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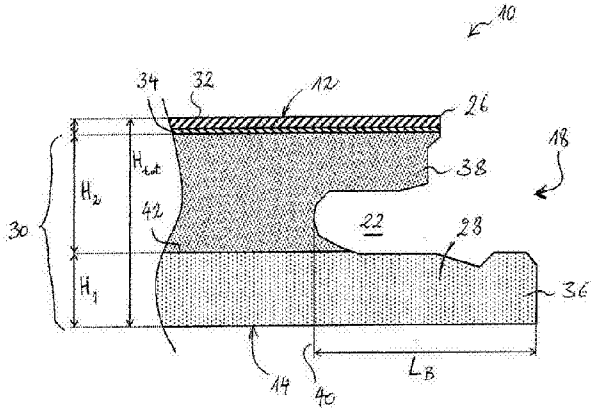
(54) **FLOOR OR WALL COVERING PANEL WITH RIGID COMPOSITE CORE LAYER.**

(57) A floor or wall covering panel has a top and a bottom surface, and at least four sides. A first and a second side comprises a first and a second connection profile, respectively. The first profile is configured for mechanically engaging and interlocking with the second profile of another panel. The first profile comprises a tongue protruding beyond the top edge of the first side, whereas the second profile comprises a groove recessed with respect to the top edge of the second side. The groove is delimited at its bottom by a base. The panel is of laminar structure, including a rigid core layer and a wear layer arranged on the core layer. The core layer includes a first and a second sublayer of a first and a second composite material, respectively. The second sublayer is arranged atop the first sublayer. Both composite materials comprise thermoplastic material and filler material but are of different formulations. The base delimiting the groove bottom is realized essentially within the first core sublayer.

Fig. 2



DESCRIPTION

FLOOR OR WALL COVERING PANEL WITH RIGID COMPOSITE CORE LAYER

Field of the Invention

[0001] The invention generally relates to a floor or wall covering panel, comprising a rigid composite core layer. The invention also relates to a process for producing a panel according to the invention. The invention further relates to a panel obtainable by the process.

Background of the Invention

[0002] Floor or wall covering panels are widely known as such. Prior art embodiments of floor or wall covering planks have been disclosed, for instance, in US 7763345. These planks, suffer in practice from allowing an uneven upper surface caused by irregularities of the underlying substrate on which the panels are applied.

[0003] This problem was recognized in WO 2017/133804, which proposed develop a panel that is more rigid so that a visible unevenness does no longer occur in practice, while meeting a general requirement that the panel does not suffer from excessive shrinking and expansion due to seasonal and/or local temperature changes. WO 2017/133804 further proposes to simplify the laminate structure by reducing the number of layers, especially avoiding the use of a reinforcement layer and/or an adhesive layer to fix two layers to each other.

[0004] The present invention addresses a different problem, which is observed in rigid, polymer-based floor or wall covering panels having mechanical connection profiles allowing them to be connected to each other. Due to the high stiffness of the panels, the mechanical connection profiles represent weak points of the floor covering once it is assembled, because each connection profile has reduced thickness compared to the rest of the panel. Accordingly, when transmission of forces from the top surface of the floor covering to the subfloor is impeded, e.g. because of slight subfloor unevenness and/or slight dimensional deviations of the connection profiles from the nominal values, high local stresses may occur within the material, which may lead to breakage where the panels are the weakest, i.e. at the connection profiles.

[0005] Possible solutions to that problem have been devised in the context of the present invention.

Summary of the Invention

[0006] In a first aspect, the present invention relates to a floor or wall covering panel, having a top surface, a bottom surface and at least four sides, wherein a first one of the sides comprises a first connection profile and a second one of the sides comprises a second connection profile, the first and second connection profiles being arranged on opposed sides of the panel, the first connection profile being configured for mechanically engaging and interlocking with a second connection profile of another floor or wall covering panel of the same type. The first side and the top surface meet at a top edge of the first side and the second side and the top surface meet at a top edge of the second side. The first connection profile comprises a tongue protruding beyond the top edge of the first side, whereas the second connection profile comprises a groove recessed with respect to the top edge of the second side. The groove is complementarily shaped to the tongue, so as to enable a tongue-and-groove connection between neighboring panels. The groove is delimited at its bottom by a base, protruding or not beyond the top edge of the second side. The floor or wall covering panel is of a laminar (layered) structure, including a rigid core layer and a wear layer arranged on the core layer. The core layer includes a first sublayer of a first composite material and a second sublayer of a second composite material atop the first sublayer. Each of the first and second composite materials comprises thermoplastic material and filler material but are of different formulations. The base delimiting the bottom of the groove is realized essentially (e.g. to at least to 80% of its weight or to at least to 90% of its weight or entirely) within the first sublayer of the core layer.

[0007] As used herein, the term "sublayer" designates a layer constituting an integral part of the core layer. The term core layer designates the layer (or assembly of sublayers) that serves as the structural support layer of the panel. Besides the first and second sublayers, the core may have further sublayers.

[0008] All indications of orientation and (relative) position used herein, such as, e.g., "top", "bottom", "above", "below", "atop", etc., refer to orientation and (relative) position as when the panel is posed flat on the floor, the decorative face turned upwards. This

convention is used also if the panel is a wall covering panel. Furthermore, this convention is not intended to imply that the inventive panel is claimed only in that position and with that orientation.

[0009] Further, the term "rigid" is herein used as a qualifier of floor or wall covering panels, or layers thereof, which are significantly more rigid than classical resilient flooring materials. Specifically, as used herein, "rigid" is meant herein to imply a relatively high modulus of elasticity (measured according to EN 310), e.g. greater than 1000 Mpa, preferably greater than 2000 MPa, more preferably greater than 4000 MPa. The MOE of the core layer (or its sublayers) is preferably situated in the range from 1000 MPa to 15000 MPa. Compared to a resilient panels, rigid panels facilitate installation and better bridge slight unevenness as well as local bumps or recesses of the installation surface in a permanent manner (over the lifetime of the surface covering).

[0010] The different formulations of the composite materials result in different physical properties of the first and second sublayers. In particular, the formulations may be selected in such a way that the first (lower) sublayer has a lower stiffness than the second sublayer. Accordingly, the first sublayer may bend or otherwise yield more easily under load, reducing the base's susceptibility to breaking. Although the first sublayer having a lower stiffness than the second sublayer is presently regarded preferable, the opposite configuration, i.e. the second sublayer having a lower stiffness than the first sublayer, may turn out to be more advantageous for specific geometric configurations of the connection profiles.

[0011] High stiffness of the core sublayers is preferably achieved by incorporating relatively large amounts of mineral filler material and/or by incorporating no or only small amounts of plasticizers into the thermoplastic material of the composite core layer. A further advantage of the panels according to the invention is their waterproofness, making them suitable for both indoor and outdoor uses.

[0012] The thermoplastic material of the first and second composite materials could comprise, e.g., PE (polyethylene, including LDPE, HDPE etc.), PU (polyurethane), ABS (acrylonitrile butadiene styrene), PP (polypropylene) or PVC (polyvinyl chloride) resin. Further possible choices of the thermoplastic materials include, without being limited to, polyvinyl acetate (PVA), polyvinyl alcohol (PVOH), other vinyl and vinylidene resins and copolymers, polystyrene (PS), styrene copolymers, propylene copolymers,

polyesters; acrylics; polyamide, polycarbonate (PC), polyimide, polysulfone, etc. The thermoplastic material can be virgin, recycled, or a mixture of both. Of all the cited thermoplastics, PVC is currently a preferred choice. Preferably, the thermoplastic material comprises 70% by weight or more of PVC resin.

[0013] Preferably, thermoplastic material of the first composite material comprises from 2.5 % to 20 % by weight of plasticizer with respect to the PVC resin.

[0014] The thermoplastic material of the second composite material preferably comprises no or less than 2.5 % by weight of plasticizer with respect to the PVC resin.

[0015] According to an embodiment, the thermoplastic material of the first composite material comprises from 2.5 % to 20 % by weight of plasticizer with respect to the PVC resin, the thermoplastic material of the second composite material comprises no or less than 2.5 % by weight of plasticizer with respect to the PVC resin, and the ratio of the plasticizer content of the thermoplastic material of the first composite material to the plasticizer content of the thermoplastic material of the second composite material is comprised in the range from 5 to 100. It should be noted that although the formulations of the first and second composite materials are different, both composite materials are substantially stiffer than classical resilient flooring materials. Accordingly, each sublayer qualifies as a rigid layer.

[0016] Low amounts of plasticizer result in higher rigidity of the core layer. Plasticizers that could be used include: organic esters of various acids such as phthalic, phosphoric, adipic, sebacic, citric, acid. Specific examples of plasticizers include dioctyl phthalate, dioctyl adipate, dibutyl sebacate, and dinonyl phthalate and glyceryl stearate. Alternative plasticizers include so-called “bioplasticizers”, e.g. plasticizers derived from vegetable oils, such as soybean oil, canola oil, corn oil, linseed oil, rapeseed oil, safflower oil, sunflower oil, tall oil, tung oil, etc.

[0017] Preferably, the first and second sublayers are coextruded composite layers. More preferably, the entire core layer is obtained by a coextrusion process.

[0018] The thickness of the first sublayer preferably amounts to 40% or less of the thickness of the core layer. The thickness of the first sublayer preferably amounts to between 10% and 40%, more preferably to between 10% and 33%, of the thickness of the entire core layer.

[0019] Preferably, the filler material of the first and second composite materials consists of at least 70% by weight of mineral material, e.g. of calcium carbonate, magnesium oxide, chalk, clay, calcium silicate, talc, silicates, aluminates or a mixture thereof. More preferably, the filler material is comprised of mineral material only. The filler material is preferably in the form of particulate mineral filler.

[0020] The composite materials of the core sublayers could comprise natural organic fibres as (part of) the filler material, e.g., cellulose fibres, wood fibre, bamboo fibres, hemp fibres, etc. Alternatively, the composite materials of the core sublayers could be free of natural organic fibres.

[0021] Preferably, the first and second composite materials of the core sublayers comprises at least 40% by weight, more preferably at least 50% by weight, even more preferably at least 60% by weight of mineral filler. Preferably, the filler content of the core sublayers does not exceed the value of 85% by weight. More preferably, the filler content of the core sublayers does not exceed the value of 75% by weight.

[0022] The floor or wall covering panel preferably has an overall height comprised in the range from 2.5 to 10 mm, more preferably in the range from 3 mm to 6 mm, and most preferably in the range from 3 mm to 4.5 mm.

[0023] According to a preferred embodiment, the first and second connection profiles are machined (e.g. cut milled or drilled) into the first and second sides, respectively.

[0024] The composite materials may comprises one or more additives, such as pigments, impact modifiers, lubricants, stabilizers, waxes and/or processing aids. Pigments, if present, may be of any desired color. Impact modifiers could include, for instance, MBS (Methacrylate-Butadiene-Styrene), CPVC (chlorinated PVC), ABS (acrylonitrile butadiene styrene) or TPE (thermoplastic elastomer). Lubricants could include internal lubricant(s) and external lubricant(s). Preferred internal lubricants include metallic stearates, such as, e.g. calcium and zinc salts of stearic acid. External lubricants, could include, for instance, low-melting paraffins. The stabilizer could, for instance, comprise a calcium zinc stabilizer. Preferably, a calcium zinc stabilizer having a zinc content of 5.5 % to 11 % by weight or more could be used. Other examples of possible stabilizers include, without being limited to, barium-cadmium stabilizer, barium-zinc stabilizer, epoxidized soybean oil, etc. Preferably, the total amount of

additives present in the composite materials of the core sublayers does not exceed 15% by weight. More preferably additive content is less than 12% by weight.

[0025] The floor or wall covering panel comprises a wear layer on top of the core layer. The wear layer could comprise a melamine-adhesive-impregnated transparent paper layer or a PVC layer with low plasticizer content (preferably less than 5% by weight with respect to the PVC content), optionally with corundum particles dispersed therein, for improved wear resistance. The wear layer and the core layer may sandwich a décor layer (e.g. a printed décor layer). The wear layer could comprise a varnish (e.g. a PU varnish) on its top surface.

[0026] A preferred process for the fabrication of a floor or wall covering panel includes:

- preparing the composite materials of the first and second sublayers in by mixing of the respective components according to the different formulations;
- co-extruding molten core sublayers of the composite materials using an extruder with a co-extrusion die;
- leading the co-extruded core sublayers over rollers so as to obtain a core layer;
- laminating a wear layer on the core layer top layer
- cutting the core layer into panels and machining the connection profiles into the sides of the panels.

[0027] Instead of a co-extruding the core layer, one could extrude the sublayers of the core separately and laminate them together (using fusion and/or adhesive) in one or more further steps. However, the machining of the connection profiles is carried out after the core layer has been assembled. The wear layer could be applied on the core layer before or after the panels are cut and before or after the machining of the connection profiles.

Brief Description of the Drawings

[0028] By way of example, preferred, non-limiting embodiments of the invention will now be described in detail with reference to the accompanying drawings, in which:

Fig. 1: is a schematic cross-sectional view of a first connection profile of a flooring panel according to a preferred embodiment of the invention;

Fig. 2: is a schematic cross-sectional view of a second connection profile of the flooring panel, complementary to the connection profile of Fig. 1;

Fig. 3: is a schematic cross-sectional view of the first connection profile according to a variant of the flooring panel of Fig. 1;

Fig. 4: is a schematic cross-sectional view of the second connection profile according to the variant of the flooring panel of Fig. 1;

Fig. 5: is an illustration of how much the height of the first core sublayer can be varied according to a preferred aspect of the invention.

Detailed Description of Preferred Embodiments of the Invention

[0029] Figs. 1 and 2 show a flooring panel 10 according to a first preferred embodiment of the invention. The flooring panel 10 has a having a top surface 12, a bottom surface 14 and at least four sides. Fig. 1 shows a first one of the sides in more detail, while Fig. shows the complementarily shaped opposite side 18 (called herein "the second side"). The first side 16 comprises a first connection profile featuring a tongue 20 and the second side 18 comprises a second connection profile featuring a groove 22. The first and second connection profiles are configured for mechanically engaging and interlocking with a second and a first connection profile, respectively, of another flooring panel of the same type.

[0030] The edge 26 where the first side 16 and the top surface 12 meet is hereinafter called the first top edge and the edge 26 where the second side 18 and the top surface 12 meet is hereinafter called the second top edge. When two flooring panels are connected at their first and second connection profile, respectively, the corresponding first and second top edges come to lie adjacent each other.

[0031] The tongue of the first connection profile protrudes beyond (as "seen" from the panel 10) the first top edge 24, whereas the groove 22 of the second connection profile is recessed with respect to the second top edge 26. The tongue 20 and groove 22 are complementarily shaped, so as to enable a tongue-and-groove connection between neighboring panels. The groove 22 is delimited at its bottom by a base 28. In the illustrated embodiment, the base 28 protrudes beyond (as "seen" from the panel 10) the second top edge 26, but whether the extremity of the base 28 protrudes or is

recessed with respect to the second top edge depends on the geometrical configuration of the first and second connection profiles.

[0032] The flooring panel 10 is of a layered structure and includes a rigid core layer 30 and a wear layer 32 arranged on the core layer. In the illustrated embodiment, the core layer 30 and the wear layer 32 sandwich a decorative layer 34 (e.g. a print layer). The wear layer 32 is in this case transparent or translucent, so that the décor is apparent to the users. The decorative layer 34 could comprise a dedicated printing substrate carrying one or more ink layers. Alternatively, the decorative layer could consist of ink layer(s) printed directly on the backside of the wear layer 32 or the top side of the core layer 30.

[0033] The core layer 30 comprises a first sublayer 36 of a first composite material and a second sublayer 38 of a second composite material atop the first sublayer 36. The first and second composite materials comprise thermoplastic material, in particular PVC resin, and filler material but are of different formulations, which give them different mechanical properties, in particular different stiffness.

[0034] The base 28 delimiting the bottom of the groove 22 is realized essentially (e.g. to at least to 80% of its weight or to at least to 90% of its weight or entirely) within the first sublayer 36 of the core layer 30. The weight of the base 28 herein means the weight of the part of the core layer 30 that extends below the groove 22 between the inner extremity of the groove 22 and the outer extremity of the base 28 (i.e. over length L_B in Fig. 2). The weight of the base 28 can thus be determined experimentally by cutting the base 28 along the line 40 and weighting the part thus obtained. The proportion of the base 28 realized in the first sublayer 36 can then be determined by cutting the base 28 at the interface 42 between the first and second sublayers 36, 38 and weighting the fragments belonging to the first or second sublayer.

[0035] In the illustrated embodiment, the formulations of the first and second sublayers are selected in such a way that the first (lower) sublayer 36 has a lower stiffness than the second sublayer 38. Accordingly, the first sublayer 36 bends or otherwise yields more easily under load, reducing the susceptibility of base 28 to breaking. Experiments showed that flooring made of rigid synthetic floor panels (not glued to the underfloor) according to this embodiment exhibited less breakage in so-called castor-chair tests than floor panels having a core layer consisting entirely of the stiffer material.

[0036] The thickness H_1 of the first sublayer 36 amounts to a value within the range from 10% to 40% of the thickness H_C of the core layer 30. More preferably, the value of H_1 is situated in the range from 15% to 33% of H_C. It should be noted that the drawings are not to scale.

[0037] The flooring panel 10 has an overall height H_{tot} in the range from 2.5 to 10 mm, preferably in the range from 3 mm to 6 mm, and most preferably in the range from 3 mm to 4.5 mm. The invention is particularly interesting for thin rigid flooring panels having a height of 5 mm or less, e.g. 4.5 mm or less, or 4 mm or less, or 3.5 mm or less, or 3.2 mm or less.

[0038] Figs. 3 and 4 show a flooring panel 10 according to a second preferred embodiment of the invention. With respect to the embodiment of Figs. 1 and 2, the difference is that the core layer 30 comprises three sublayers 36, 37, 39 instead of two. Apart from that, the flooring panel of Figs. 3 and 4 is substantially identical to the one of Figs. 1 and 2. For the sake of brevity, only the differences will be discussed hereinafter. The reader may refer to the description of Figs. 1 and 2 for explanations regarding the other aspects of the flooring panel.

[0039] The core layer 30 comprises a first sublayer 36 of a first composite material, a second sublayer 37 of a second composite material atop the first sublayer 36 and a third sublayer 39 of the first composite material atop the second sublayer 37. The first and second composite materials comprise thermoplastic material, in particular PVC resin, and filler material but are of different formulations, which give them different mechanical properties, in particular different stiffness.

[0040] Fig. 5 illustrates that the height of the first sublayer can be varied. The thickness H_1 of the first sublayer amounts to at most 40% of the core layer thickness H_C. At the same time, a substantial part of the base 28 delimiting the bottom of the groove 22 is realized essentially within the first sublayer 36 of the core layer 30. Therefore, as illustrated in Fig. 5, the height H_1 may be varied between an upper bound 44 (corresponding to $0.4 \times H_C$) and a lower bound 46 (corresponding to the height below which less than 80% of the weight of the base consists of the material of the first sublayer). The interface 42 between the first and second sublayers therefore lies within a corridor 48 delimited by bounds 44 and 46.

[0041] Examples of flooring panels in accordance with preferred embodiments of the invention are indicated in the tables below.

Table 1

Layer	Formulation	Amount (wt% w.r.t. layer)	Height
Wear layer	PVC	90	0.2 mm
	plasticizer	5	
	additives	5	
Décor layer	Compatible inks printed on backside of wear layer	100	<20 µm
Upper core sublayer	PVC	45	2 mm
	plasticizer	9	
	Filler ($CaCO_3$)	42	
	Additive (processing aid)	4	
Lower core sublayer	PVC	54	1.9 mm
	plasticizer	0.5	
	Filler ($CaCO_3$)	40.5	
	Additive (processing aid)	5	

Table 2

Layer	Formulation	Amount (wt% w.r.t. layer)	Height
Wear layer	PVC	95	0.2 mm
	additives	5	
Upper core sublayer	PVC	46	1.8 mm
	plasticizer	3	
	Filler ($CaCO_3$)	45	

	Additive (processing aid)	6	
Lower core sublayer	PVC	55	1.7 mm
	Filler ($CaCO_3$)	40	
	Additive (processing aid)	5	

Table 3

Layer	Formulation	Amount (wt% w.r.t. layer)	Height
Wear layer	PVC	92	0.2 mm
	Corundum particles	3	
	additives	5	
Décor layer	Printing substrate carrying compatible inks	100	Approx.: 100 µm
Upper core sublayer	PVC	40	1.8 mm
	plasticizer	5	
	Filler ($CaCO_3$)	48	
	Additive (processing aid)	7	
Lower core sublayer	PVC	43	1.7 mm
	plasticizer	1	
	Filler ($CaCO_3$)	50	
	Additive (processing aid)	6	

Table 4

Layer	Formulation	Amount (wt% w.r.t. layer)	Height
Wear layer	PVC	92	*0.2 mm*

	Corundum particles	3	
	additives	5	
Décor layer	Printing substrate carrying compatible inks	100	Approx.: 100 µm
Upper core sublayer	PVC	42	0.9 mm
	plasticizer	0.5	
	Filler ($CaCO_3$)	52	
	Additive (processing aid)	5.5	
Middle core sublayer	PVC	40.5	1.2 mm
	plasticizer	4.5	
	Filler ($CaCO_3$)	49	
	Additive (processing aid)	6	
Lower core sublayer	PVC	42	0.9 mm
	plasticizer	0.5	
	Filler ($CaCO_3$)	52	
	Additive (processing aid)	5.5	

[0042] While specific embodiments and examples have been described herein in detail, those skilled in the art will appreciate that various modifications and alternatives to those details could be developed in light of the overall teachings of the disclosure. Accordingly, the particular arrangements disclosed are meant to be illustrative only and not limiting as to the scope of the invention, which is to be given the full breadth of the appended claims and any and all equivalents thereof.

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Claims

1. Un panneau de revêtement de sol ou de mur, ayant une surface supérieure, une surface inférieure et au moins quatre côtés, dans lequel un premier côté des côtés comprend un premier profil de connexion et un second côté des côtés comprend un second profil de connexion, les premier et second profils de connexion étant arrangés sur des côtés opposés du panneau, le premier profil de connexion étant configuré pour engager mécaniquement et s'imbriquer avec un second profil de connexion d'un autre panneau de revêtement de sol ou de mur selon cette revendication,

   dans lequel le premier côté et la surface supérieure se rencontrent en un bord supérieur du premier côté et le second côté et la surface supérieure se rencontrent en un bord supérieur du second côté,

   dans lequel le premier profil de connexion comprend une languette dépassant le bord supérieur du premier côté,

   dans lequel le second profil de connexion comprend une rainure en retrait par rapport au bord supérieur du second côté, la rainure étant délimitée dans sa partie inférieure par une base, dépassant ou non le bord supérieur du second côté;

   dans lequel le panneau de revêtement de sol ou de mur est une structure stratifiée, incluant une couche centrale rigide et une couche d'usure arrangée sur la couche centrale;

   dans lequel la couche centrale inclut une première sous-couche d'un premier matériau composite et d'une seconde sous-couche d'un second matériau composite au-dessus de la première sous-couche;

   dans lequel chacun des premier et second matériaux composites comprend un matériau thermoplastique et un matériau de remplissage, les premier et second matériaux composites étant des formulations différentes;

   dans lequel la base délimitant la partie inférieure de la rainure est réalisée essentiellement dans la première sous-couche de la couche centrale.

2. Le panneau de revêtement de sol ou de mur tel que revendiqué à la revendication 1, dans lequel le premier matériau composite a une rigidité inférieure au second matériau composite.

3. Le panneau de revêtement de sol ou de mur tel que revendiqué à la revendication 1 ou 2, dans lequel le matériau thermoplastique des premier et second matériaux composites comprend une résine PVC.

4. Le panneau de revêtement de sol ou de mur tel que revendiqué à la revendication 3, dans lequel le matériau thermoplastique du premier matériau composite comprend de 2,5 % à 20 % en poids de plastifiant de la résine PVC.

5. Le panneau de revêtement de sol ou de mur tel que revendiqué à la revendication 3 ou 4, dans lequel le matériau thermoplastique du second matériau composite ne comprend pas ou comprend moins de 2,5 % en poids de plastifiant de la résine PVC.

6. Le panneau de revêtement de sol ou de mur tel que revendiqué à l'une quelconque des revendications 1 à 5, dans lequel le matériau thermoplastique du premier matériau composite comprend de 2,5 % à 20 % en poids de plastifiant de la résine PVC, dans lequel le matériau thermoplastique du second matériau composite ne comprend pas ou comprend moins de 2,5 % en poids de plastifiant de la résine PVC, et dans lequel le rapport du contenu en plastifiant du matériau thermoplastique du premier matériau composite et du contenu en plastifiant du matériau thermoplastique du second matériau composite est compris dans l'intervalle allant de 5 à 100.

7. Le panneau de revêtement de sol ou de mur tel que revendiqué à l'une quelconque des revendications 1 à 6, dans lequel les première et seconde sous-couches sont des couches composites coextrudées.

8. Le panneau de revêtement de sol ou de mur tel que revendiqué à l'une quelconque des revendications 1 à 7, dans lequel l'épaisseur de la première sous-couche s'élève à entre 10% et 40%, préférablement à entre 10% et 33%, de l'épaisseur de la couche centrale entière.

9. Le panneau de revêtement de sol ou de mur tel que revendiqué à l'une quelconque des revendications 1 à 8, dans lequel le matériau de remplissage des premier et second matériaux composites consiste en au moins 70% en poids d'un matériau minéral, préférablement du carbonate de calcium.

10. Le panneau de revêtement de sol ou de mur tel que revendiqué à l'une quelconque des revendications 1 à 9, ayant une hauteur totale comprise dans l'intervalle allant de 2,5 à 10 mm, plus préférablement dans l'intervalle allant de 3 mm à 6 mm, et plus préférablement dans l'intervalle allant de 3 mm à 4,5 mm.

11. Le panneau de revêtement de sol ou de mur tel que revendiqué à l'une quelconque des revendications 1 à 10, dans lequel la base délimitant la partie inférieure de la rainure est réalisée à raison d'au moins 80% de son poids dans la première sous-couche de la couche centrale.

12. Le panneau de revêtement de sol ou de mur tel que revendiqué à la revendication 11, dans lequel la base délimitant la partie inférieure de la rainure est réalisée à raison d'au moins 90% de son poids dans la première sous-couche de la couche centrale.

13. Le panneau de revêtement de sol ou de mur tel que revendiqué à l'une quelconque des revendications 1 à 10, dans lequel la base délimitant la partie inférieure de la rainure est réalisée entièrement dans la première sous-couche de la couche centrale

14. Le panneau de revêtement de sol ou de mur tel que revendiqué à l'une quelconque des revendications 1 à 13, dans lequel les premier et second profils de connexion sont usinés en les premier et second côtés, respectivement.

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Fig. 1

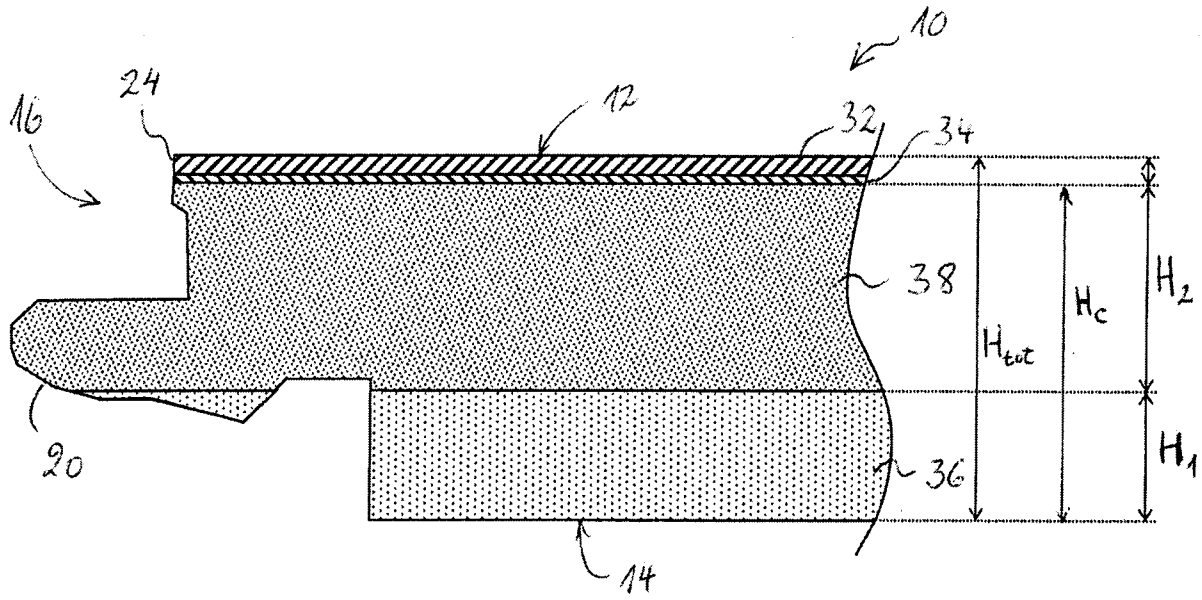


Fig. 2

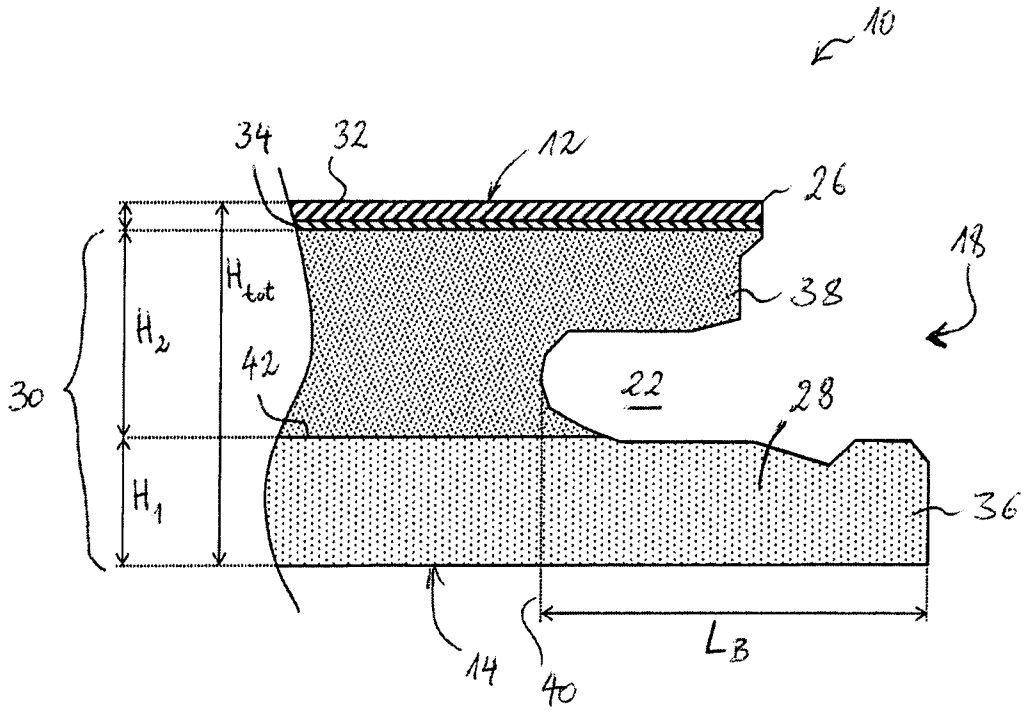


Fig. 3

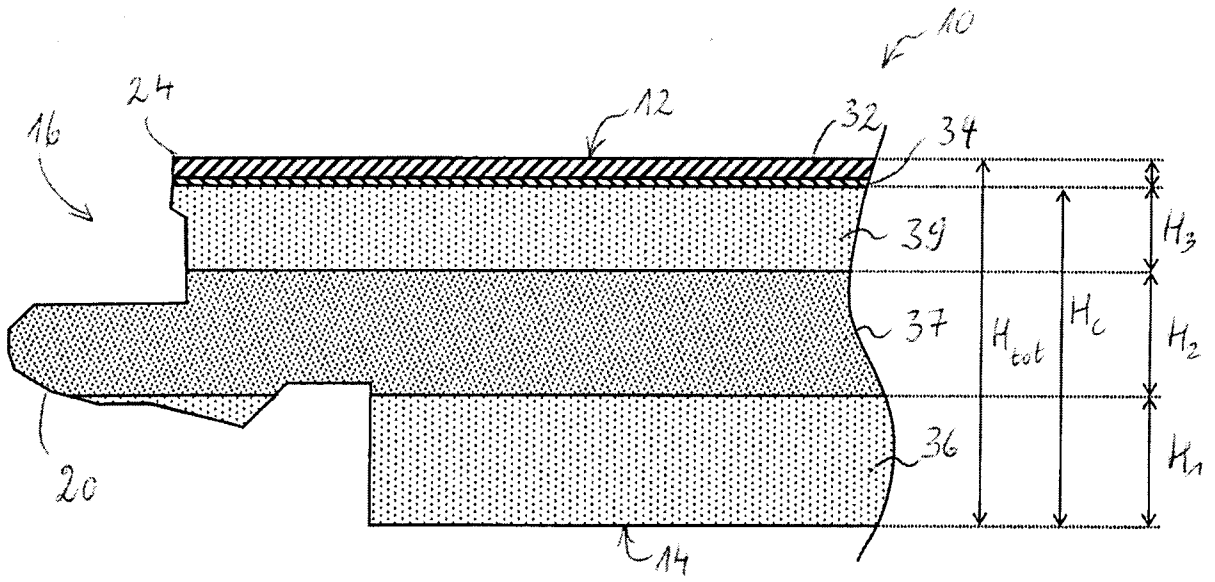

10
24
16
12
32
34
39
37
36
20
14
H_3
H_2
H_1
H_{tot}
H_c

Fig. 4

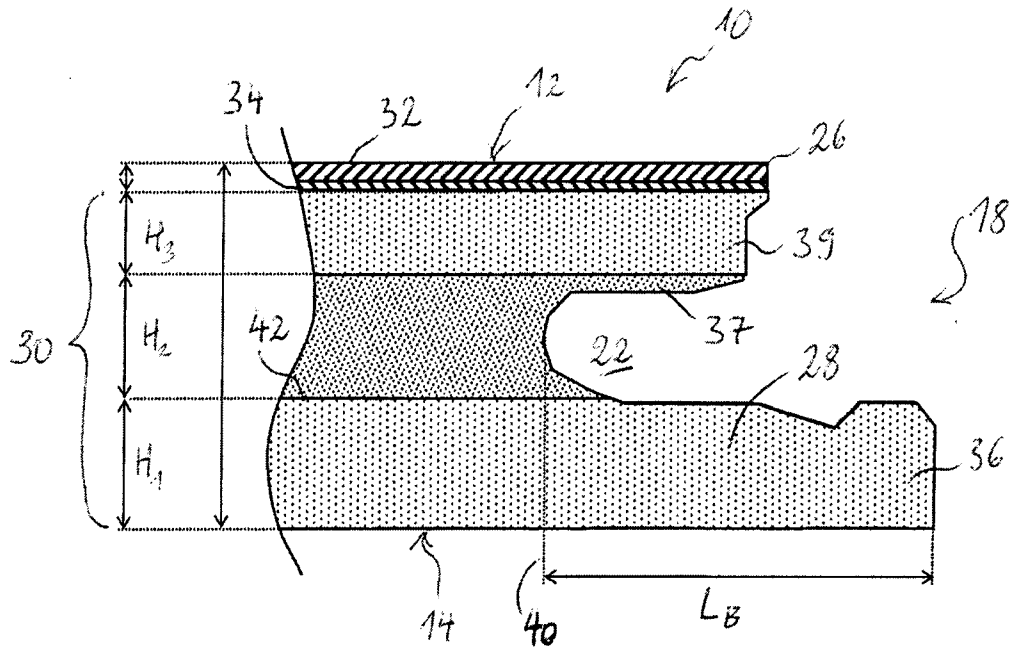
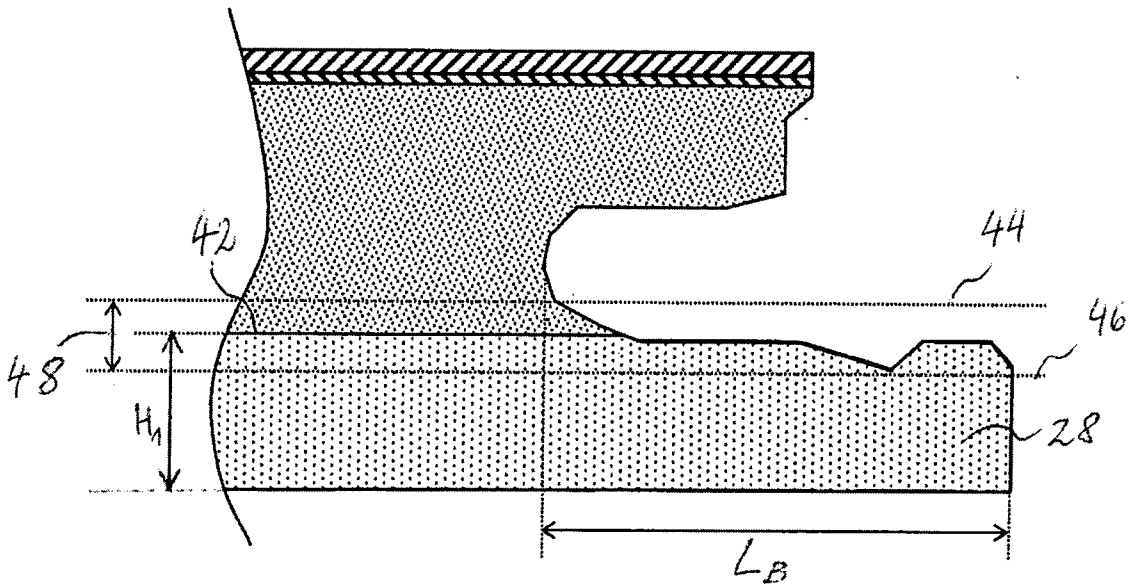

10
34
32
12
26
18
39
37
22
28
36
30
42
14
40
H_3
H_2
H_1
L_B

Fig. 5



Abstract

A floor or wall covering panel has a top and a bottom surface, and at least four sides. A first and a second side comprises a first and a second connection profile, respectively. The first profile is configured for mechanically engaging and interlocking with the second profile of another panel. The first profile comprises a tongue protruding beyond the top edge of the first side, whereas the second profile comprises a groove recessed with respect to the top edge of the second side. The groove is delimited at its bottom by a base. The panel is of laminar structure, including a rigid core layer and a wear layer arranged on the core layer. The core layer includes a first and a second sublayer of a first and a second composite material, respectively. The second sublayer is arranged atop the first sublayer. Both composite materials comprise thermoplastic material and filler material but are of different formulations. The base delimiting the groove bottom is realized essentially within the first core sublayer.

LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Économie

National Application Number

SEARCH REPORT

in accordance with Article 35.1 a)
of the Luxembourg law on patents
dated 20 July 1992

LO 1910
LU 100764

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2015/152802 A1 (FLOOR IPTECH AB [SE]) 8 October 2015 (2015-10-08) * claims 1,4,13,14,17,20,23,25,26; figures 1d,3b,4c, 4d * * page 29, line 30 - page 30, line 11 * * page 26, line 30 - page 27, line 25 * * page 18, line 7 - line 12 *	1-14	INV. B32B3/06 B32B27/30 B32B27/20 B32B27/22 E04F15/10
X	WO 2017/027155 A1 (AFI LICENSING LLC [US]) 16 February 2017 (2017-02-16) * paragraph [0018] * * paragraph [0040] * * paragraph [0050] - paragraph [0053] * * figure 2.3 *	1-6,9-14	
X	WO 2018/058766 A1 (ANJI TIAN ZE PLASTIC CO LTD [CN]; XU BIN [CN]) 5 April 2018 (2018-04-05) * paragraph [0004] - paragraph [0006] * * paragraph [0035] - paragraph [0040] * * figure 2 *	1,2,4-7, 9-14	
E	-& US 2018/142478 A1 (XU BIN [CN]) 24 May 2018 (2018-05-24) * paragraph [0004] - paragraph [0006] * * paragraph [0035] - paragraph [0040] * * figure 2 *	1,7, 10-14	TECHNICAL FIELDS SEARCHED (IPC) B32B E04F
E	WO 2018/073645 A2 (NOVALIS HOLDING LTD [CN]) 26 April 2018 (2018-04-26) * paragraph [0037] * * paragraph [0058] * * claim 1; figures 5-7 *	1-13	

The present search report has been drawn up for all claims

	Date of completion of the search	Examiner
	11 December 2018	Matthijssen, J-J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C56)

ANNEX TO THE SEARCH REPORT ON LUXEMBOURG PATENT APPLICATION NO. LO 1910 LU 100764

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-12-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2015152802 A1	08-10-2015	CN 106103096 A	09-11-2016
		EP 3126145 A1	08-02-2017
		JP 2017511266 A	20-04-2017
		KR 20160138157 A	02-12-2016
		US 2015343739 A1	03-12-2015
		US 2017120558 A1	04-05-2017
		WO 2015152802 A1	08-10-2015
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		EP 3332075 A1	13-06-2018
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		WO 2017027155 A1	16-02-2017
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		US 2018142478 A1	24-05-2018
		WO 2018058766 A1	05-04-2018
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		WO 2018058766 A1	05-04-2018
WO 2018073645 A2	26-04-2018	US 2018135313 A1	17-05-2018
		WO 2018073645 A2	26-04-2018

LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Économie

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
LO1910	10.04.2018		LU100764

International Patent Classification (IPC)
INV. B32B3/06 B32B27/30 B32B27/20 B32B27/22 E04F15/10

Applicant
TARKETT GDL

This report contains indications relating to the following items:

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

Examiner
Matthijssen, J-J

Application No.
LU100764

WRITTEN OPINION

Box No. I Basis of the opinion

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

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

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently.

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

4. Additional comments:

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

1. Statement

Novelty	Yes:	Claims	2, 4-6, 9
	No:	Claims	1, 3, 7, 8, 10-14
Inventive step	Yes:	Claims	
	No:	Claims	1-14
Industrial applicability	Yes:	Claims	1-14
	No:	Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Box No. VI Certain documents cited

☒ Certain published documents

see the Search Report

☐ Non-written disclosures

Box No. VII Certain defects in the application

The following defects in the form or contents of the application have been noted:

see separate sheet

Box No. VIII Certain observations on the application

see separate sheet

1 Re Item V

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

1.1 Reference is made to the following documents:

D1	WO 2015/152802 A1 (FLOOR IPTECH AB [SE]) 8 October 2015 (2015-10-08)
D2	WO 2017/027155 A1 (AFI LICENSING LLC [US]) 16 February 2017 (2017-02-16)
D3	WO 2018/058766 A1 (ANJI TIAN ZE PLASTIC CO LTD [CN]; XU BIN [CN]) 5 April 2018 (2018-04-05); -& US 2018/142478 A1 (XU BIN [CN]) 24 May 2018 (2018-05-24)

For document D3 (WO 2018/058766) reference is made to the US family member which is deemed to be a literal translation of the Chinese WO-document.

2 Novelty

The present application does not meet the criteria of patentability, because the subject-matter of claims 1, 3, 7, 8 and 10-14 is not new.

2.1 Feature listing of claim 1

1) A floor or wall covering panel, having a top surface, a bottom surface and at least four sides, wherein a first one of the sides comprises a first connection profile and a second one of the sides comprises a second connection profile, the first and second connection profiles being arranged on opposed sides of the panel, the first connection profile being configured for mechanically engaging and interlocking with a second connection profile of another floor or wall covering panel according to this claim,

2) wherein the first side and the top surface meet at a top edge of the first side and the second side and the top surface meet at a top edge of the second side,

3) wherein the first connection profile comprises a tongue protruding beyond the top edge of the first side,

4) wherein the second connection profile comprises a groove recessed with respect to the top edge of the second side, the groove being delimited at its bottom by a base, protruding or not beyond the top edge of the second side;

5) wherein the floor or wall covering panel is of a laminar structure, including a rigid core layer and a wear layer arranged on the core layer;

6) wherein the core layer includes a first sublayer of a first composite material and a second sublayer of a second composite material atop the first sublayer;

7) wherein each of the first and second composite materials comprises thermoplastic material and filler material, the first and second composite materials being of different formulations;

8) wherein the base delimiting the bottom of the groove is realised essentially within the first sublayer of the core layer.

Features 1-5 are deemed disclosed in any multilayer interlocking tongue and groove floor board, referred to in this opinion.

2.2 Document D1 discloses a method to produce a building panel (1), the method (c.f. claim 1) comprising:

• providing a core (5) by forming a mat shaped layer comprising a dry blend (25) of wood particles (20) in powder form and thermoplastic particles (21a) in powder form, heating and cooling the mat shaped layer under pressure such that a sheet is formed after pressing,
• applying a surface layer (4) comprising a powder mix comprising wood particles (20) and thermosetting resin on the core (5),
· laminating the powder based surface layer (4) in a hot-hot pressing operation to the core (5) and thereby forming a building panel (1), wherein the wood particles (20) of the surface layer (4) and of the core (5) are bonded to each other by cured thermosetting resin.

The thermoplastic particles (21a) of the dry blend (25) comprise polyvinyl chloride (PVC) (claim 4).

The core (5) comprises an intermediate layer (5b) and an upper layer (5a), and wherein the intermediate layer (5b) comprises a higher amount of thermoplastic material (21) than the upper layer (5a) (feature 6) (claim 13).

The intermediate layer (5b) further comprises limestone particles (claim 14).

The building panel (1) comprising a mechanical locking system comprising a tongue (10) and groove (9). Said building panel, wherein the protruding strip (7), and the locking element (8) are formed in the lower core layer (5c) (feature 8) (claims 25 and 26, fig 4d and page 31, lines 12-15).

The intermediate layer 5b is preferably softer than the upper 5a and lower 5c layers (feature 7) (page 30, lines 31-32).

Therefore, the subject matter of claim 1 is not new in view of D1.

2.3 The subject matter of claim 3 is also disclosed in D1 (claim 4).
The subject matter of claim 7 is also disclosed in D1 (fig. 3b and page 29, line 30 - page 30, line 11).
The subject matter of claim 8 is also disclosed in D1 (fig. 4c).
The subject matter of claim 10 is also disclosed in D1 (page 18, lines 7-12).
The subject matter of claims 11-13 is also disclosed in D1 (fig. 4a or 4d).
The subject matter of claim 14 is also disclosed in D1 (page 32, lines 25-28).

2.4 D2 discloses an interlocking flooring panel 10 comprising a wear layer 30 and a substrate layer 20, the wear layer 30 atop the substrate layer 20 (§0018 and fig. 2 and 3).
The substrate layer 20 is comprised of multiple core layers - including at least an upper core layer 21 and a lower core layer 22, the upper core layer 21 being atop the lower core layer 22, (§0050-0051).
The substrate layer 20, particular the lower core layer 22 forms the second horizontal locking feature 210 (§0040).
Therefore, the subject matter of claims 1, 3 and 10-14 is not new in view of D2.

2.5 Document D3 discloses an interlocking tongue and groove stone-plastic composite plate, comprising: a PVC material composite surface layer (1) comprising a PVC sheet (101) comprising plasticizers, resin powder, calcium powder; a stone-plastic material layer (2) comprising a resin powder and calcium powder, as a middle layer and a PVC material bottom layer (3). The middle layer forms the base of the groove (§0035-0040 and fig. 2).
The interlocking tongue and groove of D3 tries to solves the easy damage of tongue and groove joints of conventional PVC floors (§0004-0006).
Therefore, the subject matter of claims 1, 7 and 10-14 is not new in view of D3.

3 Inventive step

The present application does not meet the criteria of patentability, because the subject-matter of claims 2, 4-6 and 9 does not involve an inventive step.

3.1 Contrary to the subject matter of claim 2 all disclosed core layers have a lower part that is deemed to have a higher stiffness than the upper part. It is clear from the description on page 3, lines 20-22 and the examples set out in tables 1-3, that an opposite configuration may also solve the problem underlying the present invention. Thus, the subject matter of claim 2 is considered a straightforward alternative to the disclosure in D1-D3. Therefore, the subject-matter of claim 2 does not involve an inventive step.

3.2 The subject-matter of claims 4-6 and 9 is a mere variation within the ambit of claim 1 and it has not been shown that the technical features thereof substantiate to a technical effect, in order to solve a technical problem in a non-obvious manner, in view of D1, D2 or D3 taken in combination with common general knowledge as to establish an inventive step. Therefore, the subject-matter of claims 4-6 and 9 does not involve an inventive step.

4 **Re Item VI**

Certain documents cited

Certain published documents

Application No Patent No	Publication date *(day/month/year)*	Filing date *(day/month/year)*	Priority date *(valid claim)* *(day/month/year)*
WO2018/073645	26-04-2018	17-10-2017	17-10-2016

5 **Re Item VII**

Certain defects in the application

6 The relevant background art disclosed in D1-D3 is not mentioned in the description, nor are these documents identified therein.

7 **Re Item VIII**

Certain observations on the application

8 Clarity

Claim 1 is not clear.

8.1 The relative term "rigid" used in claim 1 has no well-recognized meaning and leaves the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear. Said term is defined ion page 3, §9 of the description, as having a modulus of elasticity, measured according to EN 310, of greater than 1000 Mpa. This definition should be included in claim 1.

8.2 The term "essentially within" used in claim 1 is vague and unclear and leaves the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear. The term is especially unclear in view of the subject matter of claims 11 and 12. Dependent claim 11 defines a preferred embodiment wherein the base delimiting the bottom of the groove is realised at least to 80% of its weight within the first sublayer of the core layer. The term "essentially within" in claim 1 is considered as being broader than the scope of claim 11.