

(19) **DANMARK**

(10) **DK/EP 3302957 T3**



Patent- og
Varemærkestyrelsen

(12) Oversættelse af
europæisk patentskrift

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- (51) Int.Cl.: **B 32 B 5/02 (2006.01)** **B 32 B 5/18 (2006.01)** **B 32 B 5/24 (2006.01)**
B 32 B 5/28 (2006.01) **B 32 B 13/02 (2006.01)** **B 32 B 13/04 (2006.01)**
E 04 B 1/62 (2006.01)
- (45) Oversættelsen bekendtgjort den: **2020-05-18**
- (80) Dato for Den Europæiske Patentmyndigheds
bekendtgørelse om meddelelse af patentet: **2020-02-19**
- (86) Europæisk ansøgning nr.: **16724284.1**
- (86) Europæisk indleveringsdag: **2016-05-03**
- (87) Den europæiske ansøgnings publiceringsdag: **2018-04-11**
- (86) International ansøgning nr.: **EP2016000723**
- (87) Internationalt publikationsnr.: **WO2016188607**
- (30) Prioritet: **2015-05-27 DE 102015108357**
- (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**
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- (54) Benævnelse: **Pladeformet konstruktionselement med udvendig membran**
- (56) Fremdragne publikationer:
DE-A1-102009 011 323
DE-A1-102012 101 075
DE-A1-102013 113 864
DE-U1-202014 001 573

Description

The invention relates to a method for forming a sheet component in layered construction using the method steps according to claim 1. The invention further relates to a sheet component that is produced pursuant to the method set forth in claim 1, as well as to the use of a cover ply for the installation of a sheet component pursuant to claim 10 or 11.

A sheet component is described in DE 101 31 338 A1. A cover ply is provided in the form of an acrylic resin sealant uniformly applied in the manner of a foil whereonto, and via tile adhesive, a ceramic, for example, material is layable in an areal manner. Between the cover ply and the supporting body of rigid foam there is a mortar layer which may be reinforced with a woven fabric. The disadvantage with this is that laying on the cover ply may lead to irreparable bubbling especially in the case of mortar still not fully cured.

DE 10 2009 011 323 A1 discloses a building sheet comprising a foam mat saturated with mineral adhesive, cement-bound mortar or a filled dispersion and dried. However, even after this treatment, the foam mat remains essentially open-cell and thus is particularly useful for acoustic absorption and does not form a watertight composite in its final state.

DE 10 2013 113 864 A1 discloses an insulating element for use in a composite thermal insulation system. The insulating element comprises a diffusion-tight layer of insulation and thus is unsuitable for the transmission of gases.

DE 20 2014 001 573 U1 discloses a building sheet having a vapour-checking and/or -blocking property. The building sheet as a whole has a multi-ply construction. A midply layer consists either of a vapour-blocking aluminium foil or of a vapour-checking polymeric material.

DE 10 2012 101 075 A1 discloses a semi-finished sheeting product, namely a stucco effect wallpaper, and a method of forming it. The stucco effect wallpaper comprises a fibrous nonwoven web which is saturated through with a coating composition and cures to form said stucco effect wallpaper. This stucco effect wallpaper does not have a defined air transmission rate. Hence there is also no way to ensure that gases released during the curing process diffuse outwardly

through the fibrous nonwoven web and that the coating composition itself is retained within the fibrous nonwoven web.

EP 1712169 B1 discloses a shower floor element comprising a water-impervious foil for floor and wall sealing. An adhesive layer adheres the foil uniformly to the
5 upper surface of a supporting element of rigid foam.

Known from DE 10 2012 101 075 A1 is a semi-finished sheeting product, namely a stucco effect wallpaper. In order to improve the stability of the stucco effect wallpaper, the supporting material is impregnated by a coating compound, wherein a reinforcing layer is embedded in the upper layer.

10 The disadvantage with this embodiment is that an adhesive based on a mineral type of mortar is unsuitable for adhering the foil. The background to this is that mineral adhesives always have an air content which was incorporated through the mixing process and has to be removed or escape from the adhesive layer during the cure. Where the adherents are air impervious, the air in the mortar adhesive
15 will form bubbles incapable of escaping through the foil or through the sheet of rigid foam.

The bubbles will in part ascend against the force of gravity, to collect directly underneath the foil. A further portion of the bubbles are stopped by the low buoyancy within the mortar adhesive from ascending all the way to the surface, if
20 at all, and become entrapped by the curing adhesive where they are.

The formation of air bubbles is thus solely preventable in the EP 1712169 B1 system by employing an adhesive without entrained air, for example a hot melt adhesive. Yet this gives rise to a further problem in that as with applying a protective foil to a cell phone display, there is an in-principle difficulty with applying
25 an uninterrupted protective foil to a support without air entrapments. Even with the use of an adhesive without entrained air, therefore, air bubbles may become entrapped underneath the foil.

The air bubbles remaining in the cured component greatly reduce the adherent bonding area between the cover ply and the supporting sheet. Voids are the
30 consequence, potentially increasing in size on continued use through notched stresses arising out of settling and/or extensional stress influences. Corresponding flaws are also flaws in an otherwise uninterrupted film and moreover threaten the possibly assumed waterproofness of the coating plane.

It is an object of the present invention to devise a sheet component and a method of forming it that is capable of ensuring a whole areal adhesive bond of the cover ply to the inferior layer without bubbling.

This object is achieved by a method of forming a sheet component with the steps
5 of claim 1. The cover ply has an air transmission rate between 6.0 and 21 l/dm²/min in the uninstalled state, while the composite combining the cover ply and the adhesive layer forms a watertight composite.

The object is also achieved by a sheet component obtained with the claimed method and by the method of using a cover ply in the manufacture of a
10 component, said cover ply having an air transmission rate between 6.0 and 21 l/dm²/min in the uninstalled state.

Tests in accordance with DIN EN ISO 9237 (Determination of the Permeability of Textile Fabrics to Air) have revealed that the preferred air transmission rate value of the cover ply is between 10.0 and 14.0 l/dm²/min, more preferably between
15 12.5 and 13.5 l/dm²/min.

Cover ply is to be understood as meaning a porous or/and mesh-like outer membrane/layer which, for example, is a close net of metal, a perforated metallic or polymeric foil or a textile offcut. The cover ply preferably takes the form of a prefabricated, sheet-like composite combining a mineral or non-mineral adhesive
20 based on mortar or polymer with a textile offcut embedded therein. The textile offcut may consist of at least one textile ply of woven, knit, non-crimp, bonded nonwoven web fabric or a combination thereof.

Where the cover ply comprises an element having indeterminate porous structures, for example a fibrous nonwoven web, it is an essential integer of the
25 invention that these indeterminate porous structures should have the defined air transmission rate referred to. Where the defined air transmission rate is attained as a result of the cover ply having some defined perforation, the individual pores preferably have a diameter between 25 µm and 500 µm, most preferably between 50 µm and 250 µm.

30 The adhesive comprises for example a polymer cement concrete (PCC mortar). A PCC mortar is a polymer-modified cement-bound mortar as deployed for example in renovation work. What is important in this context is that the textile offcut or the said composite should have an abovementioned air transmission rate value,

which ensures that gases, such as air particles, evolving during the curing process of the adhesive layer are capable of passing outside through the pores or meshes of the composite, wherein the composite forms a barrier to still uncured particles of adhesive and ultimately a whole-area bond of the cover ply to the adhesive
 5 layer is formed without bubbling underneath the cover ply with the outcome that the cover ply in its cured/composited state, and also the overall structure of the sheet component is water and gas impervious.

The cover ply has the following advantageous properties:

- It ensures that the air is capable of escaping through the structure of the
 10 cover ply not only during the step of laying on the cover ply but also in the early curing process of the adhesive layer.
- On the other hand, the cover ply is so close that in the step of adhering the cover ply onto the supporting body, no adhesive can penetrate through the cover ply and thereby contaminate the free surface thereof.

15 A method of fabricating the sheet component proceeds as follows:

- formatting and providing a supporting body and a prefabricated cover ply;
- applying an adhesive, which preferably comprises a PCC adhesive, and uniformly distributing same to form an adhesive layer;
- laying the prefabricated cover ply onto the still viscid adhesive layer;
- 20 - pressing the cover ply into place under pressure;
- supplying heat, if necessary, for forced curing.

The adhesive layer may be applied to the cover ply before the step of contacting with the supporting body.

A membrane press as known per se is deployable for the step of pressing the
 25 cover ply into place under pressure. In a membrane press, a pressurized membrane applies a moulding pressure to the component as propped up for example on a moulding table. It is particularly preferable for the membrane to develop an negative pressure interior for the component. This is accomplished by the membrane first enveloping the component in bag-like fashion and then the air
 30 in the interior is aspirated away. The atmospheric pressure then presses the membrane against the surface of the cover ply. The advantage with this is that the

negative pressure generated in the interior also augments the deaeration of the mortar adhesive by aspirating the air bubbles forming in the adhesive layer in the course of the curing process away through the air-pervious cover ply.

The sheet components of the present invention are variously deployable in building construction. More particularly, they find use in the sanitary sector, for example as tiled shower floor sheets, but also as lining elements and semi-finished product for fabricating bathroom fittings.

Further features and advantages of the invention will be apparent from the exemplary embodiments which follow.

The exemplary embodiments are more particularly described with reference to the drawing, where

- Fig. 1a shows a cover ply in the form of a composite consisting of a fibrous nonwoven web ply embedded in a mortar layer, in a schematic section through the cover ply;
- Fig. 1b shows the composite as depicted in Fig. 1a except with an additional woven fabric ply; Fig. 2a shows a supporting body of rigid foam with a one-sidedly applied layer of mortar, in a schematic section;
- Fig. 2b shows a sheet component comprising the supporting body of Fig. 2a with adhered cover ply, in a schematic section;
- Fig. 3a shows the cover ply laid onto an uncured mineral type layer of mortar,
- Fig. 3b shows the cover ply of Fig. 3a immediately before bonding to the supporting body,
- Fig. 3c shows a component with the cover ply of Fig. 3a after the step of curing the mortar layer, in a schematic section;
- Fig. 4 shows a component comprising a supporting body covered on both sides with mortar layers and cover plies, in a schematic section;
- Fig. 5 shows a component as per Fig. 2b with indicated additional protective layer, in a schematic section;
- Fig. 6 shows a component as per Fig. 2b additionally coated with a paint layer, in a schematic section; and

Fig. 7 shows a further component according to Fig. 2b, with two superposed cover plies, again in a schematic section.

Like or similar elements may be provided like or similar reference signs in the figures which follow. The figures of the drawing, their description and also the claims further contain numerous features in combination. A person skilled in the art will be aware in this context that these features may also be considered individually or may be brought together to form further combinations not more particularly described here.

Fig. 1a initially shows in schematic form a cover ply 3, 3' which constitutes a composite 6 comprising a textile offcut 8 embedded in a mineral adhesive 7. The textile offcut 8 is a bonded fibrous nonwoven web fabric 12 ("nonwoven") drawn exaggeratedly thick and comprising polymer fibbers present in random disposition, i.e., relatively equally dispersed in all directions of the bonded fibrous nonwoven web fabric.

Fig. 1b shows in turn a combination of the nonwoven 12 with a non-crimp fabric (NCF) 13 which combine with the adhesive 7 to form a further composite 6'. The two composites 6, 6' have numerous pores/meshes 9 through which the arrowed (reference number 4) gas, such as air, can pass. A non-mineral polymeric mortar has been chosen as adhesive 7. The nonwoven-NCF combination itself (optionally embedded in the polymer mortar) is air pervious and water pervious in its original state.

The air transmission rate value of the cover ply shown in Fig. 1b (in its uninstalled state) is ideally in the range between 12.5 and 13.5 l/dm²/min.

The overall thickness of the cover ply 3, 3' according to Fig. 1b is about 1.5 to 3 mm.

Fig. 2a shows a supporting body 1 bounded by two flat sides 5, 5' in an essentially plane parallel arrangement. The supporting body 1 consists of extruded rigid closed-cell polystyrene foam (XPS). The water vapour diffusion resistance number of the rigid polystyrene foam (XPS) used is about 150 μ .

The flat side 5 of the supporting body 1 is coated with an adhesive layer 2, in the present case comprising polymer-modified cement-bound mortar (PCC) capable of achieving the requisite hardness in the surface. The flat side 5 of the supporting

body 1 may be slightly trough-shaped or inclined relative to the other, level flat side 5'.

According to Fig. 2b, the still liquid adhesive layer 2 (mortar layer) has imported into it a cover ply 3 under contact pressure and thermal agency to cover over said
5 layer, so the mortar layer 2 cures to form a sheet component 100 wherein the supporting body 1 is composited with the prefabricated nonwoven-NCF combination. The second flat side therein, i.e., the flat side remote from flat side 5, i.e., flat side 5' is untreated, displaying no adhesive layer and no cover ply.

A similar component 100 is depicted in Fig. 5 except that the cover ply 3 is coated
10 with a protective layer 11, preferably a clear lacquer. The coating with the clear lacquer protects the surface of the cover ply 3 from external influences. The protective layer 11 may also be peelable, for example by coating it with a release adhesive.

According to Fig. 3a, the cover ply 3 is initially applied to the mineral uncured
15 adhesive layer 2 to form a cover ply/adhesive combination which according to Fig. 3b is laid onto the flat side 5 of the supporting body 1. Curing results in the air- and watertight component 100 shown in Figures 2b and 3c. Reference number 10 identifies molecules of water and/or moisture which against a free surface 14 of the cover ply 3 in the form of a water jet for example bounce and do not penetrate
20 through the cover ply 3.

An advantageous further development of the subject matter of the invention proposes forming a sheet component 100' as per Fig. 4 wherein both the flat sides 5, 5' of the supporting body 1 are covered with the adhesive layer 2, 2' and the cover ply 3. After curing, the entire structure of the supporting body 1 coated on
25 both sides is water- and airtight.

According to Fig. 6, the cover ply 3 is provided with a further coating 15, namely with a paint layer. The paint layer chosen is a low-solvent acrylic lacquer based on a polymer dispersion and capable of providing a waterproof film. The hue may be matched to a manufacturer/company-specific coloration (blue for example)
30 through appropriate pigmentation.

Fig. 7 shows two superposed prefabricated cover plies 3 and 16 bonded together via a polymeric adherent layer 17. The cover plies 3 and 16 may be identical or different in terms of material. For instance, the cover ply 3 facing the adhesive

layer 2 may comprise a nonwoven/NCF combination while the outer cover ply 16 may comprise a nonwoven/woven fabric combination.

The sheet components according to Figures 6 and 7 constitute a development of the component 100 described in Fig. 2B.

- 5 The following remarks apply to all the components 100, 100' described above:
- The supporting body 1 may be fabricated from other mineral or non-mineral materials of construction, for example from rigid EPS foam, rigid polyurethane foam, wood fibbers, mineral wool, etc. or mixed materials.
 - The supporting body 1, when considered in plan view looking down on its flat
10 side 5, 5', may be polygonal, especially rectangular and/or at least partly oval or rounded off.
 - The mineral or non-mineral adhesive may be referred to as mortar.
 - A reinforcement as known per se may be installed into the adhesive layer 2, 2'.

List of reference numbers

1	supporting body
2, 2'	adhesive layer
3, 3'	cover ply
4	gas (air)
5, 5'	flat side
6, 6'	composite
7	adhesive
8	textile offcut
9	pores or meshes
10	molecules of moisture
11	protective layer (clear lacquer)
12	nonwoven fabric
13	woven/non-crimp fabric
14	surface
15	additional coating
16	further cover ply
17	adherent layer
100, 100'	component

Patentkrav

1. Fremgangsmåde til fremstilling af et pladeformet konstruktionselement (100; 100') med de følgende fremgangsmådetrin:

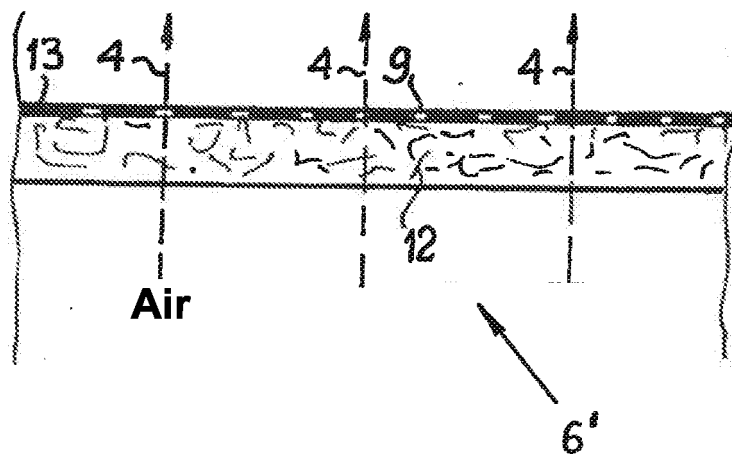
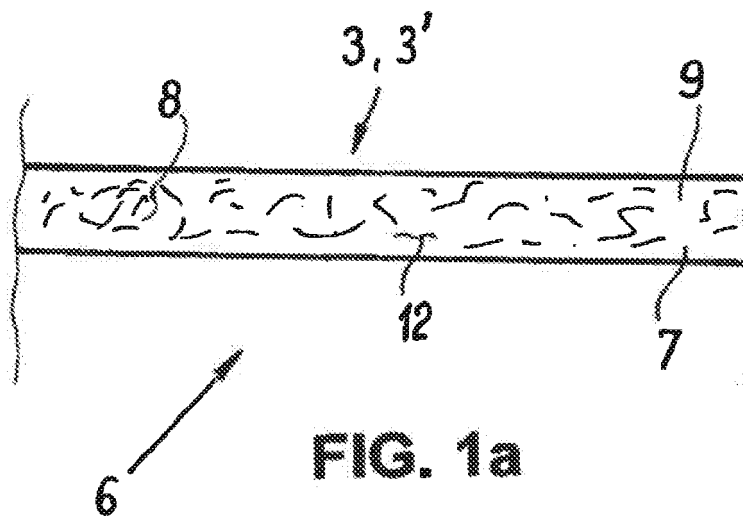
- 5 - tilskæring og tilvejebringelse af et bærelag (1) og et præfabrikeret dæklag (3, 3');
 - påføring af en polymermørtel (PCC-klæbemiddel) og ensartet fordeling med henblik på dannelse af et klæbemiddellag (2, 2');
 - at lægge det præfabrikerede dæklag (3, 3') oven på det endnu sejtflydende klæbemiddellag (2, 2');
 - 10 - hærkning af klæbemidlet, der befinder sig inden i konstruktionselementet (100; 100'),

kendetegnet ved, at det præfabrikerede dæklag (3, 3') har en luftgennemtrængelighed på mellem 6,0 og 21 l/dm²/min, og der, efter at dæklaget (3, 3') er blevet lagt oven på det endnu sejtflydende klæbemiddellag (2, 2'), via en trykpåvirket membran af en membranpresse påføres et pressetryk på konstruktionselementet (100; 100'), og at gasser, der frigives under hærkningen af klæbemiddellaget (2, 2'), såsom luftpartikler, kan passere ud igennem porerne eller maskerne i kompositproduktet, hvor kompositprodukt danner en barriere for endnu ikke hærdede klæbemiddelpartikler, og der som sluteffekt opstår en helfladet forbindelse af dæklaget (3, 3') med klæbemiddellaget (2, 2') uden dannelse af blærer neden under dæklaget (3, 3') med det resultat, at dæklaget (3, 3') i den hærdede/forbundne tilstand, samt det pladeformede konstruktionselements (100; 100') samlede struktur er vand- og gasuigennemtrængeligt.

2. Fremgangsmåde til fremstilling af et pladeformet konstruktionselement (100; 100') ifølge krav 1, **kendetegnet ved, at** membranpressens membran udgør et undertryk-inderrum for konstruktionselementet (100; 100'), idet den først indhyller konstruktionselementet (100; 100') på en poseagtig måde, og der derefter suges luft, der befinder sig i inderrummet, ud, således at membranen presses mod dæklagets (3, 3') overflade, og det undertryk, der genereres i inderrummet, understøtter udluftningen af klæbemidlet.

- 5 **3.** Fremgangsmåde til fremstilling af et pladeformet konstruktionselement (100; 100') ifølge krav 1 eller 2, **kendetegnet ved, at** dæklaget (3, 3') har en luftgennemtrængelighed på mellem 10,0 und 14,0 l/dm²/min, foretrukket mellem 12,5 og 13,5 l/dm²/min.
- 10 **4.** Fremgangsmåde til fremstilling af et pladeformet konstruktionselement (100; 100') ifølge et af kravene 1 til 3, **kendetegnet ved, at** dæklaget (3, 3') først og fremmest lægges oven på det mineralske, ikke hærdede klæbemiddellag (2, 2'), som igen kan forbindes med bærelegemet (1).
- 15 **5.** Fremgangsmåde til fremstilling af et pladeformet konstruktionselement (100; 100') ifølge et af kravene 1 til 4, **kendetegnet ved, at** dæklaget (3, 3') forbindes med klæbemiddellaget (2, 2') under indvirkning af forhøjet temperatur.
- 20 **6.** Fremgangsmåde til fremstilling af et pladeformet konstruktionselement (100; 100') ifølge et af kravene 1 til 5, **kendetegnet ved, at** kompositproduktet (6, 6') af dæklaget (3, 3') med klæbemiddellaget (2, 2'), ligesom også hærdetiden af klæbemiddellagets (2, 2') klæbemiddelmasse kan accelereres på en kontrolleret måde ved hjælp af indvirkning fra presstryk og/eller temperatur.
- 25 **7.** Fremgangsmåde til fremstilling af et pladeformet konstruktionselement (100; 100') ifølge et af kravene 1 til 6, **kendetegnet ved, at** der påføres mindst et polymert beskyttelseslag (11), såsom klar lak, på dæklaget (3, 3').
- 30 **8.** Fremgangsmåde til fremstilling af et pladeformet konstruktionselement (100; 100') ifølge et af kravene 1 til 7, **kendetegnet ved, at** dæklaget (3, 3') overtrækkes med mindst en yderligere coating (15) med mineralsk masse eller farvecoating.
- 9.** Fremgangsmåde til fremstilling af et pladeformet konstruktionselement (100; 100') ifølge et af kravene 1 til 8, **kendetegnet ved, at** dæklaget (3, 3') dækkes med et yderligere præfabrikeret dæklag (16).

- 10.** Pladeformet konstruktionselement (100; 100') opbygget i lag, fremstillet ifølge fremgangsmåden i krav 1, omfattende et dæklag med en luftgennemtrængelighed, som i ikke indbygget tilstand udgør mellem 6,0 og 21 l/dm²/min.
- 5 **11.** Pladeformet konstruktionselement (100; 100') opbygget i lag ifølge krav 10, **kendetegnet ved, at** dæklagets luftgennemtrængelighed i ikke indbygget tilstand har en værdi på mellem 10,0 og 14,0 l/dm²/min, foretrukket mellem 12,5 og 13,5 l/dm²/min.
- 10 **12.** Anvendelse af et dæklag (3, 3') med en luftgennemtrængelighed på mellem 6,0 og 21 l/dm²/min, fortrinsvis på mellem 10,0 og 14,0 l/dm²/min, højst fortrinsvis på mellem 12,5 og 13,5 l/dm²/min, til indbygning i et pladeformet konstruktionselement (100; 100') ifølge krav 10 eller 11.



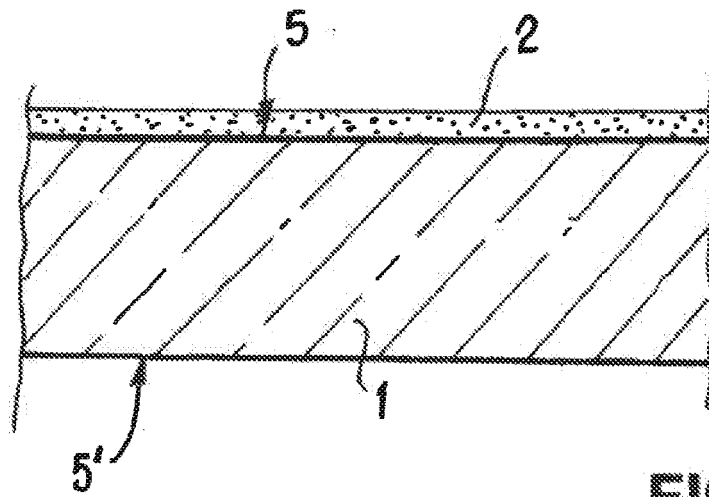


FIG. 2a

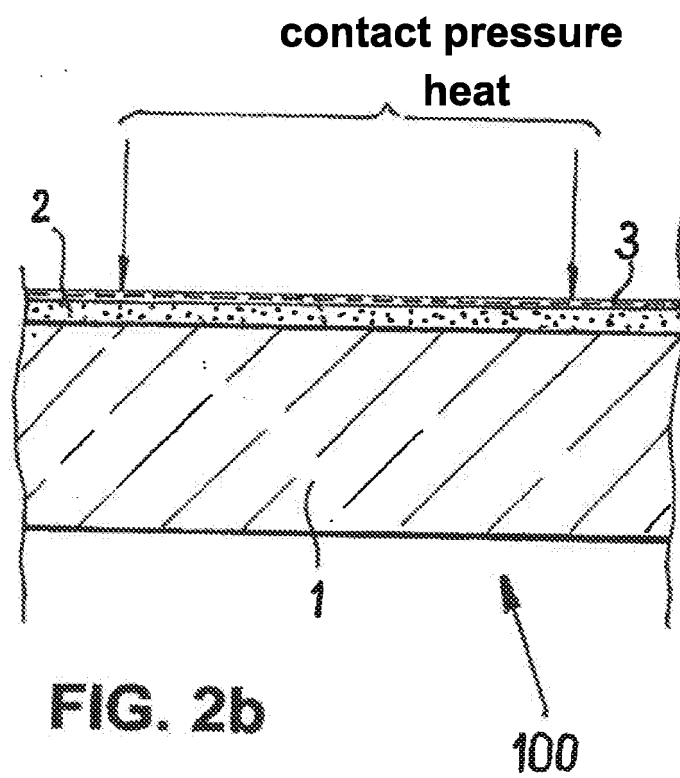


FIG. 2b

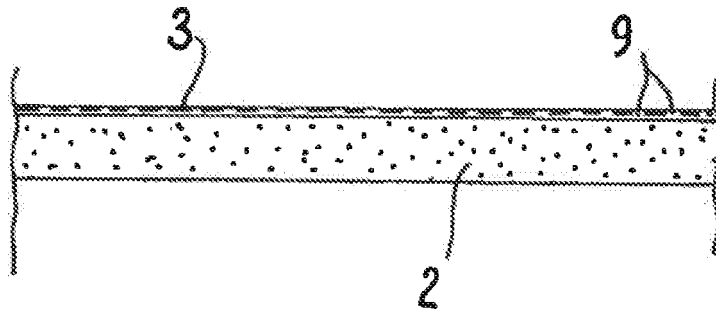


FIG. 3a

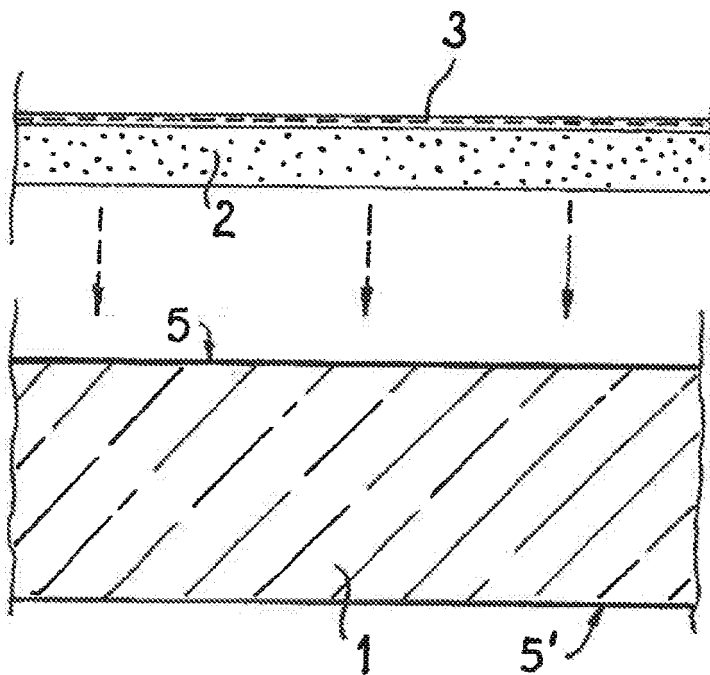
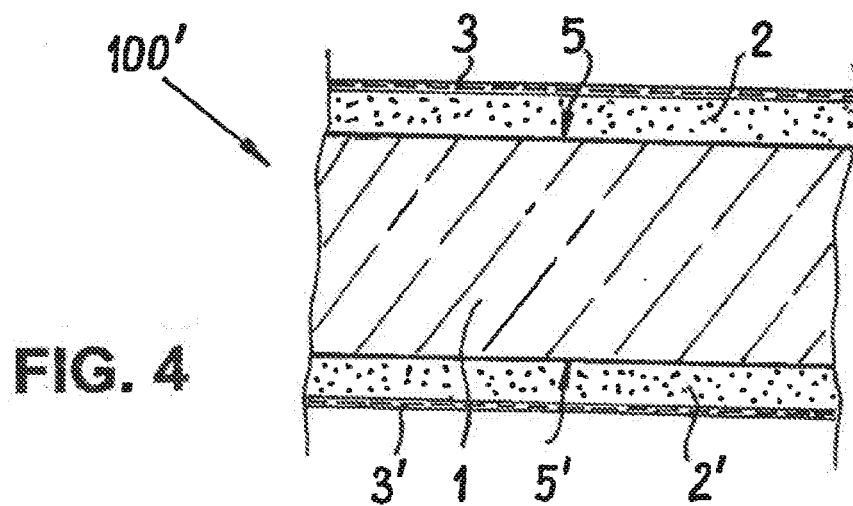
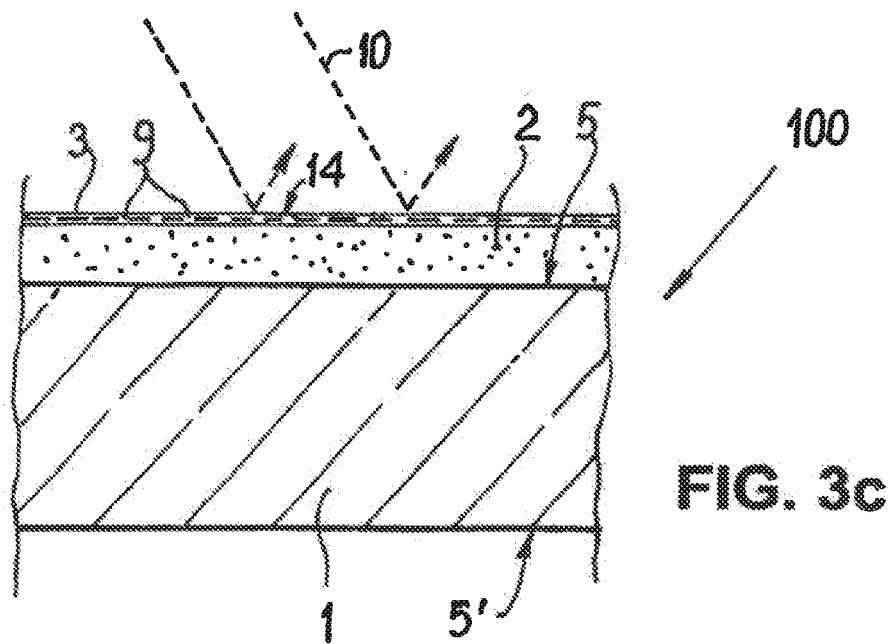
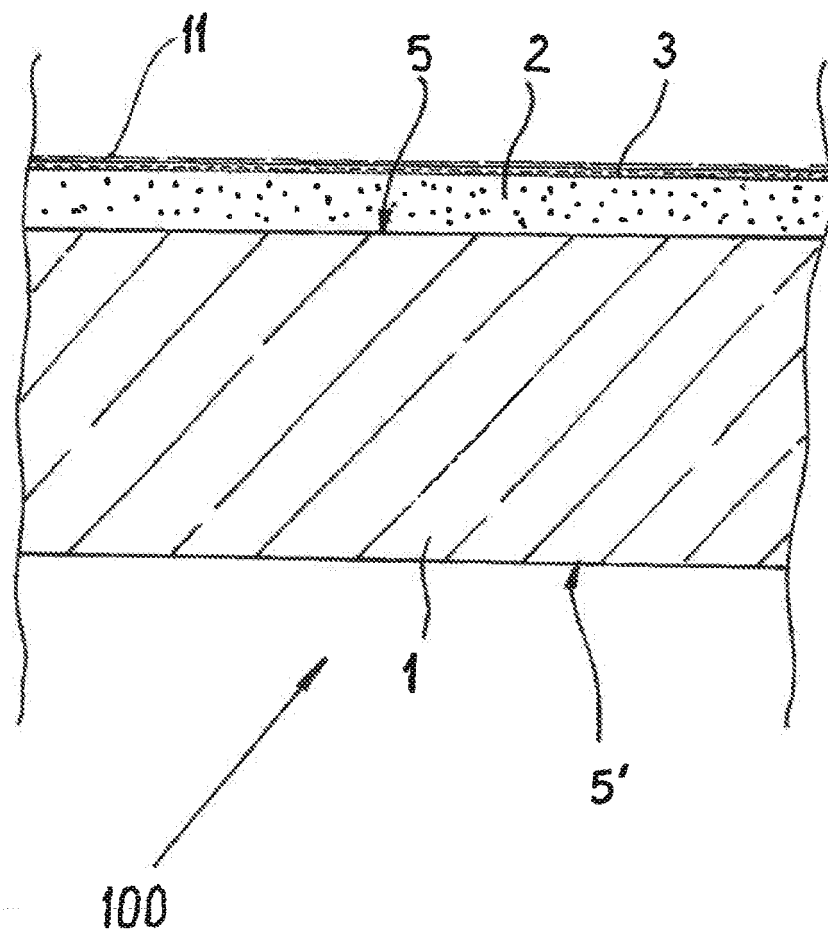


FIG. 3b



**FIG. 5**

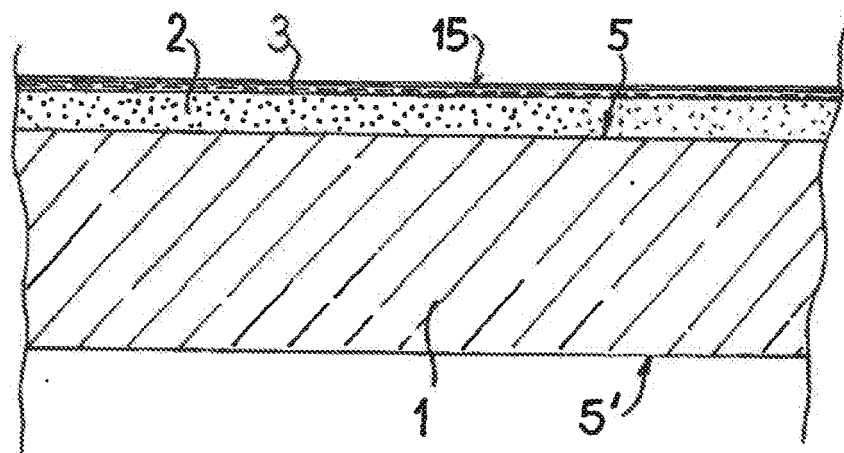


FIG. 6

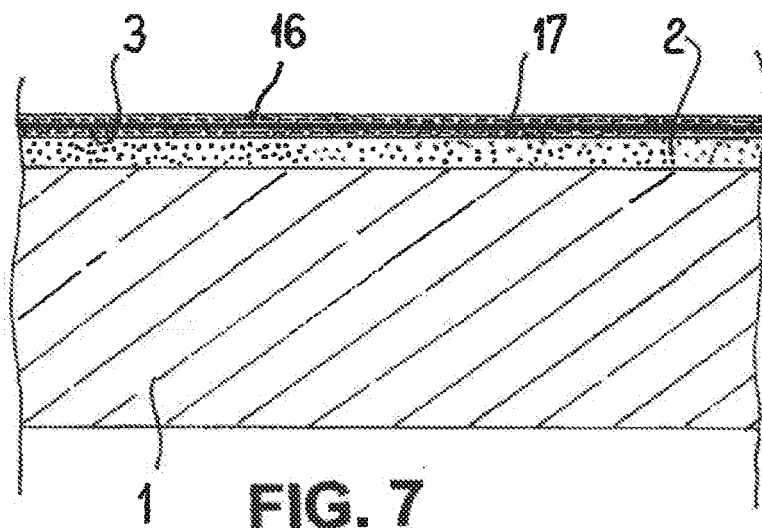


FIG. 7