(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 196 378 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
26.07.2017 Bulletin 2017/30

(51) Int Cl.:
E04D 3/35 *(2006.01)* ***E04D 3/366*** *(2006.01)*
E04C 2/296 *(2006.01)*

(21) Application number: **16151964.0**

(22) Date of filing: **19.01.2016**

(84) Designated Contracting States:
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
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(54) METHOD FOR CONSTRUCTING A THERMALLY INSULATING WATER-TIGHT ROOF COVER

(57) The present invention relates to a method for constructing a thermally insulating water-tight roof cover (1) wherein panels (3) which comprise a slab (6) of thermally insulating material are placed on a roof deck (2) next to one another with seams (16) between said panels (3), wherein a self-adhesive sealing tape (17) is applied over said seams (16) and adhered along said seams (16) onto said panels (3) and wherein a finishing coating layer (15) is applied onto said sealing tape (17) and at least along said sealing tape (17) onto said panels (3). Since the roof cover (1) is already rendered water-tight by the sealing tape (17), it does not need to be covered when rainy weather is expected and the roof cover (1) is not entirely finished yet.

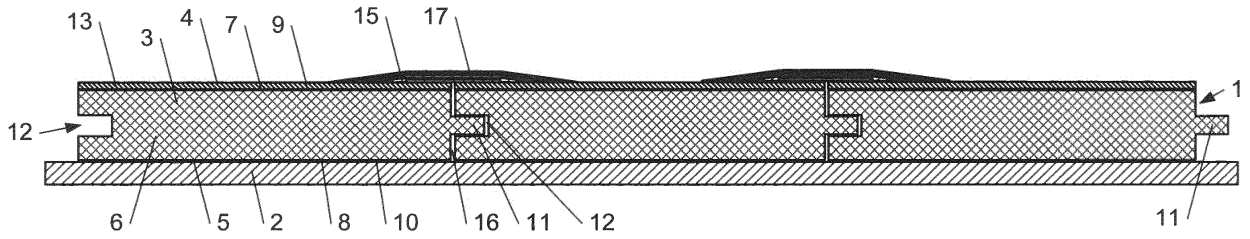

Fig. 2

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Description

[0001] The present invention relates to a method for constructing a thermally insulating water-tight roof cover, wherein panels are provided which have a top surface and a bottom surface and which comprise a slab of thermally insulating material which has a top face and a bottom face, wherein said panels are placed on a roof deck next to one another with seams between said panels, and wherein a water-tight covering material is applied onto the top surfaces of said panels after having placed said panels on said roof deck.

[0002] Thermally insulating panels which can be used in such a method are commercially available such as for example the "Powerdeck F" and the "Eurothane" insulation panels of Recticel. These panels are intended to be placed side by side on a roof deck after which a water-tight covering material is to be applied over the panels to render the roof cover water-tight. The water-tight covering material comprises in particular rolls of a bituminous covering layer or of a synthetic foil (EPDM rubber membrane) which are to be glued over the different panels to cover the entire roof deck.

[0003] A drawback of such a method is that it takes quite some time before the entire roof cover is water-tight. In case rain is expected, and the roof cover is not entirely finished at the end of the day, the roof should be covered with a tarpaulin. In case of a flat roof, this is however often not possible or at least difficult since a tarpaulin which is simply laid over a flat roof doesn't allow the water to be evacuated from the roof. In fact, the water pipes which are provided for evacuating the water cannot be connected easily to the tarpaulin.

[0004] Moreover, for larger roofs, the covering material has to be applied in different strips which partly overlap at the edges to ensure a water-tight cover layer. Placing the strips of cover material in the correct manner needs to be done by a skilled person since otherwise mistakes can be made which can result in the roof cover not being water-tight. When there is an overlap between the different strips of covering material, these strips need moreover to be adhered to one another in order to be made water-tight.

[0005] A further drawback of the prior art method is that it cannot be executed during inclement weather, for example during precipitation or when freezing conditions may occur within 24 hours. This is because the glue used between overlapping parts of different sheets is liquid based and cannot cure under humid or freezing weather conditions.

[0006] An object of the present invention is to provide a new method for constructing a thermally insulating water-tight roof cover which is easier and faster to execute and which enables in particular to obtain quickly a water-tight covering when the roof cover is not yet entirely finished so that no tarpaulins or other covers are needed in case rain is expected before the roof cover is entirely finished.

[0007] To this end, the method according to the invention is characterised in that said panels comprise a water-tight covering provided on the top face of said slab, in that the water-tight covering material which is applied onto the top surfaces of said panels comprises a self-adhesive sealing tape which is applied over said seams and adhered along said seams onto the top surfaces of said panels, and in that after having applied the self-adhesive sealing tape over said seams, at least one finishing coating layer is applied onto said sealing tape and at least along said sealing tape onto said top surfaces of said panels.

[0008] Due to the fact that the panels which are placed onto the roof deck already comprise a water-tight covering there is no need to cover the entire surface of the roof with the water-tight covering material. It is sufficient to seal only the seams between the panels by adhering the self-adhesive sealing tape over these seams. By avoiding having to apply an entire water-tight cover layer, but using only a sealing tape, the roof cover can be made water-tight in a much shorter period of time. Also, in practice, water-tight sealing tapes are available which can be used under cold or even humid conditions. The method of the present invention is simpler since, compared to adhering rolls of covering material onto the panels, adhering a narrow self-adhesive sealing tape over the seams is straightforward. When subsequently the finishing coating layer is applied onto the sealing tape, which can be done immediately or after some days or even weeks, the sealing tape itself is no longer exposed to the atmospheric conditions. As such, the sealing tape does not degrade over time which could result in leaks. The water-tight covering of the panels is moreover preferably already weather-resistant as such so that it does not need to be covered by a coating layer. Moreover, since the coating layer which is applied onto the sealing tape is also applied over the edges of the sealing tape, there are no seams so that the roof cover is not only completely water-tight but the sealing strip can also not become detached, for example by wind or birds or when a person is walking over the roof.

[0009] In a preferred embodiment of the method according to the present invention, said finishing coating layer comprises an infrared radiation reflecting material which preferably contains at least 3% by dry weight, more preferably at least 5% by dry weight of titanium dioxide, said finishing coating layer having preferably a total solar reflectance of at least 40%, more preferably of at least 50% and most preferably of at least 60%.

[0010] In this embodiment, using a finishing coating layer which reflects infrared radiation ensures that the temperature of each panel increases less due to the sunlight. As such there are less temperature variations in the panels and the panels will expand and/or contract less which reduces the risk that the sealing tape may become damaged due to variations in the width of the seams between the different panels.

[0011] Preferably, the water-tight covering which is al-

ready provided on the top faces of the slabs of the panels comprises a further finishing coating layer which has substantially the same chemical composition as the finishing coating layer which is applied onto said sealing tape. In this way, that the roof cover has over its entire surface the same reflective properties and the location of the seams is also no longer visible after having applied the finishing coating layer onto the sealing tape.

[0012] In a further preferred embodiment of the method according to the present invention, a water-tight coating layer is applied onto said sealing tape and at least along said sealing tape onto said top surfaces of said panels after having applied said sealing tape onto the top surfaces of said panels, but before applying said finishing coating layer.

[0013] In this preferred embodiment, an additional water-tight layer is provided over the seams between the panels and the back side of the sealing tape, which often consists of a fabric, is shielded of from water so that the roof cover becomes more weather resistant. Furthermore, when the sealing tape would locally not be adhered in an entirely water-tight manner onto the top surface of the panels, the water-tight coating layer, which is applied in a liquid form, ensures an entirely water-tight roof cover.

[0014] In an advantageous embodiment of the method according to the present invention, said sealing tape comprises a reinforcing backing layer and a layer of sealant adhered to said backing layer, which sealant preferably comprises a butyl rubber sealant. Moreover, the sealing tape preferably has an elongation at break of at least 10%, preferably of at least 15% and more preferably of at least 20% according to the ISO 37:2011 Standard.

[0015] The reinforcing backing layer increases the tensile strength of the sealing tape and enables to walk over the tape after having applied it over the seams without damaging the tape. The backing layer also reinforces the coating layer which is applied onto the back thereof. The minimum elongation at break ensures that the sealing tape will not rip when the seams expand and/or contract due to the expansion and/or contraction of the panels as a result of temperature changes. Therefore, at the location of the seams, the sealing tape and the coating layers applied thereon will not become damaged when mechanical forces are exerted thereon or as a result of shrinkage or expansion of the thermally insulating panels.

[0016] In an advantageous embodiment of the method according to the present invention, said panels comprise a reinforcement layer on the top face of said slab and preferably a further reinforcement layer on the bottom face of said slab. Preferably, the reinforcement layer on the top face of the slab comprises a polyester fabric, in particular a non-woven polyester fabric.

[0017] The reinforcement layers further strengthen the roof cover and prevent in particular indentations in the foam when a pressure is locally exerted thereon.

[0018] In a further advantageous embodiment, said panels have lateral sides provided with mutually co-operating interlocking elements which comprise in particular tongue and groove elements.

[0019] In this way, it can be assured that the top surfaces of adjoining panels are always at the same level, even in case of a roof deck with an irregular top surface, so that the seams can be covered with a flat coating, which is less exposed to mechanical forces when somebody is walking for example over the roof. The tongue and groove elements also enable to anchor the panels mechanically onto the roof deck without making holes in the top surface of the panels itself so that these holes doesn't have to be rendered water-tight by means of the sealing tape or the coating applied thereon.

[0020] Advantageously, the thermally insulating panels are glued onto said roof deck.

[0021] Gluing said panels onto said roof deck ensures that no openings need to be provided in each panel for screws in order to attach the panels to the roof deck. A narrower, less expensive sealing tape can thus be used since the sealing tape doesn't have to be applied over these holes or openings.

[0022] The present invention also relates to a set for use in a method according to any one of the preceding claims, which set comprises panels having a water-tight covering which forms a top surface of said panels; a sealing tape configured for being applied onto said top surfaces of said panels; and a coating material configured for being applied onto said sealing tape to form said at least one finishing coating layer.

[0023] The present invention moreover relates to a thermally insulating water-tight roof cover which is obtainable by the method according to the invention and which comprises:

- panels having a water-tight covering which forms a top surface of said panels, which panels are located on a roof deck next to one another with seams between said panels;
- a self-adhesive sealing tape applied over said seams and adhered along said seams onto the top surfaces of said panels; and
- at least one finishing coating layer applied onto said sealing tape and at least along said sealing tape onto said top surfaces of said panels.

[0024] Other particularities and advantages of the invention will become apparent from the following description of a particular embodiment of the method for constructing a thermally insulating water-tight roof cover of the present invention. The reference numerals used in this description relate to the annexed drawings wherein:

Figure 1 shows a perspective view of a roof cover constructed in accordance with the method of the present invention;

Figure 2 shows a cross-sectional view of a roof cover illustrated in Figure 1; and

Figure 3 shows an enlarged cross-sectional view of the different coating layers forming the top surface

of the panels and the different coating layers applied onto the sealing tape of the roof cover illustrated in the previous figures.

[0025] The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto but only by the claims. The drawings described are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn on scale for illustrative purposes. The dimensions and the relative dimensions do not necessarily correspond to actual reductions to practice of the invention.

[0026] Moreover, the various embodiments, although referred to as "preferred" are to be construed as exemplary manners in which the invention may be implemented rather than as limiting the scope of the invention.

[0027] Figure 1 illustrates a thermally insulating water-tight roof cover 1 constructed according to the method of the present invention. The roof cover 1 is placed on and supported by a roof deck 2. The roof deck 2 can be any substantially flat sheet or a number of crossbeams to support the roof cover 1. The roof deck 2 can be made of a number of different materials such as concrete, wood, steel, etc. The roof cover 1 can in particular also be placed on an existing roof as part of a renovation for example. As such, the roof cover 1 may have to be placed onto a layer of bituminous roofing, an EPDM rubber membrane (ethylene propylene diene monomer rubber) or onto metal roof covering plates, etc.

[0028] The first step in constructing the roof cover 1 is to place panels 3 on the roof deck 2. The panels 3 can be attached to the roof deck 2 in a number of ways, for example they can be mechanically fixed to the roof deck 2 using for example screws either or not in combination with fixation elements, such as brackets or profiles. Preferably, the panels 3 are adhered to the roof deck 2, for example by means of a glue or by means of a bituminous adhesive, as this avoids having to provide openings in the panels 3 for placing screws. Typical dimensions of the panels 3 are 60 cm or 80 cm across and 120 cm or 200 cm along with a thickness of around 5 cm to 10 cm but other dimensions are possible.

[0029] Figures 2 and especially Figure 3 show the panels 3 in more detail. The panels 3 have a top surface 4 and a bottom surface 5 and comprise a slab 6 of thermally insulating material which has a top face 7 and a bottom face 8. The thermally insulating material comprises preferably a foam, in particular a polyisocyanurate (PIR) foam and/or a polyurethane (PUR) foam, although other materials such rock wool can also be used. The panels 3 are placed such that the bottom surface 5 comes into contact with the roof deck 2 and the top surface 4 is exposed to the outside environment.

[0030] The panels 3 further comprise a reinforcement layer 9 on the top face 7 of said slab 6 and a further reinforcement layer 10 on the bottom face 8 of said slab 6. The reinforcement layers 9, 10 strengthen the roof cover 1 and also increase the dimensional stability thereof, in particular in case of temperature fluctuations. The reinforcement layers 9, 10 can be adhered to the slabs 6 after said slabs 6 are produced. In case the slabs are made of a foam, the foam is preferably produced against the reinforcement layers 9, 10 so that the foam material can preferably partially penetrate into the reinforcement layers 9, 10 to achieve a strong connection between the foam and the reinforcement layers. Preferably, the reinforcement layer 9 which is applied onto the top face 7 of the slabs 6 comprises a polyester fabric, in particular a non-woven polyester fabric. Such a polyester fabric provides the necessary strength to substantially avoid indentations in the panels especially in case a person is walking on the roof. The reinforcement layer on the bottom face of the slabs may also comprise a polyester fabric but it may also comprise a less expensive non-woven glass fabric (i.e. a glass fleece). This reinforcement layer can in particular be impregnated with bitumen. Other reinforcement layers, such as an aluminium foil, or combination of reinforcement layers are also possible.

[0031] In the embodiment illustrated in Figure 2 the panels 3 have lateral sides provided with mutually co-operating tongue 11 and groove elements 12. The tongue 11 and groove elements 12 allow for easy placement of the panels 3 onto the roof deck 2. More complicated mutually co-operating interlocking elements 11, 12 are possible wherein openings can be provided or made in one of the elements 12 for attaching the panels 3 to the roof deck 2 using screws and wherein said openings are covered by the other element 11 of an adjacent panel 3. For example, the tongue elements 11 are placed near the bottom surface 5 of the panels 3 such that the bottom surface of the tongue elements 11 and the bottom surface 5 of the panels 3 form a single surface. In this example, the groove elements 12 are indentations of the bottom surface 5 of the panels 3 such that a panel 3 can be placed over the tongue element 11 of an adjacent panel 3. In this example, screws are preferably inserted in the tongue element 11 of a panel 3 to attach the panel 3 to the roof deck 2. In this way, the screws are covered by placing an adjacent panel 3 over the tongue element 11. Moreover, the panels 3 can also be placed onto the roof deck 2 without the use of mutually co-operating tongue 11 and groove elements 12. For example, the lateral sides of the panels 3 are flat, i.e. without mutually co-operating tongue 11 and groove elements 12, and the panels do not interlock with one another.

[0032] Figure 2 illustrates that each of the panels 3 comprises a water-tight covering 13 on the top face 7 of the slab 6. The water-tight covering 13 can be an EPDM rubber or a bitumen covering which is adhered to the top face 7 of said slab 6. This can be done by means of an adhesive or by foaming the foam slab against the covering 13. Preferably, the water-tight covering 13 is a water-tight coating which comprises preferably multiple coating layers which are applied onto the top face 7 of the slab 6 as illustrated in Figure 3. The bottom coating layer is a

water-tight coating layer 14 which is formed by applying a water-tight coating material to the top face 7 and allowing the material to harden. Preferably, the water-tight coating material contains 40% to 50% acrylate polymers, 25% to 35% calcium carbonate, 1 % to 5% titanium dioxide, 1% to 5% palygorskite and 28% to 33% water. Such a water-tight coating material is commercially available, e.g. Numastec base sealer no. 4. Figure 3 illustrates that multiple water-tight coating layers 14 can be used to form part of the water-tight covering 13. Using multiple water-tight coating layers 14 ensures an extra layer of security to avoid leaks.

[0033] Figure 3 further illustrates that the water-tight covering 13 comprises two finishing coating layers 15 on top of the two water-tight coating layers 14. As such, the water-tight covering 4 is formed by subsequently applying four coating layers on the top face 7 of the slab 6. One finishing coating layer 15 is formed by applying a finishing coating material to the top water-tight coating layer 14 and allowing the material to cure. Preferably, the finishing coating material contains 50% to 60% acrylate polymers, 30% to 40% calcium carbonate, 5% to 10% titanium dioxide, 1% to 5% zinc oxide and 10% to 15% water. Such a finishing coating material is commercially available, e.g. Numastec no. 2000 finish. The finishing coating material used comprises titanium dioxide and zinc oxide which are both known for reflecting solar radiation. The goal of using these materials is that the panels 3 have a low total solar reflectance, i.e. the percentage of irradiated energy reflected by an object. Preferably, the finishing coating layer 15 has a total solar reflectance of at least 40%, more preferably at least 50% and most preferably at least 60%. The total solar reflectance of the coating can be measured in accordance with the ASTM G173 standard of 2003, revised in 2006. The total solar reflection, i.e. the albedo, of the Numastec no. 2000 finish comprises about 87%.

[0034] Figures 2 and 3 illustrate that the panels 3 are placed on the roof deck 2 with a seam 16 between the panels 3. As described above, the panels 3 are water-tight due to the water-tight covering 13 and are thermally insulated due to the slab 6 of thermally insulating material, however in order to have a thermally insulated water-tight roof cover 1 the seams 16 between adjacent panels 3 also need to be make water-tight. To this end, a self-adhesive sealing tape 17 is applied over said seams 16 and adhered along said seams 16 onto the top surfaces 4 of said panels 3. The sealing tape 17 has a width which is preferably comprised between 2 and 20 cm, more preferably between 3 and 15 cm, for example 10 cm. It has for example a thickness of about 0.5 mm but other dimensions are possible. In particular, the sealing tape 17 comprises a reinforcing backing layer 18 and a layer of sealant 19 adhered to said backing layer 18. The sealant 19 preferably comprises a butyl rubber sealant. The sealant is preferably kneadable, meaning that it can be pressed against the top surface 4 of the panels 3 and can correct any deficiencies in the top surface 7, e.g. small cavities or small bumps. The sealing tape 17 can be curable or not curable and may contain solvents.

[0035] An important parameter of the sealing tape 17 is the elongation at break, i.e. how much the sealing tape 17 can stretch before it breaks. Because the panels 3 are exposed to the environment, in particular the sun, the panels 3 will contract and expand due to changes in temperature. In order to avoid breaking of the sealing tape 17 it preferably has an elongation at break of at least 10%, preferably of at least 15% and more preferably of at least 20% according to the ISO 37:2011 Standard.

[0036] The sealing tape 17 can be exposed to the environment for a number of days but is not meant to be in contact with the environment for extended periods of time. Therefore, Figure 3 illustrates that the sealing tape 17 is covered by four coating layers, two water-tight coating layers 14 and two finishing coating layers 15. Preferably, the finishing coating layer or layers 15 have the same chemical composition as the finishing coating layer or layers 15 of the panels 3 but other compositions are also possible. Applying one or more coating layers 14, 15 onto the sealing tape 17 and partially onto the surrounding surface of the panels 3 ensure that the sealing tape 17 cannot be removed from the panels 3. Furthermore, applying a water-tight coating material to form the water-tight coating layer 14 ensures that small openings between the sealing tape 17 and the panel 3 are also made water-tight. The finishing coating layer 15 ensures that the area above the sealing tape 17 also reflect the same amount of infrared radiation which lowers the heating of the panels 3 and therefore their expansion and contraction.

[0037] Figures 2 and 3 illustrate that each coating layer 14, 15 applied onto the sealing tape 17 is also partially applied onto the top surface 4 of the panels 3. In this way the entire roof cover 1 is seamless and has the same reflective properties everywhere.

Claims

1. A method for constructing a thermally insulating water-tight roof cover (1), wherein:

   panels (3) are provided which have a top surface (4) and a bottom surface (5) and which comprise a slab (6) of thermally insulating material which has a top face (7) and a bottom face (8);
   said panels (3) are placed on a roof deck (2) next to one another with seams (16) between said panels (3); and
   after having placed said panels (3) onto said roof deck (2) a water-tight covering material is applied onto the top surfaces (4) of said panels (3),
   characterised in that
   said panels (3) comprise a water-tight covering (13) provided on the top face (7) of said slab (6),
   in that said water-tight covering material com-

prises a self-adhesive sealing tape (17) which is applied over said seams (16) and adhered along said seams (16) onto the top surfaces (4) of said panels (3), and
in that at least one finishing coating layer (15) is applied onto said sealing tape (17) and at least along said sealing tape (17) onto said top surfaces (4) of said panels (3).

2. A method according to claim 1, **characterised in that** said finishing coating layer (15) comprises an infrared radiation reflecting material which preferably contains at least 3% by dry weight, more preferably at least 5% by dry weight of titanium dioxide.

3. A method according to claim 1 or 2, **characterised in that** said finishing coating layer (15) has a total solar reflectance of at least 40%, more preferably at least 50% and most preferably at least 60%.

4. A method according to any one of the preceding claims, **characterised in that** after having applied said sealing tape (17) onto the top surfaces (4) of said panels (3), but before applying said finishing coating layer (15) a water-tight coating layer (14) is applied onto said sealing tape (17) and at least along said sealing tape (17) onto said top surfaces (4) of said panels (3).

5. A method according to any one of the preceding claims, **characterised in that** said water-tight covering (13) comprises a further finishing coating layer which has substantially the same chemical composition as the finishing coating layer (15) applied onto said sealing tape (17).

6. A method according to any one of the preceding claims, **characterised in that** said sealing tape (17) comprises a reinforcing backing layer (18) and a layer of sealant (19) adhered to said backing layer (18), preferably said sealant (19) comprises a butyl rubber sealant.

7. A method according to any one of the preceding claims, **characterised in that** said sealing tape (17) has an elongation at break of at least 10%, preferably of at least 15% and more preferably of at least 20% according to the ISO 37:2011 Standard.

8. A method according to any one of the preceding claims, **characterised in that** said panels (3) have lateral sides provided with mutually co-operating interlocking elements (11, 12) which comprise in particular tongue (11) and groove (12) elements.

9. A method according to any one of the preceding claims, **characterised in that** said thermally insulating material comprises a foam, in particular a PIR foam and/or a PUR foam.

10. A method according to any one of the preceding claims, **characterised in that** said panels (3) comprise a reinforcement layer (9) on the top face (7) of said slab (6), preferably said reinforcement layer (9) comprises a polyester fabric.

11. A method according to any one of the preceding claims, **characterised in that** said panels (3) comprise a further reinforcement layer (10) on the bottom face (8) of said slab (6), preferably said further reinforcement layer (10) comprises a fabric.

12. A method according to any one of the preceding claims, **characterised in that** said panels (3) are glued onto said roof deck (2).

13. A method according to any one of the preceding claims, **characterised in that** said panels (3) are mechanically anchored onto said roof deck (2).

14. A set for use in a method according to any one of the preceding claims, which set comprises:

panels (3) having a water-tight covering (13) which forms a top surface (4) of said panels (3);
a sealing tape (17) configured for being applied onto said top surfaces (4) of said panels (3); and
a coating material configured for being applied onto said sealing tape (17) to form said at least one finishing coating layer (15).

15. A thermally insulating water-tight roof cover (1) which is obtainable by the method according to any one of the preceding claims and which comprises:

panels (3) having a water-tight covering (13) which forms a top surface (4) of said panels (3), which panels (3) are located on a roof deck (2) next to one another with seams (16) between said panels (3);
a self-adhesive sealing tape (17) applied over said seams (16) and adhered along said seams (16) onto the top surfaces (4) of said panels (3); and
at least one finishing coating layer (15) applied onto said sealing tape (17) and at least along said sealing tape (17) onto said top surfaces (4) of said panels (3).

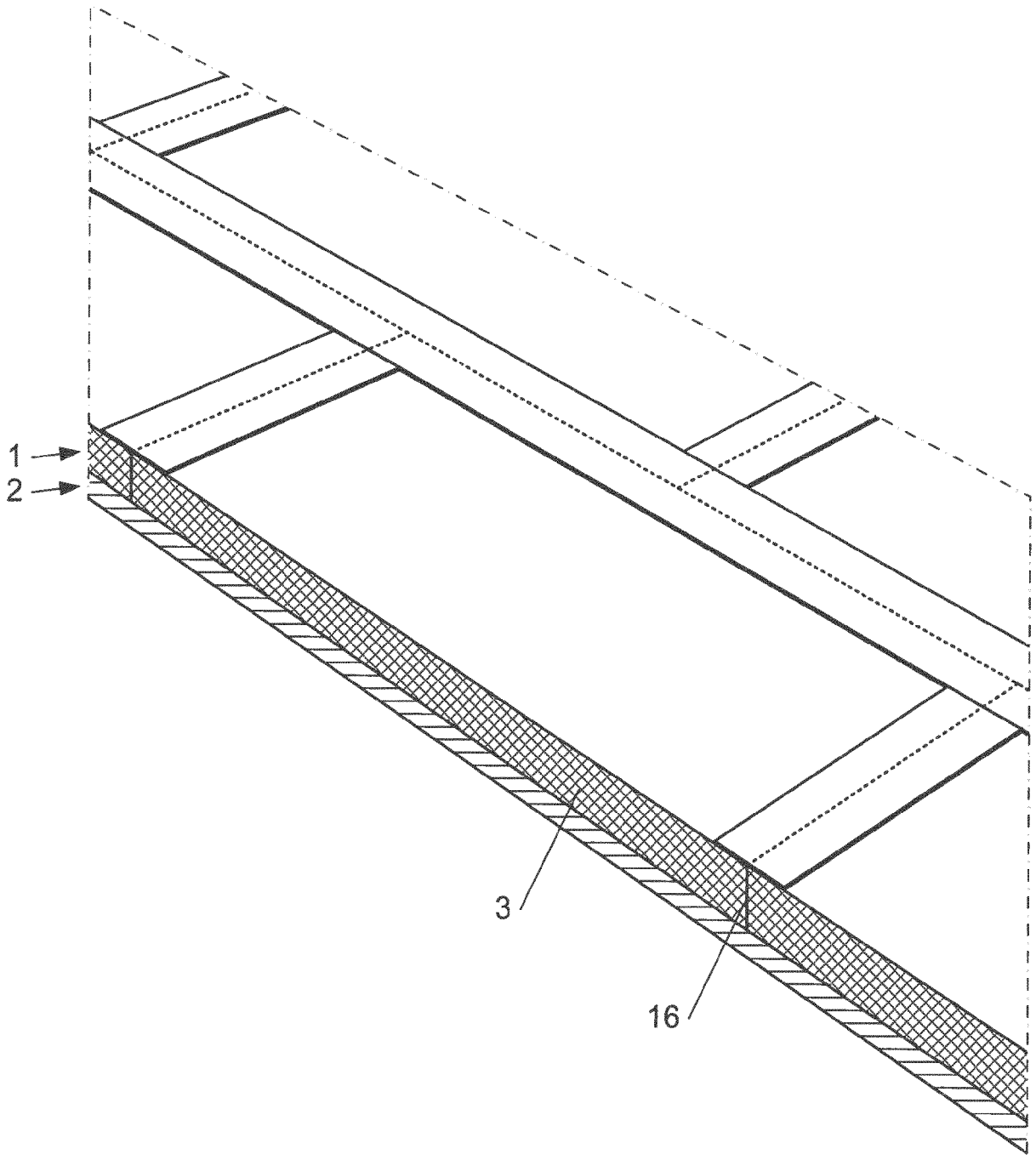

Fig. 1

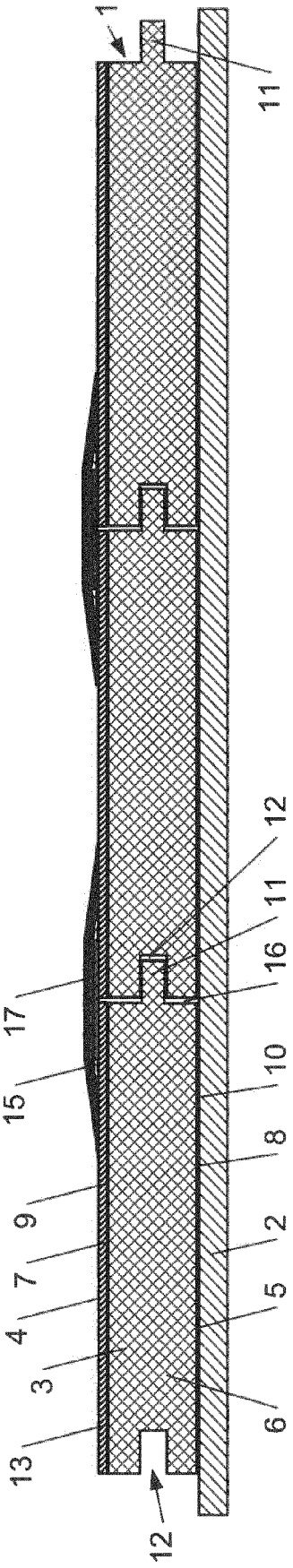

Fig. 2

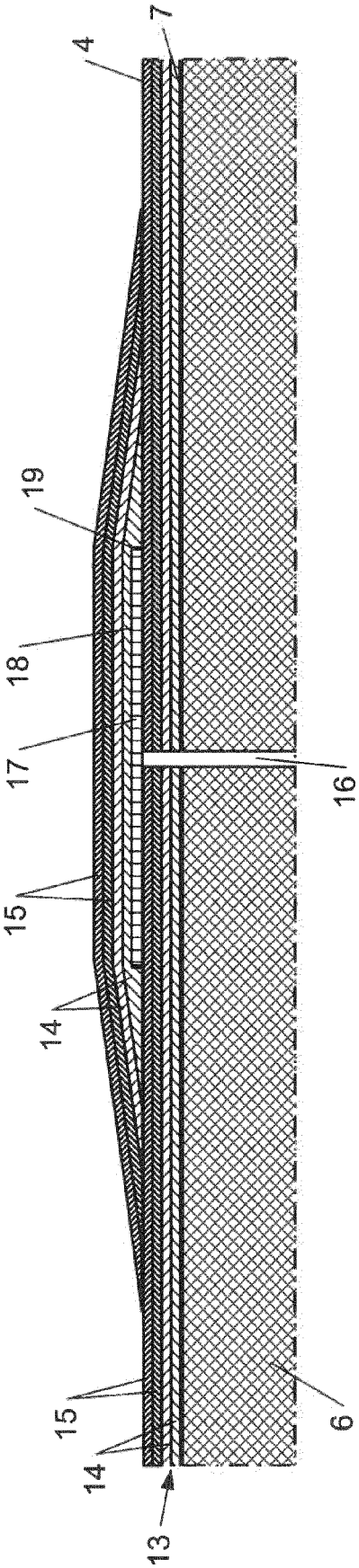

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 16 15 1964

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 May 2016	Demeester, Jan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 15 1964

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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