(19) DANMARK

(10) **DK/EP 3772556 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

(51) Int.Cl.: ***E 04 C 2/292 (2006.01)*** ***E 04 F 13/12 (2006.01)*** *E 04 F 13/08 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2021-12-20**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-11-10**

(86) Europæisk ansøgning nr.: **19190513.2**

(86) Europæisk indleveringsdag: **2019-08-07**

(87) Den europæiske ansøgnings publiceringsdag: **2021-02-10**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **Rautaruukki Oyj, Panuntie 11, 00620 Helsinki, Finland**

(72) Opfinder: **Kesti, Jyrki, , 00620 Helsinki, Finland**
Honkakoski, Erkki, , 00620 Helsinki, Finland
Roivio, Pekka, , 00620 Helsinki, Finland

(74) Fuldmægtig i Danmark: **Zacco Denmark A/S, Arne Jacobsens Allé 15, 2300 København S, Danmark**

(54) Benævnelse: **Kompositpanel og fremgangsmåde til fremstilling af et kompositpanel**

(56) Fremdragne publikationer:
WO-A1-99/67086
WO-A1-2005/059265
WO-A1-2008/074926
DE-A1- 2 304 886
JP-A- 2000 017 816
US-A- 4 104 840

DESCRIPTION

BACKGROUND

[0001] The invention relates to a sandwich-structured composite panel, comprising a first face skin of sheet metal and a second face skin of sheet metal.

[0002] US 4 104 840 A discloses a sandwich-structured composite panel, comprising a first and a second face skins of sheet metal and a core made of thermally insulating material. An attachment edge comprising an attachment profile formed from the sheet metal of at least one of said skins, and shaped for a tongue-and-groove attachment, is provided at the edge of the composite panel for attaching the composite panel to another composite panel. A protective layer of hydrophobic material is arranged on the outer surface of the sheet metal.

[0003] The invention further relates to a method for manufacturing the composite panel.

[0004] It is known to use steel composite panels in buildings and constructions as a façade cladding panel element, a partition wall panel element, or a ceiling panel element. A phenomenon known as crevice corrosion may be problematic for such steel composite panels. The crevice corrosion may take place in confined areas where water solution can penetrate but it cannot change at the same speed as other areas of the metal surface. For instance, seams and joints between composite panels attached to each other may create said confined areas hospitable for crevice corrosion.

[0005] Especially weathering steels, such as COR-TEN steel, may be very sensitive to crevice corrosion. Said weathering steels are group of steel alloys which were developed to eliminate the need for painting and form a stable rust-like appearance after several years' exposure to weather.

BRIEF DESCRIPTION

[0006] Viewed from a first aspect, there can be provided a sandwich-structured composite panel, comprising

- a first face skin of sheet metal,
- a second face skin of sheet metal, and
- a core made of thermally insulating material arranged between the first face skin and the second face skin, the first and second face skins being attached to the core,
- an attachment edge at the edge of the composite panel for attaching the composite panel to another composite panel,
- the attachment edge comprising

- an attachment profile being formed from the sheet metal of at least one of said skins and shaped for a tongue-and-groove attachment,
- the sandwich-structured composite panel further comprising
- a protective layer of hydrophobic material arranged on the outer surface of a portion of the sheet metal in the attachment profile , for inhibiting or attenuating galvanic contacts or couplings between composite panels attached to each other, wherein the face skins are without said protective layer.

[0007] Thereby the composite panel may provide inhibited or attenuated galvanic contacts or couplings between composite panels attached to each other. Thus, a final panel structure having good resistance against crevice corrosion at composite panel attachment joints may be achieved.

[0008] Viewed from a further aspect, the invention further provides a method for manufacturing the composite panel as claimed in any one of the preceding claims, the method comprising, simultaneously or in any order, the steps of:

- providing a sheet metal,
- forming the attachment edge and the attachment profile to the sheet metal, thus providing the first face skin and the second face skin,
- attaching the first face skin and the second face skin to a core made of thermally insulating material,
- providing the protective layer of hydrophobic material in the attachment profile, and
- leaving the face skins without said protective layer.

[0009] Thereby a method for manufacturing composite panels providing metallic face skin(s) but still having good resistance against crevice corrosion at composite panel attachment joints in a final structure may be achieved.

[0010] The arrangement and the method are characterised by what is stated in the independent claims.

[0011] Advantageously, the protective layer is a polymer or polymer composite film. An advantage is that a protective layer that is durable may be achieved.

[0012] Advantageously, the protective layer is a paint layer. An advantage is that a very thin protective layer may be achieved.

[0013] In particular, the attachment profile comprises a tongue-profile, and wherein the protective layer is arranged on surface of said tongue-profile. An advantage is that the protective layer is easy to arrange on the tongue-profile.

[0014] In particular, the attachment profile comprises a groove-profile, and wherein the protective layer is arranged on surface of said groove-profile. An advantage is that the protective layer is well-protected in the groove-profile against mechanical damages.

[0015] Optionally, the attachment edge comprises at least two attachment profiles. An advantage is that a robust attachment of panels may be achieved.

[0016] Optionally, a first attachment profile is formed from the first face skin and a second attachment profile is formed from the second face skin. An advantage is that the attachment edge may be provided with two attachment profiles in a simple way.

[0017] In particular, the attachment edge comprises a section of the core between the first and second attachment profiles. An advantage is that thermal insulation property may be extended to the attachment edge.

[0018] In particular, the composite panel comprises attachment edges at opposite edges thereof, such that said attachment edges are counterparts to each other. An advantage is at least two of said panels may be attached to each other.

[0019] In particular, the material of the face skin is of naturally passivating metal. An advantage is that the need for painting or another surface finishing may be eliminated.

[0020] In particular, the core is a board of foamed polyurethane. An advantage is that good thermal insulation properties may be achieved.

[0021] Optionally, the core is a polyisocyanurate (PIR) insulation board. An advantage is that good thermal insulation properties with improved flame-retardant properties may be achieved.

[0022] Optionally, the core is a mineral wool element. An advantage is that a composite panel having good flame-retardant properties may be achieved.

[0023] Optionally, the attachment edge is arranged on the upper or the lower edge of the panel. An advantage is that risk of corrosion in horizontal joints of a panel structure may be reduced.

[0024] Optionally, the composite panel comprises an airtight seal component arranged in the groove-profile. An advantage is that transport of air and moisture through the joint of composite panels may be prevented, and thus life-time of the panels extended.

[0025] In particular, the method comprises: arranging a temporary protective layer of hydrophobic material on the surface of the sheet metal, forming the outer faces of the first face skin and the second face skin from the surface of sheet metal comprising the temporary protective layer, and following assembling the composite panel: removing the temporary

protective layer on the outer faces of at least one of the skins, but leaving the temporary protective layer on the attachment profile, thus forming the protective layer in the attachment profile. An advantage is that the temporary protective layer that protects the skins during manufacturing of the composite panels is utilized as the protective layer, and thus material costs of the composite panels may be reduced.

[0026] Optionally, the method comprises: providing the protective layer in the attachment profile by painting. An advantage is that painting is simple way to provide layers on a substrate.

[0027] Optionally, the method comprises: arranging a temporary protective layer on the surface of the sheet metal, forming the outer faces of the first face skin and the second face skin from the surface of sheet metal comprising the temporary protective layer, removing the temporary protective layer from the attachment profile, and providing the protective layer in the attachment profile by painting. An advantage is that the temporary protective layer serves as a masking element for painting, thus a very precise painting may be realized.

BRIEF DESCRIPTION OF FIGURES

[0028] 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 a composite panel in partial cross-section, and

Figures 2a - 2d are schematic views of method for manufacturing a composite panel.

[0029] 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

[0030] Figure 1 is a schematic side view of a composite panel in partial cross-section.

[0031] The composite panel 1 may be e.g. a façade cladding panel element, or a partition wall panel element, or a ceiling panel element.

[0032] The composite panel 1 has a sandwich-structure, comprising a first face skin 3 of sheet metal, a second face skin 4 of sheet metal, and a core 5 made of thermally insulating material arranged between the first face skin and the second face skin. The first and second face skins 3, 4 are attached to the core 5.

[0033] Advantageously, the material of the face skin 3, 4 is naturally passivating metal, such as weathering steel or COR-TEN steel.

[0034] In particular, the core 5 is a board of foamed polyurethane. More in particular, the core 5 is a polyisocyanurate (PIR) insulation board. In still another embodiment, the core 5 is a wool element, such as a mineral wool element.

[0035] An attachment edge 2 is arranged at the edge of the composite panel 1 for attaching the composite panel to another composite panel. According to an aspect of the invention, the attachment edge 2 comprises an attachment profile 6 being formed from the sheet metal of first or second face skin 3, 4, or of both first and second skins. The attachment edge 2 is shaped such that the composite panels may be attached by a tongue-and-groove attachment to each other.

[0036] According to the invention, the composite panel 1 comprises attachment edges 2 at opposite edges thereof, such that said attachment edges 2 are counterparts to each other.

[0037] The composite panel 1 comprises further a protective layer 7 made of hydrophobic material and arranged on the outer surface of a portion of the sheet metal in the attachment profile 6. Optionally, the protective layer 7 is a polymer or polymer composite film, such as polyethylene (e.g. high-density polyethylene HDPE) or polypropylene film. In an embodiment, the protective layer comprises polyethylene terephthalate PET, having good ultraviolet resistance, low water absorption and low electrical conductivity. Optionally, the protective layer comprises polyethylene naphthalene PEN, having better ultraviolet resistance, lower water absorption and lower electrical conductivity. Optionally, the protective layer comprises polyimide PI, having still better ultraviolet resistance, lower water absorption and lower electrical conductivity. The protective layer 7 comprising polymer film may be a monolayered film or multi-layer film.

[0038] Optionally, the protective layer 7 is a paint layer.

[0039] In particular, the attachment profile 6 comprises a tongue-profile 8, and the protective layer 7 is arranged on surface of said tongue-profile. Optionally, the attachment profile 6 comprises a groove-profile 9, and the protective layer 7 is arranged on surface of said groove-profile.

[0040] In particular, the attachment edge 2 comprises at least two attachment profiles 6. In particular (e.g. as shown in Figures), the attachment edge 2 comprises two parallel tongue-profiles 8, or two parallel groove-profiles 9. In particular, the attachment edge 2 comprises one tongue-profile and one groove-profile arranged parallel with the tongue-profile. More in particular, a first of said attachment profiles 6 may be formed from the first face skin 3, whereas the second attachment profile is formed from the second face skin 4.

[0041] In particular, attachment edge 2 comprises an airtight seal component 10 extending

preferably all over the length of the attachment edge 2. The seal component 10 may be attached e.g. in the groove-profile 9, and as the tongue-profile is arranged in said groove-profile, the seal component 10 gets squeezed between the profiles.

[0042] In particular, the attachment edge 2 comprises a section of the core 5 between the first and second attachment profiles 6.

[0043] The attachment edge 2 may be arranged on the upper or the lower edge of the panel. Thus, the attachment edges 2 connected to each other may establish a horizontal seam of a panel structure. However, optionally, the attachment edge 2 is arranged another way. For example, the attachment edge 2 may be arranged on a side edge of the panel, and thus form a part of a vertical seam of a panel structure.

[0044] In Figure 1, attachment means 12 attaching the composite panels 1 to a support structure 13 are screws. Optionally, another type of attachment means may be used. For instance, the composite panel is glued to the support structure.

[0045] The support structure 13 may be basically any structure of a building or a construction being suitable for the attachment of the composite panels.

[0046] **Figures 2a - 2d** are schematic views of method for manufacturing a composite panel. In the embodiment of the method shown in the Figures, it is first provided 100 a sheet metal 14. As shown in Figure 2a, the sheet metal is provided from a roll of metal sheet 15. However, the sheet metal may also be provided in plate-form.

[0047] A temporary protective layer 11 of hydrophobic material is arranged 101 on the surface of the sheet metal 14.

[0048] Figure 2b is showing forming 102 the attachment edges 2 and the attachment profile 6 to the sheet metal 14, thus providing the first face skin and the second face skin.

[0049] The temporary protective layer 11 lies on outer faces of the first face skin and the second face skin. The forming 102 may be realized e.g. by roll-forming or cold forming methods.

[0050] Figure 2b is showing attaching 103 the first face skin 3 and the second face skin to a core made of thermally insulating material, by e.g. gluing. Thus, the composite panel 1 has been assembled, shown in Figure 2c.

[0051] Following assembling the composite panel 1, the temporary protective layer 11 is removed 105 on the outer face of at least one of the skins 3, 4, but it is left 106 on the attachment profile 6, thus forming 104 the protective layer 7 in the attachment profile 6. In an embodiment, the temporary protective layer 11 is removed 105 on the outer face of both of the skins 3, 4, but it is left 106 on the attachment profile 6. In an embodiment, in the removing step

it is first made a cutting or slit on an appropriate line in the temporary protective layer 11, and then the sections to be removed are stripped or pulled away from the outer faces of the skin 3, 4.

[0052] It is to be noted that in Figure 2d, the upper face skin 3 is shown with section of the temporary protective layer 11 to be removed (dashed line), whereas the lower face skin 4 is shown said section already removed.

[0053] In particular (e.g. as the shown embodiment), the protective layer 7 is arranged only to one attachment edge of the composite panel. The protective layer 7 can be arranged to both or all the attachment edges of the composite panel.

[0054] Optionally, the protective layer 7 is provided as a strip of polymer or polymer composite film that is attached to the attachment profile 6.

[0055] Optionally, the protective layer 7 is applied in the attachment profile 6 by painting. Advantageously, it is possible to utilize the temporary protective layer 11 as a painting masking, i.e. the temporary protective layer 11 is removed on sections of the attachment profile 6 to be painted, and then applying paint on exposed sections of the attachment profile 6.

[0056] The invention is not limited solely to the embodiments described above, but instead variations are possible within the claims below.

[0057] 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 defined in the following claims.

REFERENCE SYMBOLS

[0058]

1 composite panel
2 attachment edge
3 first face skin
4 second face skin
5 core
6 attachment profile
7

protective layer

8
tongue-profile

9
groove-profile

10
seal component

11
temporary protective layer

12
attachment means

13
support structure

14
sheet metal

15
roll of metal sheet

100 - 106
method steps

REFERENCES CITED IN THE DESCRIPTION

Cited references

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US4104840A [0002]

Patentkrav

1. Kompositpanel med sandwichstruktur (1), omfattende
- en første overfladehud (3) af plademetal,
- en anden overfladehud (4) af plademetal, og
- en kerne (5) fremstillet af termisk isolerende materiale, der er anbragt mellem den første overfladehud og den anden overfladehud, hvor den første og den anden overfladehud er fastgjort til kernen,
- en fastgørelseskant (2) ved kanten af kompositpanelet (1) til fastgørelse af kompositpanelet til et andet kompositpanel (1),
- hvor fastgørelseskanten (2) omfatter
- et fastgørelsesprofil (6), der er formet ud fra plademetallet af mindst en af huderne (3, 4) og er udformet med henblik på en tunge-og-not-fastgørelse,
- hvor kompositpanelet med sandwichstruktur (1) yderligere omfatter
- et beskyttende lag (7) af hydrofobisk materiale, der er anbragt på den udvendige overflade af en del af plademetallet i fastgørelsesprofilet (6), med henblik på at hæmme eller dæmpe galvaniske kontakter eller forbindelser mellem kompositpaneler, der er fastgjort til hinanden, hvor
- overfladehuderne (3, 4) er uden det beskyttende lag (7).

2. Kompositpanel ifølge krav 1, hvor det beskyttende lag (7) er en polymer eller polymerkompositfilm.

3. Kompositpanel ifølge krav 1, hvor det beskyttende lag (7) er et lag af maling.

4. Kompositpanel ifølge et af de foregående krav, hvor fastgørelsesprofilet (6) omfatter et tunge-profil (8), og hvor det beskyttende lag (7) er anbragt på overfladen af tunge-profilet.

5. Kompositpanel ifølge et af de foregående krav, hvor fastgørelsesprofilet (6) omfatter et not-profil (9), og hvor det beskyttende lag (7) er anbragt på overfladen af not-profilet.

6. Kompositpanel ifølge et af de foregående krav, hvor fastgørelseskanten (2) omfatter mindst to fastgørelsesprofiler (6).

7. Kompositpanel ifølge krav 6, hvor et første fastgørelsesprofil (6) er formet ud fra den første overfladehud (3), og et andet fastgørelsesprofil (6) er formet ud fra den anden overfladehud (4).

8. Kompositpanel ifølge krav 7, hvor fastgørelseskanten (2) omfatter en sektion af kernen (5) mellem det første og det andet fastgørelsesprofil (6).

9. Kompositpanel ifølge et af de foregående krav, omfattende fastgørelseskanter (2) ved overfor liggende kanter deraf, således at fastgørelseskanterne (2) er modparter for hinanden.

10. Kompositpanel ifølge et af de foregående krav, hvor materialet af overfladehuden (3, 4) er af naturligt passiverende metal.

11. Kompositpanel ifølge et af kravene 5 - 10, omfattende en lufttæt tætningskomponent (10), der er anbragt i not-profilet (9).

12. Fremgangsmåde til fremstilling af kompositpanelet ifølge et af de foregående krav, hvor fremgangsmåden omfatter de følgende trin:
- at tilvejebringe (100) en metalplade (14),
- at forme (102) en fastgørelseskant (2) og et fastgørelsesprofil (6) til metalpladen (14) og således tilvejebringe en første overfladehud (3) og en anden overfladehud (4),
- at fastgøre (103) den første overfladehud (3) og den anden overfladehud (4) til en kerne (5) fremstillet af termisk isolerende materiale,
- at tilvejebringe (104) et beskyttende lag (7) af hydrofobisk materiale i fastgørelsesprofilet (6), og
- at lade (105) overfladehuderne (3, 4) være uden det beskyttende lag (7).

13. Fremgangsmåde ifølge krav 12, omfattende:
- at anbringe (101) et midlertidigt beskyttende lag (11) af hydrofobisk materiale på overfladen af metalpladen (14),
- at forme de udvendige sider af den første overfladehud (3) og den anden overfladehud (4) ud fra overfladen af plademetal (14), der omfatter det midlertidige beskyttende lag (11), og
- derefter at samle kompositpanelet (1):

- at fjerne (105) det midlertidige beskyttende lag (11) på mindst en af de udvendige sider af huderne, men
- at efterlade (106) det midlertidige beskyttende lag (11) på fastgørelsesprofilet (6), og således at danne det beskyttende lag (7) i fastgørelsesprofilet (6).

14. Fremgangsmåde ifølge krav 12, omfattende:
- at tilvejebringe (104) det beskyttende lag (7) i fastgørelsesprofilet (6) ved at male det på.

15. Fremgangsmåde ifølge krav 12, omfattende:
- at anbringe (100) et midlertidigt beskyttende lag (11) på overfladen af metalpladen (14),
- at forme de udvendige sider af den første overfladehud (3) og den anden overfladehud (4) ud fra overfladen af plademetal (14), der omfatter det midlertidige beskyttende lag (11),
- at fjerne det midlertidige beskyttende lag (11) fra fastgørelsesprofilet (6), og
- at tilvejebringe (104) det beskyttende lag (7) i fastgørelsesprofilet (6) ved at male det på.

DRAWINGS

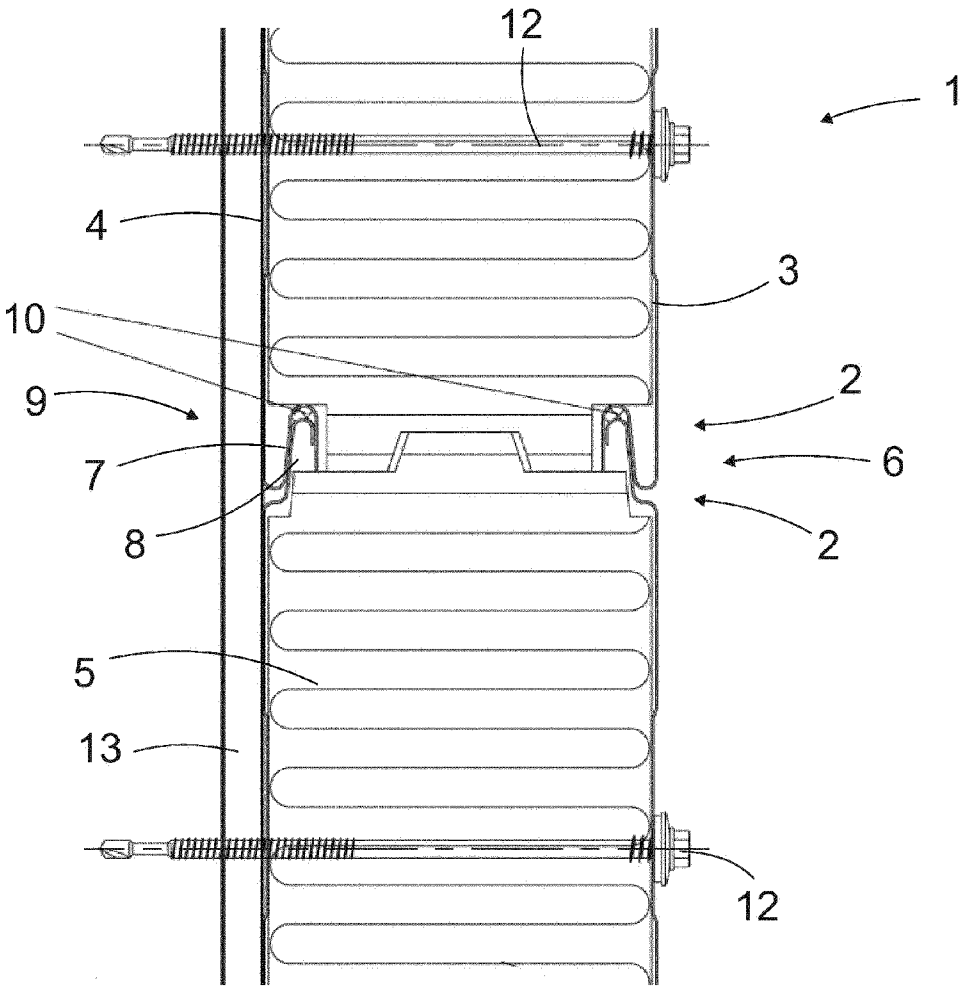


Fig. 1

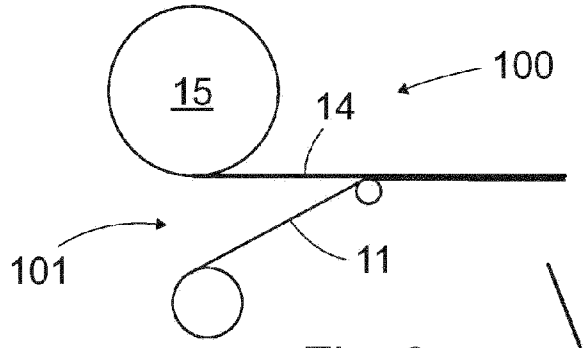


Fig. 2a

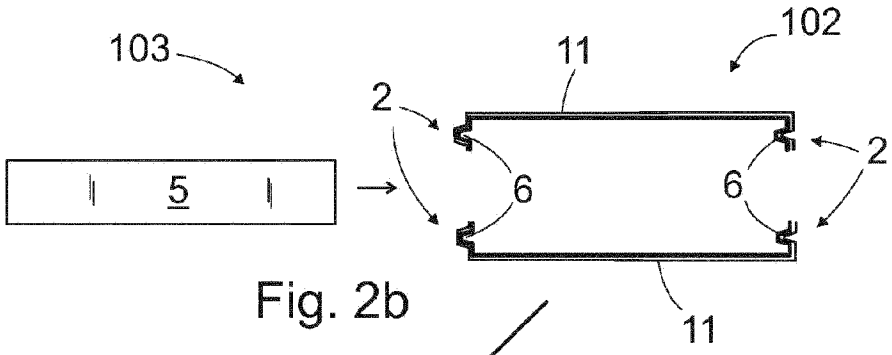


Fig. 2b

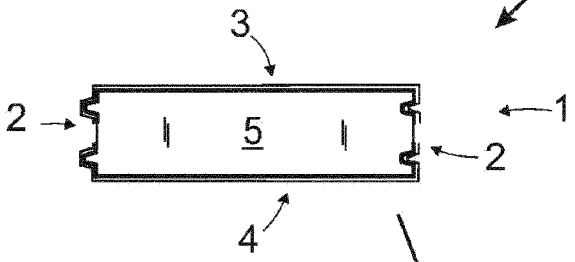


Fig. 2c

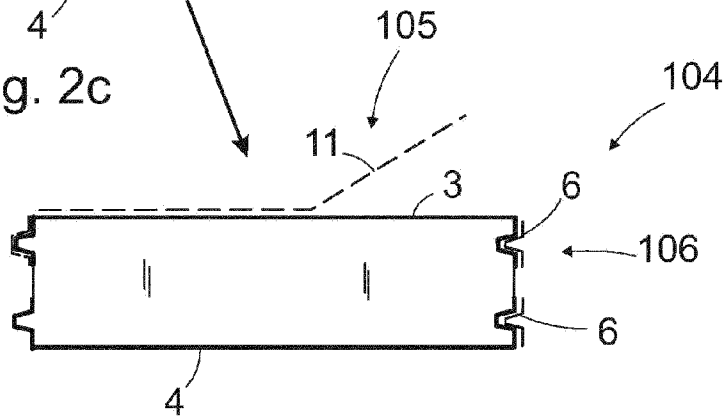


Fig. 2d