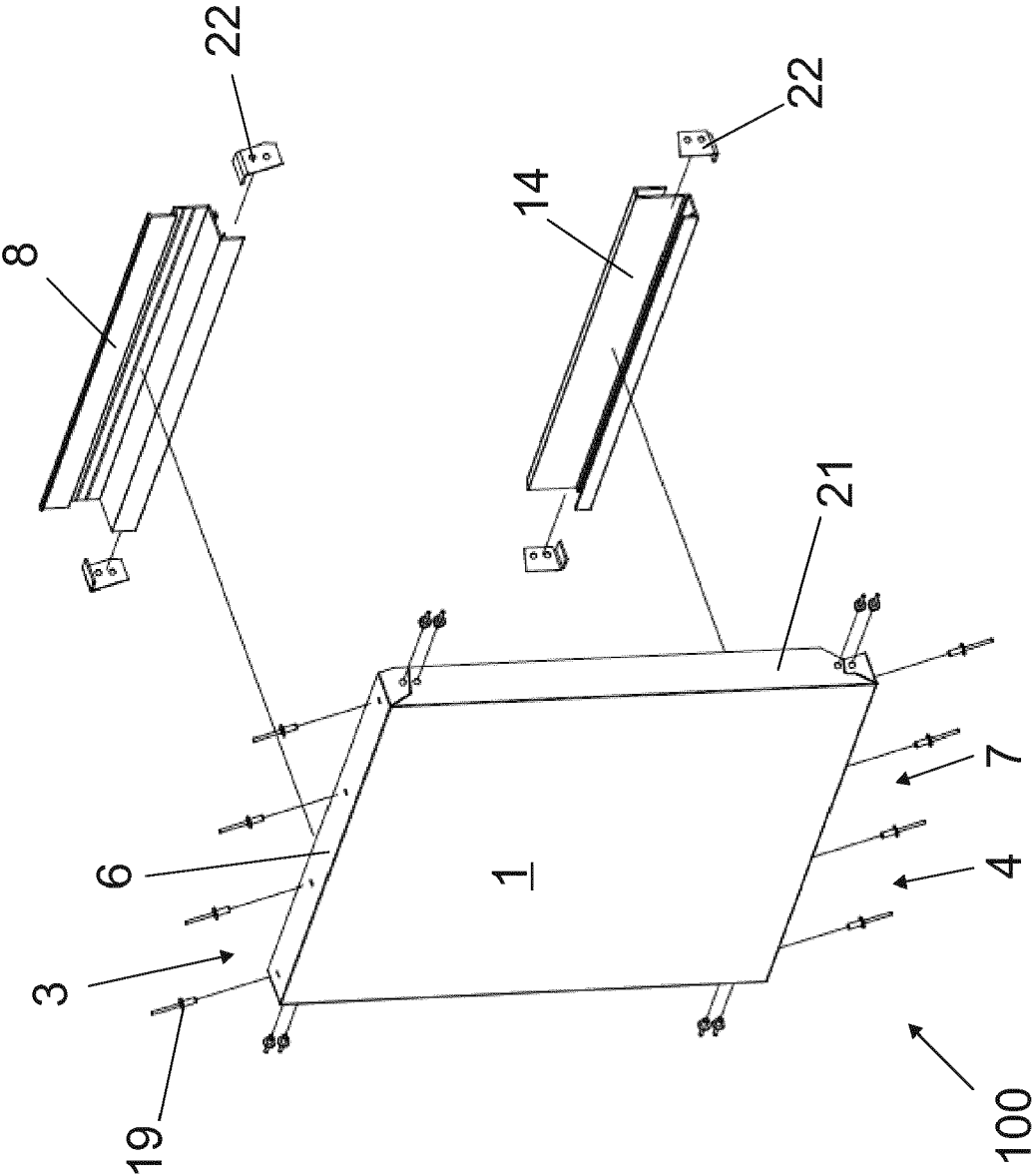


Fig. 5



## EUROPEAN SEARCH REPORT

Application Number  
EP 19 20 9416

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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                   |                                  |                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|--------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                     | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC)    |
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| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                   | Date of completion of the search | Examiner                                   |
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| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                                   |                                  |                                            |

EPO FORM 1503 03/82 (P04C01)



**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 19 20 9416

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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