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(54) **DECORATIVE PANEL**

(57) Decorative panel, comprising a substrate (15) and a decorative top layer(16) having a thickness (T) of 1 mm or more, characterized in that said decorative panel (1) at at least two opposite edges (2-3;4-5) is provided with coupling means (6), wherein at the respective edges (2-3;4-5), in a coupled condition, the decorative top layers (16) laterally face each other with a clearance (23) in between, while the panels (1) are connected practically free from play or free from play.

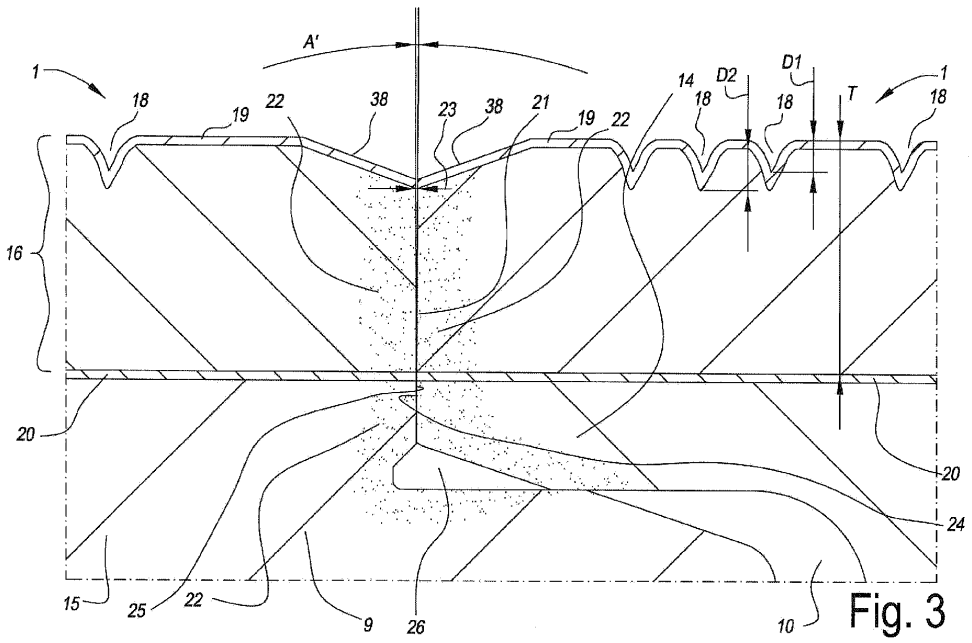

Fig. 3

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Description

[0001] The present invention is disclosed in the claims and concerns decorative panels, in particular floor panels having a decorative top layer of wood.

[0002] The invention in particular concerns decorative panels having an improved resistance to deterioration due to moisture.

[0003] Creating an acceptable moisture resistance for panels having relatively thick decorative top layers, for example 1 mm or thicker, is challenging, since such top layer may have irregular edges. The irregularities at the edge may lead to uncontrollable openings paving the way for moisture to penetrate. The irregularities may be irregularities in shape, for example local absence of top layer material along the edge, and/or irregularities in material properties, for example softer and harder areas along one or more of the edges of such top layer material. Such irregularities are common in for example wooden decorative layers, such as in wooden decorative layers for engineered parquet flooring. Such flooring may have a wooden decorative layer with a thickness of 2.5 mm or more. The present invention is in particular suitable for such floor panels, as the decorative top layer may have harder and softer spots for example corresponding to summer and spring grain, and/or irregularities due to absence of material, such as due to wood knots irregularly filled with a filling material, such as so-called putty.

[0004] Creating an acceptable moisture resistance for panels having a wood based decorative top layer may also be challenging since moisture is able to be transferred through the decorative top layer, especially at such areas where wood knots have been replaced by putty. Moisture reaching a less moisture resistance substrate material such as MDF or HDF may lead to swelling of the substrate that is and may remain visible at the surface of the decorative top layer.

[0005] Wooden top layers having a wood grain structure with open pores are particularly challenging, as the open pores tend to collect dirt from any moisture it has been exposed to, and may become dark. The open pores are difficult to clean, especially since the moisture resistance of the panels as a whole does not allow to use a large amount of water and/or detergents, such as soap. Open pores, i.e wood pores that are available at the surface of the wooden top layer as excavations in the surface, are however fashionable as they add to the natural look of e.g. a parquet floor.

[0006] The present invention in the first place aims at providing an alternative decorative panel, wherein in accordance with preferred embodiments solutions are offered to one or more of the problems with the decorative panels of the state of the art.

[0007] Therefore, the present invention concerns four measures, identified herein as a first to fourth independent aspect of the invention, that may lead to an increased performance in humid ambient conditions of decorative panels. These measures may be applied separately or in any combination in one and the same decorative panel.

[0008] In accordance with a first independent aspect, the invention is a decorative panel, preferably a floor panel, comprising a substrate and a decorative top layer, with as a characteristic that said decorative top layer comprises a wooden top layer having a wood grain structure comprising open pores and a lacquer layer applied on said wooden top layer, wherein said lacquer layer is continuous over the surface of said wooden top layer, and follows the shape of said open pores. Because the lacquer layer has been made to follow the shape of the open pores, a combination of a natural look and a more easy to clean wooden surface can be achieved. The availability of the lacquer layer in the open pores tends to collect dust to a lesser extent, and any dust collected may be more easily wept or cleaned out of the open pores.

[0009] The wooden top layer may have any thickness, for example from 0.3 to 10 mm, for example about 0.6 mm. Preferably the wooden top layer has a thickness of 1 mm or more, even better of at least 2.5 mm.

[0010] Preferably, said lacquer layer is a UV cured lacquer and/or an acrylic lacquer. Said lacquer layer may comprise additives. Preferably said additives are silane based additives, silicone acrylates and/or fluor acrylates. These additives are particularly effective to create a surface which is easy to clean, and may lead to a more straight forward cleaning of any dirty open pores.

[0011] Preferably, said lacquer layer comprises abrasion resistant particles and/or aluminum oxide particles. In accordance to a first preferred embodiment, the particles have an average particle size as expressed by d50 value and measured using laser light scattering granulometry of 3 to 90 micron, preferably 10 to 50 micron. According to a second preferred embodiment, said abrasion resistant particles and/or aluminum oxide particles have an average particle size, either so large that they cannot enter the average open pore, or so small that they can easily enter the average pore. In either case, the risk that open pores become blocked is minimized. Preferably, in such case, said abrasion resistant particles have an average particle size as expressed by the d50 value of at least 60 micrometer, or of 30 micrometer or less, even better of 10 micrometer or less, for example less than 1 micrometer. These ranges of average particle size have been found to create a smaller risk of blocking the open pores. It is of course possible to use a mix of particles that has a multi modal, preferably bimodal, distribution with one peak at 60μm or more, and one peak at 30 μm or less, or even better at 10 micrometer or less. In such case the particles of a size that is critical for blocking the open pores can be avoided to a large extent, while the actual d50 value may be within 30-60 μm.

[0012] The d50 values as mentioned above are measured using laser light scattering granulometry performed in accordance with ISO 13320, namely by a dynamic light scattering technique using a laser having an emission wavelength of 632.8 nm and measured under a scattering angle of 90 degrees. Such granulometry may e.g. be

performed with a Malvern® Mastersizer 2000 or with a Malvern® Mastersizer 3000. For executing the measurement of the particle size distribution, the respective particles may be dispersed in a liquid, such as water.

[0013] In accordance with a second independent aspect, the invention is a decorative panel, comprising a substrate and a decorative top layer, with as a characteristic that said decorative top layer is applied to said substrate by means of a waterproof glue and/or by means of a polyisocyanate based glue and/or by means of a glue containing isocyanate as a cross linking agent, wherein said glue preferably forms a continuous layer covering substantially the entire bottom of said decorative top layer. Preferably, said glue is at least available at the location underneath one or more areas of the decorative top layer that have a diminished watertightness, such as at the location of one or more excavations or through openings, whether or not at least partially filled with filler material, such as with putty. The availability of glue at these locations, though preferably extending over the entire bottom of the decorative top layer, creates an additional barrier to moisture penetrating the decorative top layer. This is of special importance in the cases where the substrate is prone to deterioration due to moisture, for example as is the case with wood-based substrate materials, such as MDF or HDF, or with magnesiumoxychloride or magnesiumoxysulphate containing substrate materials.

[0014] For the glue, a polyurethane glue, an epoxy glue or a cross-linking PVA (poly vinylacetate) glue may be used. As a crosslinking agent in PVA glue, isocyanate may be used. As an alternative TDI (toluene di-isocyanate) or MDI (methylene di-phenyl di-isocyanate) may be used. As a further a thermosetting resin such as melamine formaldehyde resin, ureum formaldehyde resin, melamine ureum formaldehyde resin or phenol formaldehyde resin may be used.

[0015] Preferably, said top layer is a wooden top layer, wherein said top layer may have any thickness, for example from 0.3 to 10 mm, for example about 0.6 mm. Preferably the top layer has a thickness of 1 mm or more, even better of at least 2.5 mm. The wooden top layer may comprise excavations or through openings that have been filled using filler material, such as putty. This may for example be the case at location where wood knots have been removed. Other top layer materials than wooden top layers may profit from the advantages of the second independent aspect as well, such as bamboo top layers, and especially such top layer materials that are not entirely moisture tight or vapor tight, such as a textile covering and/or a covering having through openings.

[0016] In accordance with a third independent aspect, the invention is a decorative panel, comprising a substrate and a decorative top layer, with as a characteristic that said decorative top layer comprises a wooden top layer, preferably having a thickness of 1 mm or more, even better of at least 2.5 mm, wherein at least one lateral edge of said wooden top layer has been provided with a water repellent agent. Preferably said water repellent agent is available on the complete thickness of said lateral edge, and preferably also over the complete length thereof. Preferably at least the edges of the wooden top layer where the wood grain has been generally cross-cut, or transversely cut, are treated with said water repellent agent. According to the most preferred embodiment all lateral edges of the wooden top layer are, preferably entirely, i.e. over their entire thickness and length, treated with said water repellent agent.

[0017] The treatment with a water repellent agent has a double effect. On the one hand the water repellent agent may create a burden for moisture to penetrate the seam between adjacent lateral edges and to reach the underlying substrate. On the other hand the water repellent agent creates a burden for water to be absorbed into to decorative top layer, where it could potentially create an undesired local discoloration of the wooden top layer. The risk for absorption of moisture into the wooden top layer is particularly prominent where open wood vessels are available, i.e. in particular at these locations where the wood grain has been generally cross-cut or transversely cut. This mostly concerns the short edges of rectangular decorative panels, in the cases where the wood grain generally extends in the longitudinal direction of the decorative panels.

[0018] The water repellent agent may in particular be protective towards substrate materials that are prone to deterioration due to moisture, for example as is the case with wood-based substrate materials, such as MDF or HDF, or with magnesiumoxychloride or magnesiumoxysulphate containing substrate materials.

[0019] In accordance with a third independent aspect, the invention is a decorative panel, comprising a substrate and a decorative top layer, preferably having a thickness of 1 mm or more, with as a characteristic that said decorative panel at at least two opposite edges is provided with coupling means allowing two such panels to be connected at the respective edges wherein a locking is obtained in a vertical direction perpendicular to the plane of the coupled panels, as well as in a horizontal direction perpendicular to the coupled edges and in the plane of the panels, wherein at the respective edges, in a coupled condition, the decorative top layers laterally face each other with a clearance in between, said clearance at the top surface preferably being smaller than 0.2 mm, preferably 0.05 or 0.03 mm or smaller, while the panels, in said coupled condition, are connected practically free from play or free from play, for example with a pretension. The availability of a clearance between the lateral facing edges of the decorative top layers allows the realization of a tight connection by means of the coupling means, that are then substantially, or practically entirely, realized within the thickness of the substrate material. The potentially available play in the coupling means is preferably limited to a freedom of movement in said horizontal direction that is 0.15 mm or smaller, preferably 0.07 mm or smaller. In the case of an available

play, said clearance is defined in the connected state wherein the facing lateral edges are in their most mutually remote position. Preferably, however, the panels are connected free from play, i.e. without the possibility of a free movement in said horizontal direction. This is preferably realized by providing coupling means at said opposite edges that have an overlapping profile contour or so-called pretension. The overlap is preferably at least available at those surfaces that are active in creating said locking in said horizontal direction. With an overlapping profile contour, it is meant that the profile contours of the coupling means at the two opposite edges, when drawn in a theoretical connected condition, interfere with each other, as stated preferably at least at the horizontally active contact surfaces.

[0020] Preferably the size of the clearance diminishes from the top surface towards the substrate material.

[0021] Said clearance is preferably available between the laterally facing edges of the decorative top layer over the entire thickness, or at least over 80% of the thickness thereof. A remaining contact surface on the laterally facing edges of the decorative top layer over a limited portion of the thickness thereof may possibly not interfere with the good working of the present invention in accordance with said fourth aspect.

[0022] It is noted that any lowered edge areas, such as bevels and the likes, are considered to be part of the top surface, and that the size of said clearance at the top surface is defined below such lowered edge areas. The size of said clearance is defined in the horizontal direction perpendicular to the longitudinal direction of the respective edge of the decorative panel.

[0023] The laterally facing edges of said decorative top layer defining said clearance are preferably oriented substantially vertically or vertically, i.e. with a maximum deviation from the vertical of 10°, preferably a maximum deviation of 1°, or even beter maximally 0.5° deviation from the vertical.

[0024] Said coupling means may basically be formed as a tongue and a groove bordered by a lower and an upper groove lip. Preferably said lower groove lip protrudes in said horizontal direction beyond said upper groove lip. The tongue and groove are provided with locking elements preventing the drifting apart in said horizontal direction of the tongue and groove. The locking element at the side of the tongue may be formed as an excavation at the lower side of the tongue and the locking element at the side of the groove may be formed as a protrusion at the top surface of the lower groove lip. Said horizontally active surfaces are preferably formed on said locking elements. Preferably, the coupling means are such that the lower groove lip, in a coupled condition, is bent, for example due to the above described overlap at the location of the horizontally active contact surfaces. In so doing the coupled edges may actively be pushed towards each other by means of the resilient restoring force exerted by the bent lower groove lip on the bottom of the tongue.

[0025] Preferably, a substantially vertically extending contact surface is formed at a location below said decorative top layer, preferably on the substrate material. The vertically extending contact surface is preferably formed on a lateral edge of said upper groove lip, or, in other words, above the position where the actual tongue and groove engage or above any contact surface active in said vertical direction. The vertically extending contact surfaces may provide for a closed seam below, preferably immediately below, said decorative top layer. In the case of a pretension, such a seam may actively be closed in a connected condition, as explained above. Preferably a chamber or clearance is available between the coupled edges at a location between said vertically extending contact surfaces and said position where the actual tongue and groove engage or above any contact surface active in said vertical direction. The availability of said chamber enables a more reliable contact on said vertically extending contact surfaces.

[0026] As a variant, or in combination with said substantially vertically extending surfaces, support surfaces, active in a vertical direction and preferably substantially horizontally extending, may be provided at a location below said clearance. Preferably the support surfaces are formed on the material of the substrate, and are preferably in contact. Such support surface may attribute an additional sealing barrier for water seeking its way to the substrate material. Preferably a water repellent agent is applied on the respective edge at least at the location of said support surfaces and, preferably on any substrate material located above said support surfaces. Clearly, preferably also the laterally facing edges of said decorative top layer have been provided with a water repellent agent as discussed above in connection with said third independent aspect.

[0027] Preferably, said decorative surface layers comprise a lateral edge that is vertical or inclined with respect to the vertical, said inclination from the substrate to the top surface being proximally directed, i.e. towards the panel. Said inclination is preferably smaller than 10°, smaller than 1°, or even better smaller than 0.5°. These inclinations allow to create said clearance and said vertically extending contact surfaces with a convenient geometry, while, for a user, the floor covering may be perceived as being virtually without gaps at the seams. The substrate material may be concealed from view, and instead the lateral edges of the decorative top layer may be partially in sight.

[0028] It is of special interest to combine said fourth independent aspect with said third independent aspect, since a water repellent agent applied to the laterally facing edges of the decorative top layer in accordance with said third independent aspect may be effective enough to keep moisture from penetrating the clearance between said laterally facing edges, as defined by means of said fourth independent aspect.

[0029] Here below, some preferred embodiments are listed, that may be practiced in combination with any of

the above mentioned aspects, or combinations thereof.

[0030] Preferably, said substrate at a location immediately below said decorative top layer is preferably provided with a water repellent agent. In such case any moisture reaching the substrate material may experience an additional barrier.

[0031] Preferably, a watertight layer is provided between said decorative top layer and said substrate. As explained in connection to the second independent aspect, the layer may be formed by means of a glue. However, it is, in general, also possible to achieve a watertight layer by means of a plastic layer, such as by means a layer or foil of PE (poly ethylene), PET (poly ethylene terephthalate), PU (polyurethane), PVC (polyvinyl chloride), PLA (poly lactic acid), or PP (polypropylene). A whether or not water resistant glue may be used to secure the layer in between the decorative top layer and the substrate.

[0032] The substrate material may be a wood fiberboard, preferably MDF or HDF. The invention, according to any of said independent aspects is especially effective to create more moisture resistant flooring, even with MDF and HDF, that are known for lacking moisture resistance per se. Even if such wood fiberboard is of a so-called water resistant quality, such decorative panels may still benefit from the measures of any or a combination of any of the independent aspects. MDF and HDF are generally well machinable with milling, and surfaces with low roughness can be obtained, such that contacts formed on such surface may be relatively tight. The compressibility of MDF or HDF, as limited as it is, may provide for additional tightness when such surface are being pressed onto each other for example by means of a pretension as described above.

[0033] Preferably, said wood fiberboard comprises 0.1 to 2% of paraffin or wax, which may have a beneficial impact on the water resistant quality of the respective board, especially when a water repellent agent is to be applied on the edges of the wood fiberboard.

[0034] Preferably, said wood fiberboard has an average density of at least 800 kg/m^3. The density of the wood fiberboard may prevent excessive swelling in the thickness direction in case some moisture does still reach the wood fiberboard.

[0035] Preferably, said wood fiberboard comprises pMDI (polymeric methylene di-phenyl di-isocyanate) glue and or MUF (melamine-ureumformaldehyde) glue. Wood fiberboards prepared with these glues are considered to be the more water resistant varieties of MDF or HDF, and additional resistance to moisture may be obtained in the decorative panel when such substrate materials are applied.

[0036] In accordance with a variant, the substrate material is a thermoplastic material, such as PVC, potentially filled with inorganic filler materials, such as CaCO3 based fillers, or the substrate is a mineral based material, such as a cement fiber board, a Calcium-Silicate board or a magnesiumoxysulphate or mgnesiumoxychloride board.

[0037] In accordance with another variant, the substrate material is a lamella core, i.e. a core assembled from at least a plurality of transversely extending wooden and/or wood-based blocks. In the case of an oblong panel, the short pair of opposite edges of the substrate material is preferably provided by means of an MDF, HDF, plywood or plastic block.

[0038] In accordance with another variant, the substrate material is a plywood board.

[0039] Preferably, said decorative panel is rectangular, preferably oblong, with a first and a second pair of opposite edges, wherein at least said first pair of opposite edges comprises coupling means allowing two of such panels to be connected at the respective edges wherein a locking is obtained in a vertical direction perpendicular to the plane of the coupled panels as well as in a horizontal direction perpendicular to the coupled edges and in a plane of the panels. The coupling means at said first pair of opposite edges is preferably formed as a tongue and a groove bordered by a lower and an upper groove lip. Preferably said lower groove lip protrudes in said horizontal direction beyond said upper groove lip. The tongue and groove are provided with locking elements preventing the drifting apart in said horizontal direction of the tongue and groove. The locking element at the side of the tongue may be formed as an excavation at the lower side of the tongue and the locking element at the side of the groove may be formed as a protrusion at the top surface of the lower groove lip. Said horizontally active surfaces are preferably formed on said locking elements. Preferably the tongue and groove and locking elements are realized in one piece from the material of said substrate and/or allow to become connected by means of an angling motion around the respective opposite edges to be coupled. The second pair of opposite edges may equally be provided with coupling means, for example formed as a tongue and a groove bordered by a lower and an upper groove lip, as described above in connection with the first pair of opposite edges. In accordance with a variant the first and/or second pair of opposite edges may be provided with coupling means formed as a male part and a female part that can be brought into each other by means of a substantially downward movement of the male part into the female part. Also, in such case, a locking may be obtained in said horizontal direction, as well as in said vertical direction. The male part may be formed as an upper lip protruding from an upper edge and having a downwardly protruding hook-shaped element bordering a proximal male recess, and the female part may be formed as a lower lip protruding from a lower edge and having an upwardly protruding hook-shaped element bordering a proximal female recess. In a connected state the downwardly protruding hook-shaped element engages with the female recess, and the upwardly protruding hook-shaped element engages with the male recess. The cooperation of the hook-shaped parts and recesses allow for said locking in said horizontal direction. Locking elements, e.g.

hooks and undercuts may be provided to prevent the separation of the male and female part in the vertical direction. Said hook-shaped parts, recesses and locking elements may be realized in one piece with the material of the substrate, or may comprises separate elements, for example of plastic or steel. Such separate, preferably resilient, element may for example be applied to embody a hook or undercut.

[0040] In the case of an oblong panel, said first pair of opposite edges is preferably formed by the long pair of opposite edges, and said second pair of opposite edges is preferably formed by the short pair or opposite edges. In a special embodiment, the first pair of opposite edges are provided with tongue and groove and locking elements as described above, while the second pair of opposite edges are provided with a male and a female part as described above. In such case, the panel may be connectable at long and short sides with a so-called fold-down movement, namely by means of an angling motion at the long sides, and by means of a downward motion at the short sides.

[0041] Where in that above putty is mentioned, this concerns preferably an oil-based filler material. Such filler material may further comprise wood particles, wood dust or wood fibers, and/or colorants.

[0042] In summary, the present invention in particular is a decorative panel, comprising a substrate and a decorative top layer preferably having a thickness of 1 mm or more, with as a characteristic that said panel shows one or a combination of two or more of the following properties:

(a) the property that said decorative top layer comprises a wooden top layer having a wood grain structure comprising open pores and a lacquer layer applied on said wooden top layer, wherein said lacquer layer is continuous over the surface of said wooden top layer, and follows the shape of said open pores;
(b) the property that said decorative top layer is applied to said substrate by means of a waterproof glue and/or by means of a polyisocyanate based glue, wherein said glue preferably forms a continuous layer covering substantially the entire bottom of said decorative top layer;
(c) the property that said decorative top layer comprises a wooden top layer, wherein at least one edge of said wooden top layer has been provided with a water repellent agent;
(d) the property that said decorative panel at at least two opposite edges is provided with coupling means allowing two such panels to be connected at the respective edges wherein a locking is obtained in a vertical direction perpendicular to the plane of the coupled panels, as well as in a horizontal direction perpendicular to the coupled edges and in the plane of the panels, wherein at the respective edges, in a coupled condition, the decorative top layers laterally face each other with a clearance in between, said clearance at the top surface preferably being smaller than 0.2 mm, preferably 0.05 or 0.03 or smaller, while the panels, in said coupled condition, are connected practically free from play or free from play, for example with a pretension.

[0043] According to preferred embodiments, the decorative panel of the invention may further show one or more of the following properties:

(e) the property (d) above and wherein a substantially vertically extending contact surface is formed at a location below said decorative top layer;
(f) the properties (d) and/or (e) and wherein said decorative surface layers comprise a lateral edge that is inclined with respect to the vertical, said inclination from the substrate to the top surface being proximally directed, i.e. towards the panel. Said inclination preferably being smaller than 1°, even better smaller than 0.5°;
(g) the property that said substrate at a location immediately below said decorative top layer has been provided with a water repellent agent;
(h) the property that a watertight layer is provided between said decorative top layer and said substrate;
(j) the property that said substrate is a wood fiberboard, preferably MDF or HDF;
(k) the property (j), wherein said wood fiberboard is of a water resistant quality;
(l) the property (j) and/or (k) wherein said wood fiberboard comprises 0.1 to 2% of paraffin or wax;
(m) the property (j), (k) and/or (l) wherein said wood fiberboard has an average density of at least 800 kg/m^3;
(n) the property (j), (k), (l) and/or (m) wherein said wood fiberboard comprises pMDI glue and or MUF (melamine-ureumformaldehyde) glue;
(o) the property (a) wherein said lacquer layer is a UV cured lacquer and/or an acrylic lacquer;
(p) the property (a) and/or (o) wherein said lacquer layer comprises additives, wherein said additives are preferably silane based additives, silicone acrylates and/or fluor acrylates;
(q) the property that said lacquer layer comprises abrasion resistant particles and/or aluminum oxide particles.

[0044] In the cases where a water repellent agent is used, this preferably concerns a fluor copolymer and/or a fluor acrylate and/or the substances mentioned in WO 2016/182,896 and/or WO 2021/124,042 and/or BE 2021/5443 (from the present applicant, but not published at the time of filing the present application), all incorporated herein by reference. Preferably, the water repellent agent is applied in a dispersion or emulsion. Water-based or solvent based dispersion or emulsions are possible. The application can be performed in accordance with the

disclosure of the above mentioned WO and/or BE patent documents and/or by means of one or more spraying nozzles, rotating transfer disks and/or vacuum application techniques.

[0045] Preferably the water repellent agent is able to impregnate the material of the decorative panel to at least some extent. As an alternative wax or paraffin may be used instead of the water repellent agents mentioned above. The wax or paraffin may be available as a layer on the edge of the panel.

[0046] Even though an optimal water decorative panel may be obtained by combining several of the above properties in the same panel, any one of the above properties in itself creates advantageous effects by itself. Combinations of the above properties may give rise to synergistic effects coming into play.

[0047] Preferably the present invention is put to practice with floor panels having a wooden top layer of at least 2.5 mm thickness and a wood based substrate, preferably a substrate of MDF or HDF (Medium or High Density Fiberboard). Preferably the wooden top layer is a top layer of oak or ash. Preferably the wooden top layer has been brushed, preferably to create an open wood pore structure. Preferably the wooden top layer is a quarter sawn or plain sawn wooden top layer. Preferably the decorative panel is rectangular and oblong with the decorative top layer consisting of a single one piece wood layer, having a wood grain globally extending in the longitudinal direction.

[0048] Preferably the decorative panel of the invention has a thickness between 9.5 and 18 mm, even better from 12 to and including 15 mm.

[0049] Preferably, the decorative panel of the invention, more particularly the decorative toplayer, has a width between 10 cm and 30 cm, preferably between 15 and 25 cm.

[0050] Preferably, the decorative panel of the invention, more particularly the decorative top layer, has a length between 120 cm and 280 cm, preferably between 130 and 210 cm.

[0051] With the intention of better showing the characteristics according to the invention, in the following, as an example without limitative character, several embodiments are described, with reference to the accompanying drawings, wherein

Figure 1 represents a perspective view of a floor panel in accordance with the invention;

Figure 2 at a larger scale shows a cross-section in accordance with the line II-II shown in figure 1;

Figure 3 at a larger scale represents the area indicated with F3 in figure 2, but for a variant having bevels;

Figure 4 at a larger scale shows a cross-section in accordance with the line IV-IV shown in figure 1;

Figure 5 at a larger scale represents the area indicated with F5 in figure 4, but for a variant having bevels;

Figure 6 for a variant gives a view on the area indicated with F6 in figure 4;

Figures 7 and 8 in a similar view represent further variants;

Figure 9 for a variant gives a view on the area indicated with F9 in figure 3; and

Figure 10 in a view similar to that of figure 6 shows a further variant.

[0052] Preferred features of each of the properties mentioned in the introduction have been described here below by means of the embodiments of the figures. It is however clear that these preferred features do not necessarily have to be applied in combination with the other properties or preferred features of such properties, in the same way as is the case in the embodiments of the figures.

[0053] Figure 1 shows a rectangular and oblong decorative panel, in this case a floor panel 1. The floor panel has a pair of long opposite edges 2-3, and a pair of short opposite edges 4-5. Both pairs of edges are provided with coupling means 6 allowing two such panels 1 to be connected at the respective edges 2-3-4-5 wherein a locking is obtained in a vertical direction V perpendicular to the plane of the coupled panels 1, as well as in a horizontal direction H perpendicular to the coupled edges 2-3-4-5 and in the plane of the panels 1.

[0054] As shown in figure 2, the coupling means 6 at the long pair of edges 2-3 are basically formed as a tongue 9 and groove 10 having locking elements 11-12 preventing the drifting apart of the tongue 9 and groove 10. The locking element 11 at the side edge 2 comprising the tongue 9 is formed as an excavation at the lower side of the tongue 9. The locking element 12 is formed as a protrusion at the lower groove lip 13. In this case the lower groove lip 13 protrudes beyond the upper groove lip 14. In the represented case, the coupling means at the longitudinal edges 2-3 at least allow to couple the panels 1 at the respective edges by means of an angling motion.

[0055] Figure 2 further shows that the coupling means 6 are realized with so-called pretension, as per se also described in EP 1 026 341. In this case, the coupling means 6 are realized such that the lower groove lip 13, in coupled condition, is bent. The resilient restoring force exerted by the lower groove lip 13 on the bottom of the tongue 9 pushes the decorative panels 1 towards each other.

[0056] Figure 2 further shows that the panel 1 comprises a substrate 15 and a decorative top layer 16 having a thickness T of 1 millimeter or more. In this case, and is also clear from figure 3, the decorative top layer 16 is a wooden top layer having a thickness T of at least 2.5 mm. In the example, a further layer 17 is provided at the bottom of the panel. In this case, it also concerns a wooden layer.

[0057] The substrate 15 is a wood fiberboard, namely HDF of a water resistant quality, for example HDF with

a swelling of less than 15%, as measured according to EN 317:1993. Preferably, the fiberboard comprises 0.1 to 2% of paraffin or wax. The fiberboard has an average density of at least 800 kg/m^3 and is glued by means of melamine-ureumformaldehyde glue.

[0058] Figures 4 shows that the coupling means 6 at the short pair of opposite edges 4-5, in the example, have mainly the same features as the coupling means 6 at the long pair of opposite edges. It is however not excluded that the coupling means 6 at the short pair of opposite edges 4-5 could have different features. For example, the coupling means 6 at the short pair of opposite edges 4-5 could be formed as a male part and a female part that can be brought into each other by means of a substantially downward movement of the male part into the female part. Also, in such case, a locking can be obtained in said horizontal H and in said vertical direction V.

[0059] Figures 2 and 4 show, by means of a dashed line, that the longitudinal pair of opposite edges 2-3 and/or the short pair of opposite edges 4-5 can be provided with lowered edge areas, such as with bevels 38.

[0060] It is clear that in figure 3 and 5 an enlargement is shown, for a variant that has bevels 38 at both pair of opposite edges 2-3-4-5, but is for the remainder the same as the panel illustrated in figures 2 and 4.

[0061] From figures 3 and 5 it becomes clear that the decorative panels show several of the measures as defined by means of the independent aspects mentioned in the introduction.

[0062] In the example, said decorative top layer 16 comprises a wooden top layer having a wood grain structure comprising open pores 18 and a lacquer layer 19 applied on said wooden top layer, wherein said lacquer layer 19 is continuous over the surface of said wooden top layer, and follows the shape of said open pores 18. With open pores 18, it is meant that excavations are present at the top surface of the decorative panel 1 at the position where the original wood pores were present. The lacquer layer 19 follows the shape of the original pores without filling them entirely. Preferably the excavations at the top surface have a depth D1 corresponding to at least 60% of the depth D2 of the original wood pores.

[0063] Such open wood pores 18 may be obtained by brushing the wooden top layer before applying said lacquer layer 19. The brushing removes the softer material in the original wood pores. The lacquer 19 is preferably applied by means of a combination of at least a steel roller and a roller having a surface hardness below Shore A 80, and preferably between 60 and 80 shore A hardness. This may for example be a roller having a rubber surface, for example having a surface of neoprene. By using a combination of steel and softer rollers, a sufficient amount of lacquer may be applied to the surface to cover the entire surface and the pores by means of the steel roller. The softer roller is able to remove the lacquer again partially from the deeper laying excavations in the wood top layer, thereby freeing the wood pores again at least in part, and creating said open wood pores 18.

[0064] Preferably, said lacquer layer 19 is a UV cured acrylic lacquer, preferably containing a silane based additive, silicone acrylate additive and/or fluor acrylate additive. Such additives may provide for additional stain resistance and cleanability. This is of special interest in the case of the presence of open wood pores 18, as these tend to collect dirt and become dark. Preferably said lacquer layer comprises abrasion resistant particles, such as aluminum oxide particles. Such particles may have an average particle size as expressed by d50 and measured using laser light scattering granulometry of 3 to 90 micron, preferably 10 to 50 micron. The laser light scattering granulometry is performed in accordance with ISO 13320, namely by a dynamic light scattering technique using a laser having an emission wavelength of 632.8 nm and measured under a scattering angle of 90 degrees. Such granulometry may e.g. be performed with a Malvern® Mastersizer 2000 or with a Malvern® Mastersizer 3000. For executing the measurement of the particle size distribution, the respective particles may be dispersed in a liquid, such as water.

[0065] The lacquer layer 19 is preferably transparent or translucent. The lacquer layer 19 may be pigmented to create a varnished or oiled look of the decorative top layer 16.

[0066] In the example, said decorative top layer 16 is applied to said substrate 15 by means of a waterproof glue 20, in this case by means of a poly isocyanate based glue. Said glue preferably forms a continuous layer covering substantially the entire bottom of said decorative top layer 16. In so doing the glue 20 forms a watertight layer in between the decorative top layer 16 and the substrate 2. Such watertight layer is of importance to form a barrier against moisture penetrating the decorative top layer 16, for example through cracks and/or wood knots available in the wooden top layer. Also when such imperfections in the wooden top layer are filled by means of a filler material, such as putty, moisture may be transferred towards the substrate 15 in particular at such areas. It is clear that a watertight layer may also be achieved in a different manner than by means of a waterproof glue. For example a plastic layer, such as a layer or foil of PE (poly ethylene), PET (poly ethylene terephthalate), PU (polyurethane), PVC (polyvinyl chloride), PLA (poly lactic acid), or PP (polypropylene) may be applied. Of course, a whether or not water resistant glue may be used to secure the layer in between the decorative top layer 16 and the substrate 15. It is clear that such watertight layer, be it obtained through a glue layer or a plastic foil, may be dispensed with in case the substrate 15 has a minimal risk of water absorption or a high water resistance, such as, in the case where the substrate 15 is based on thermoplastic material, for example PVC, potentially filled with inorganic filler materials, such as CaCO3 based fillers, or in the case where the substrate 15 is mineral based, for example is a cement fiber board or a board based on Ca-Silicate.

[0067] Figures 3 and 5 further illustrate that at least

one lateral edge 21 of said wooden top layer 16 has been provided with a water repellent agent 22. In this example, all lateral edges 21 of said wooden top layer, as well at the long pair of opposite edges 2-3 as at the short pair of opposite edges 4-5 have been provided with a water repellent agent 22. It is however remarked that, most importantly, at least those lateral edges of the wooden top layer where the wood grain has been cut transversely, in this case at the short pair of opposite edges 4-5, are preferably provided with said water repellent agent 22. Transversely cut wood grain tends to take up moisture more easily due to a large amount of available open wood vessels. When the water is dirty, due to dust, the wooden top layer may tend to discolor. The availability of the water repellent agent 22 at these edges 4-5 can delay the discoloration effect or may even completely avoid it.

[0068] It is also shown here, that in the present example, said substrate 15 at a location immediately below said decorative top layer 16 has been provided with a water repellent agent 22 as well.

[0069] Figures 3 and 5 clearly illustrate that, in a coupled condition, the decorative top layers 16 laterally face each other with a clearance 23 in between. Said clearance 23 at the top surface is smaller than 0.2 mm, preferably 0.05 mm or 0.03 mm or smaller. Preferably, as is the case here, said clearance 23 is available between the lateral edges 21 of said decorative top layers 16 over the entire thickness T thereof, i.e. from the top surface of the decorative panel 1 at least down to said glue 20 and/or substrate 15. Said panels 1, in said coupled condition, are connected free from play, in this case, as already mentioned with a pretension. Substantially vertically extending contact surfaces 24-25 are formed at a location below said decorative top layer 15. Preferably said substantially vertically extending contact surfaces 24-25 are available immediately below said glue 20.

[0070] With regard to the size of the clearance 23, it is remarked that this is measured as the maximal opening between the laterally facing edges 21 of the decorative top layer 16. In the case of the presence of bevels 38, this is below the bevels 38. In the case of coupling means 6 having some play, this is in the connected state wherein said opening is at maximum, or in other words, said clearance 23 is defined in the connected state wherein the facing lateral edges 21 of the decorative top layer 16 are in their most mutually remote position.

[0071] As shown in figures 3 and 5, a chamber 26 may be available between the coupled edges 2-3-4-5 at a location between said vertically extending contact surfaces 24-25 and the position where the actual tongue and groove engage or above any contact surface active in said vertical direction V.

[0072] As is illustrated here, said decorative surface layers 16 may comprise a lateral edge 21 that is inclined with respect to the vertical, said inclination A from the substrate 15 to the top surface being proximally directed, i.e. towards the panel 1. Said inclination A preferably being smaller than 1°, even better smaller than 0.5°. For clarity purposes, in the figures 3 and 5 the sum of the inclinations A of two lateral edges 21 facing each other has been indicated with A'.

[0073] The combination of the clearance 23 between said lateral edges 23, the contacts 24-25 on the substrate 15, and the availability of the water repellent agent 22 at said lateral edges 21 and at the location of said contacts 24-25, together with coupling means that are practically free from play, i.e. without play or with play smaller than 0.07mm, delivers the synergistic effect of a water tight seam even in the case of a decorative top layer 16 with a thickness of 1 mm or more and/or in the case of a decorative top layer 16 based on natural material such as wood, that may have imperfections along said lateral edges 21. The minimal clearance 23 in combination with said water repellent agent 22 is able to repel water from the clearance 23. In case moisture is still able to enter the clearance 23 a tight seam at the contacts 24-25 prevents the moisture from entering the substrate 15 where it could cause damage to the integrity of the substrate 15 and/or the coupling means 6. This set-up may also prevent moisture to penetrate the seam and to accumulate below a floor covering assembled from a plurality of such decorative panels 1, such that subsequent nasty effects, such as growing of mold below the floor covering, may be avoided.

[0074] It is noted that the bent of the lower groove lip 13 in figure 2 is caused due to the provision of coupling means 6 that have an overlapping profile contour. The overlap 27 is, in this case, at least available at those surfaces 28-29 that are active in creating said locking in said horizontal direction H. As shown with the dashed line 30, the profile contours of the coupling means 6 at the two opposite edges 2-3, when drawn in a theoretical connected condition, interfere with each other at least at the horizontally active contact surfaces 28-29. The resiliency of the bent out lower groove lip 13 pushes on the bottom of the tongue 9 in an attempt to push the connected panels 1 towards each other. Preferably, this results in the vertically extending surfaces 24-25 to be pressed onto each other.

[0075] From the above it is clear that the embodiments illustrated by means of the figures 1 to 5 combine a large amount of the preferred properties (a) to (q) mentioned in the introduction, and that, in so doing, a decorative panel 1 with a wooden top surface may be obtained with a high moisture resistance, such as a moisture resistance making it suitable to be assembled together with other similar panels to a floor covering for application in wet rooms, such as kitchens and bathrooms. However, it is further clear that each of the properties (a) to (q) per se create advantages that enable wider application of decorative panels and/or with improved surface or joint properties.

[0076] Figure 6 shows a possible embodiment for the coupling means 6 at the short pair of opposite edges 4-5. In this embodiment, the coupling means 6 at the short pair of opposite edges 4-5 are formed as a male part 31

and a female part 32 that can be brought into each other by means of a substantially downward movement D of the male part 31 into the female part 32. As is the case here, in the connected state, a locking can be obtained in said horizontal H and in said vertical direction V.

[0077] The male part 31 is formed as an upper lip 33 protruding from an upper edge and having a downwardly protruding hook-shaped element 34 bordering a proximal male recess 35, and the female part 32 may be formed as a lower lip 36 protruding from a lower edge and having an upwardly protruding hook-shaped element 37 bordering a proximal female recess 39. In a connected state the downwardly protruding hook-shaped element 34 engages with the female recess 39, and the upwardly protruding hook-shaped element 37 engages with the male recess 35. The cooperation of the hook-shaped elements 34-37 and recesses 35-39 allow for said locking in said horizontal direction H. Locking elements in the form of hooks 40 and undercuts 41 are provided to prevent the separation of the male part 31 and female part 32 in the vertical direction V. Said hook-shaped elements 34-37 and recesses 35-39 are, in the example, realized in one piece with the material of the substrate 15, in this case HDF. The undercut 41 is formed by means of a separate resilient element 42 embodying an undercut 41 cooperation with the hook 40 that is realized in one piece with the material of the substrate 15. The separate element 42 is in this case positioned in a cavity 43 at the female part 32.

[0078] Figure 6 further shows that the decorative top layer 16 may be applied with a thickness T of 1 mm or below, for example, in this case with a wood veneer layer having a thickness T of about 0.6 mm. Even though represented here as being thicker than the decorative top layer 16, the layer 17 provided at the bottom of the decorative panel 1 may be of a same or similar thickness as the decorative top layer 16.

[0079] The embodiment illustrated in figure 7 comprises coupling means 6 that mainly have the same features as those described in connection with figure 6, with two main differences, which need not necessarily be combined. The first difference is that a second pair of hook 40A and undercut 41A is available at the distal end of the lower lip 36. The second difference is that the undercut 41 formed at the proximal end of the female part 32 is in this example also realized in one piece from the material of the substrate 15.

[0080] It is further noted that the inclinations A are in this case separately indicated in the figure 7, and that the decorative top layer 16 is shown here as having a thickness T being larger than 1 mm, and even larger than 2.5 mm.

[0081] The embodiment illustrated in figure 8 comprises coupling means that mainly have the same features as those described in connection with figure 7, with two main differences, which need not necessarily be combined, The first difference is that a pair of hook 40 and undercut 41 at the proximal end of the female part 32 is absent, while a pair of hook 40A and 41A at the distal end of the lower lip 36 is present, and is, in the example, the only available pair of hook and undercut. The second difference is that the horizontally active contact surfaces 28-29 are upwardly inclined towards the proximal end of the female part 32, while the horizontally active contact surfaces 28-29 of figures 1 to 7 are vertical or upwardly inclined towards the distal end of the female part 31 or groove 10, as the case may be. Such inclination of the horizontally active contact surfaces 28-29 provides for an additional locking in said vertical direction V. The inclination of the horizontally active contact surfaces 28-29, when upwardly inclined towards the proximal end of the female part 32 is preferably such that it deviates from the vertical with less than 10°, or even with 5° or less.

[0082] The coupling means of figure 8 have been demonstrated here by means of an embodiment having a decorative top layer 16 of wood veneer with a thickness T being smaller than 1 mm, for example of about 0.6 mm.

[0083] Figure 9 shows an alternative for the coupling means 6 which could for example be employed at the longitudinal pair of opposite edges 2-3. The coupling means 6 are basically formed as a tongue 9 and groove 10 having locking elements 11-12 preventing the drifting apart of the tongue 9 and groove 10. The locking element 11 at the side edge 2 comprising the tongue 9 is formed as an excavation at the lower side of the tongue 9. The locking element 12 is formed as a protrusion at the lower groove lip 13. In this case the lower groove lip 13 protrudes beyond the upper groove lip 14. In the represented case, the coupling means at the longitudinal edges 2-3 at least allow to couple the panels 1 at the respective edges by means of an angling motion. A clearance 23 is formed between the laterally facing edges 21 of the decorative top layer 16, while the coupling means 6 allow to obtain a coupling that is, at least, practically free from play, or free from play.

[0084] Figure 9 in particular illustrates that support surfaces 44-45, in this case substantially horizontally extending, may be formed at a location below said clearance 23, though above the actual engagement of the tongue 9 and the groove 10, i.e. above any contact surface active in preventing the vertical separation of the tongue out of the groove in an upward vertical direction. In this case, said support surfaces 44-45 are formed at a location below the glue 20 on a top surface of the upper groove lip 14 which is, as in the example, preferably free from said decorative top layer 16. The support surfaces 44-45 are preferably formed, as is the case here, on the material of the substrate 15.

[0085] The support surfaces 44-45 are preferably in contact. Potentially the support surfaces 44-45 may be pressed onto each other by appropriate vertical positioning of the tongue 9, groove 10 and the support surfaces 44-45.

[0086] Such support surfaces 44-45 may be practiced instead or in addition to substantially vertically extending surfaces 24-25 in order to create a tight seam that may

be realized water-tight, especially when such support surfaces 44-45 and/or substantially vertically extending surfaces 44-45 have been provided with a water-repellent agent 22, such is not shown here. In the case support surfaces 44-45 are combined with substantially vertically extending surfaces 24-25, the support surfaces 44-45 are preferably positioned closer to the decorative top layer 16 than the substantially vertically extending surfaces 24-25. The support surfaces 44-45 may be positioned, at least in part or wholly, within said decorative top layer 16.

[0087] Figure 10 shows that also the short pair of opposite edges 4-5 may comprise such support surfaces 44-45. In this case, also substantially vertically extending surfaces 24-25 are present. For coupling means 6 illustrated in figure 10 are for the remainder similar to the coupling means 6 illustrated in figure 6, and more particularly comprise a male part 31 and a female part 32 with lips 33-36, hook-shaped elements 34-37, recesses 34-37, hooks 40 and undercuts 41 as described in connection to figure 6.

[0088] The aspects and concepts disclosed in the claims and drawings may be combined with one another as long as they are not mutually contradictory.

[0089] From the above it is clear that the invention disclosed herein may be defined by means of one or more of the below numbered paragraphs, of which preferred embodiments have been described in more detail above.

1.- Decorative panel, comprising a substrate 15 and a decorative top layer 16, preferably having a thickness T of 1 mm or more, characterized in that said decorative top layer 16 comprises a wooden top layer having a wood grain structure comprising open pores 18 and a lacquer layer 19 applied on said wooden top layer, wherein said lacquer layer 19 is continuous over the surface of said wooden top layer, and follows the shape of said open pores 18.

2.- Decorative panel according to numbered paragraph 1, characterized in that said lacquer layer is a UV cured lacquer and/or an acrylic lacquer.

3.- Decorative panel according to numbered paragraph 1 or 2, characterized in that said lacquer layer 19 comprises additives, wherein said additives are preferably silane based additives, silicone acrylates and/or fluor acrylates.

4.- Decorative panel according to any of the preceding numbered paragraphs, characterized in that said lacquer layer comprises abrasion resistant particles and/or aluminum oxide particles.

5.- Decorative panel whether or not in accordance with any of the preceding numbered paragraphs, comprising a substrate 15 and a decorative top layer 16, preferably having a thickness T of 1 mm or more, characterized in that said decorative top layer 16 is applied to said substrate 15 by means of a waterproof glue 20 and/or by means of a polyisocyanate based glue, wherein said glue 20 preferably forms a continuous layer covering substantially the entire bottom of said decorative top layer 16.

6.- Decorative panel whether or not in accordance with any of the preceding numbered paragraphs, comprising a substrate 15 and a decorative top layer 16, preferably having a thickness T of 1 mm or more, characterized in that said decorative top layer 16 comprises a wooden top layer, wherein at least one lateral edge 21 of said wooden top layer has been provided with a water repellent agent 22.

7.- Decorative panel whether or not in accordance with any of the preceding numbered paragraphs, comprising a substrate 15 and a decorative top layer 16, preferably having a thickness T of 1 mm or more characterized in that said decorative panel 1 at at least two opposite edges 2-3;4-5 is provided with coupling means 6 allowing two such panels 1 to be connected at the respective edges 2-3;4-5 wherein a locking is obtained in a vertical direction V perpendicular to the plane of the coupled panels 1, as well as in a horizontal direction H perpendicular to the coupled edges 2-3;4-5 and in the plane of the panels 1, wherein at the respective edges 2-3;4-5, in a coupled condition, the decorative top layers 16 laterally face each other with a clearance 23 in between, said clearance 23 at the top surface preferably being smaller than 0.2 mm, preferably 0.05 or 0.03 or smaller, while the panels 1, in said coupled condition, are connected practically free from play or free from play, for example with a pretension.

8.- Decorative panel according to numbered paragraph 7, characterized in that a substantially vertically extending contact surface 24-25 is formed at a location below said decorative top layer 16 and/or substantially horizontally extending support surfaces (44-45) are formed at a location below said clearance (23).

9.- Decorative panel according to numbered paragraph 7 or 8, characterized in that said decorative surface layers 16 comprise a lateral edge 21 that is inclined with respect to the vertical, said inclination A from the substrate 15 to the top surface being proximally directed, i.e. towards the panel 1, wherein said inclination A is preferably smaller than 1°, even better smaller than 0.5°.

10.- Decorative panel according to any of the preceding numbered paragraphs, characterized in that said substrate 15 at a location immediately below said decorative top layer 16 has been provided with

a water repellent agent 22.

11.- Decorative panel according to any of the preceding numbered paragraphs, characterized in that a watertight layer is provided between said decorative top layer 16 and said substrate 15.

12.- Decorative panel according to any of the preceding numbered paragraphs, characterized in that said substrate 15 is a wood fiberboard, preferably MDF or HDF.

13.- Decorative panel according to numbered paragraph 12, characterized in that said wood fiberboard is of a water resistant quality.

14.- Decorative panel according to numbered paragraph 12 or 13, characterized in that said wood fiberboard comprises 0.1 to 2% of paraffin or wax.

15.- Decorative panel according to any of numbered paragraphs 12 to 14, characterized in that said wood fiberboard has an average density of at least 800 kg/m^3.

16.- Decorative panel according to any of numbered paragraphs 12 to 15, characterized in that said wood fiberboard comprises pMDI glue and or MUF (melamine-ureumformaldehyde) glue.

[0090] The present invention is in no way limited to the above described embodiments, but such decorative panels may be realized according to several variants without leaving the scope of the invention.

Claims

1. Decorative panel, comprising a substrate (15) and a decorative top layer(16), said decorative top layer comprising a wooden top layer having a thickness (T) of 2.5 mm or more, wherein said decorative panel (1) at at least two opposite edges (2-3;4-5) is provided with coupling means (6) allowing two such panels (1) to be connected at the respective edges (2-3;4-5) wherein a locking is obtained in a vertical direction (V) perpendicular to the plane of the coupled panels (1), as well as in a horizontal direction (H) perpendicular to the coupled edges (2-3;4-5) and in the plane of the panels (1), **characterized in that** at the respective edges (2-3;4-5), in a coupled condition, the decorative top layers (16) laterally face each other with a clearance (23) in between, said clearance (23) at the top surface preferably being smaller than 0.2 mm, preferably 0.05 or 0.03 or smaller, while the panels (1), in said coupled condition, are connected practically free from play or free from play.

2. Decorative panel according to claim 1, **characterized in that** said panels (1) in said coupled condition are coupled with a pretension.

3. Decorative panel according to claim 1 or 2, **characterized in that** a substantially vertically extending contact surface (24-25) is formed at a location below said decorative top layer (16).

4. Decorative panel according to any of the preceding claims, **characterized in that** said decorative surface layers (16) comprise a lateral edge (21) that is inclined with respect to the vertical, said inclination (A) from the substrate (15) to the top surface being proximally directed, i.e. towards the panel (1), wherein said inclination (A) is preferably smaller than 1°, even better smaller than 0.5°.

5. Decorative panel according to any of the preceding claims, **characterized in that** said substrate (15) at a location immediately below said decorative top layer (16) has been provided with a water repellent agent (22).

6. Decorative panel according to any of the preceding claims, **characterized in that** a watertight layer is provided between said decorative top layer (16) and said substrate (15).

7. Decorative panel according to any of the preceding claims, **characterized in that** said substrate (15) is a wood fiberboard, preferably MDF or HDF.

8. Decorative panel according to claim 7, **characterized in that** said wood fiberboard is of a water resistant quality and/or comprises 0.1 to 2% of paraffin or wax.

9. Decorative panel according to claim 7 or 8, **characterized in that** said wood fiberboard has an average density of at least 800 kg/m^3.

10. Decorative panel according to any of claims 7 to 9, **characterized in that** said wood fiberboard comprises pMDI glue and or MUF (melamine-ureumformaldehyde) glue.

11. Decorative panel according to any of the preceding claims, **characterized in that** said wooden top layer has a wood grain structure comprising open pores (18) and a lacquer layer (19) applied on said wooden top layer, wherein said lacquer layer (19) is continuous over the surface of said wooden top layer, and follows the shape of said open pores (18).

12. Decorative panel according to claim 11, **characterized in that** said lacquer layer is a UV cured lacquer and/or an acrylic lacquer.

13. Decorative panel according to any of the preceding claims, **characterized in that** said decorative top layer (16) is applied to said substrate (15) by means of a waterproof glue (20) and/or by means of a polyisocyanate based glue, wherein said glue (20) preferably forms a continuous layer covering substantially the entire bottom of said decorative top layer (16).

14. Decorative panel according to any of the preceding claims, **characterized in that** at least one lateral edge (21) of said wooden top layer has been provided with a water repellent agent (22).

15. Decorative panel according to any of the preceding claims, **characterized in that** substantially horizontally extending support surfaces (44-45) are formed at a lovation below said clearance (23).

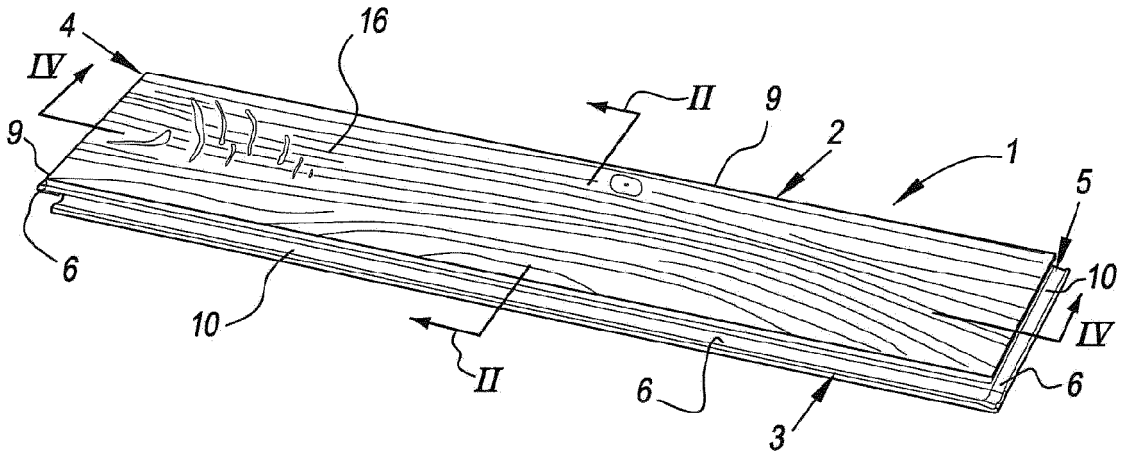

Fig. 1

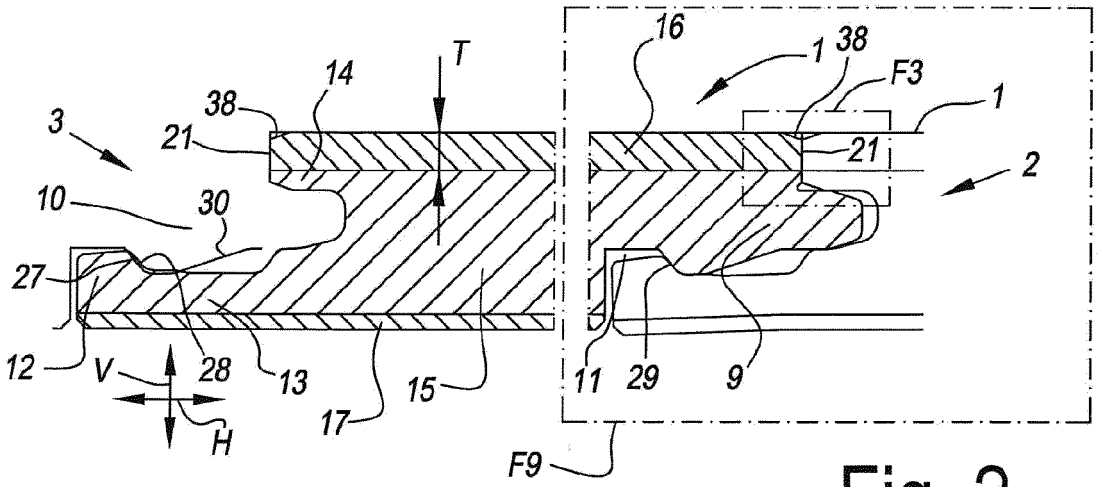

Fig. 2

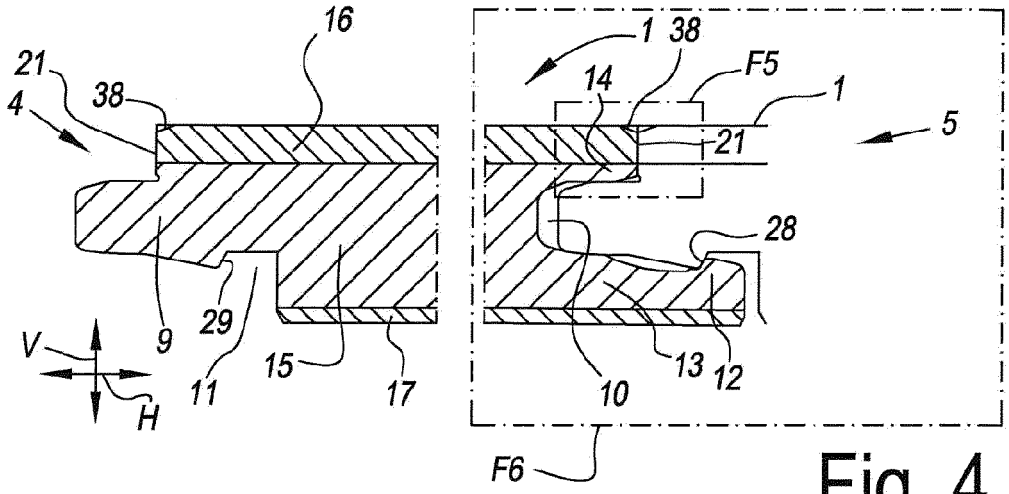

Fig. 4

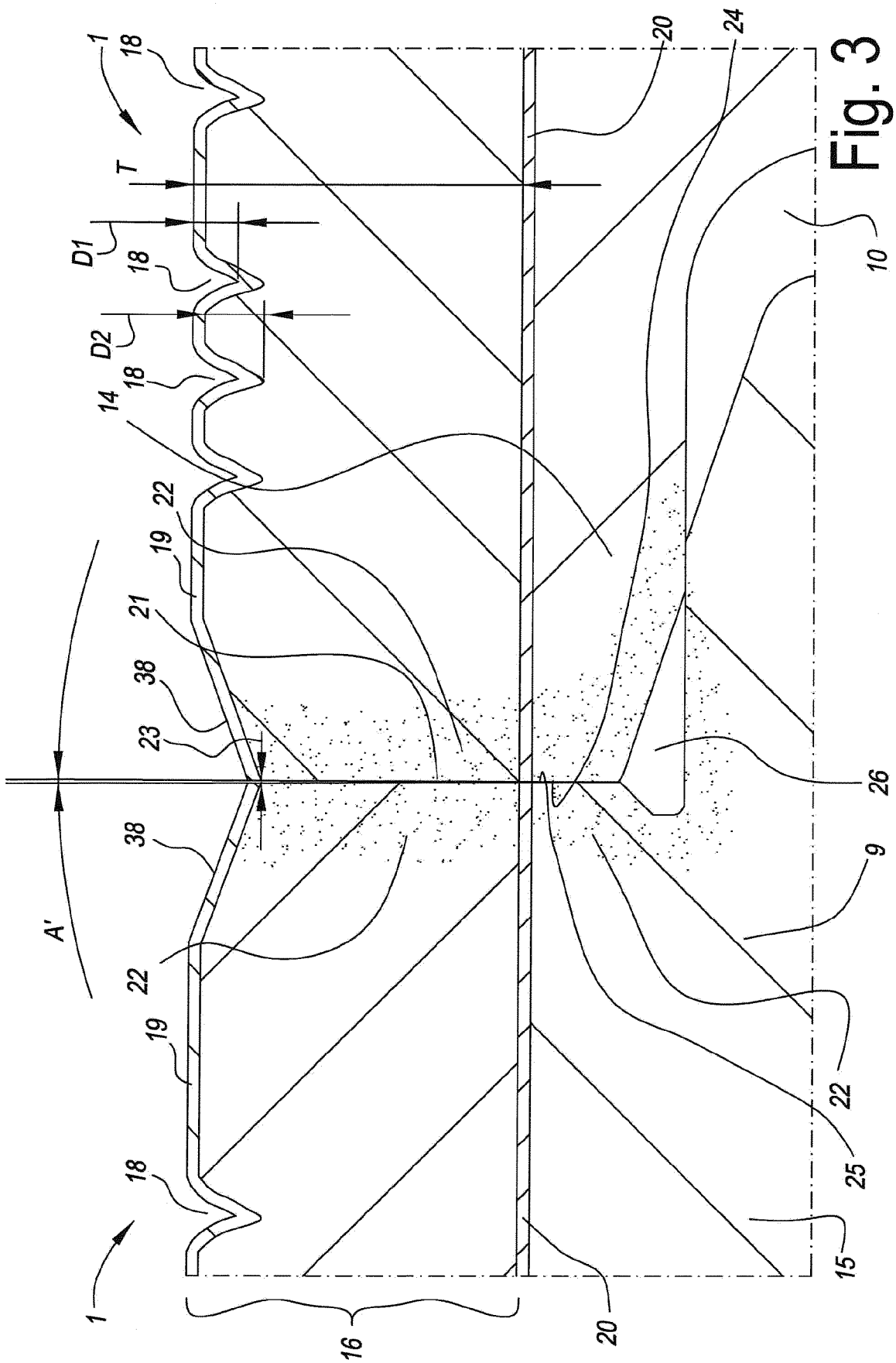
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Fig. 3

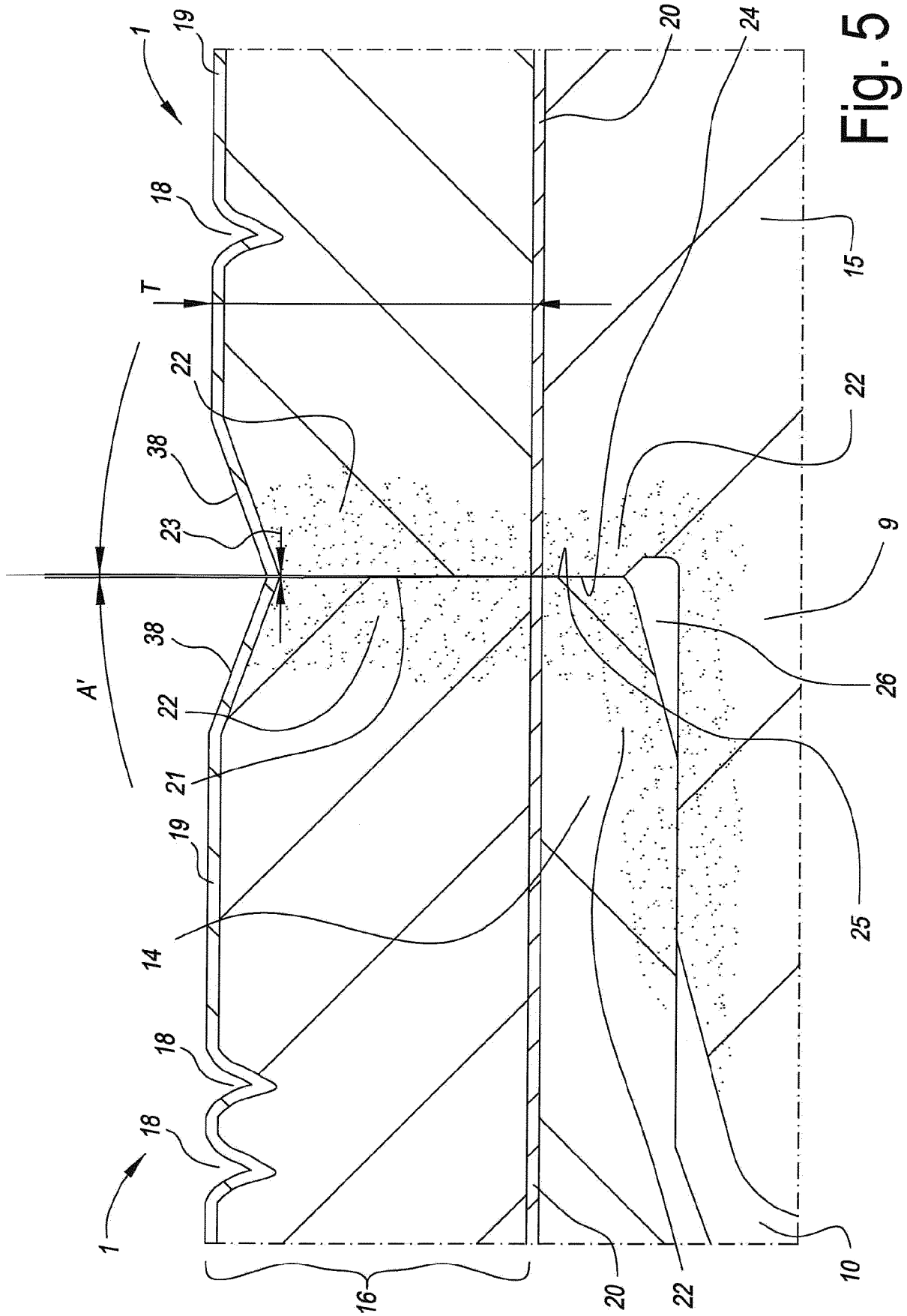

Fig. 5

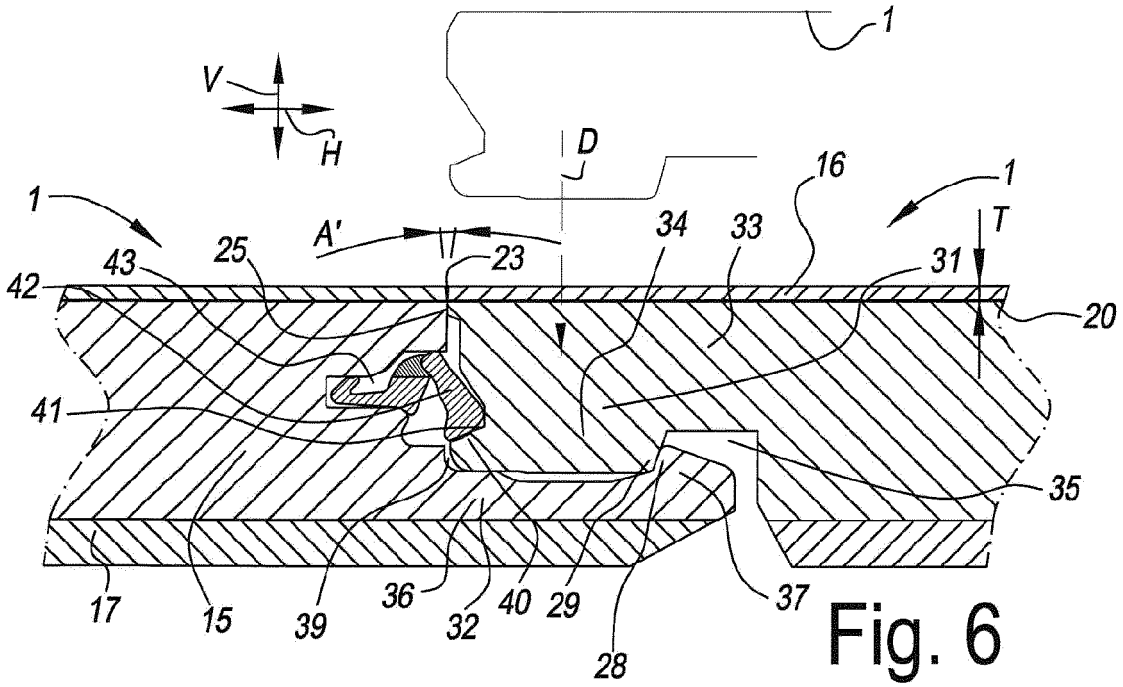

Fig. 6

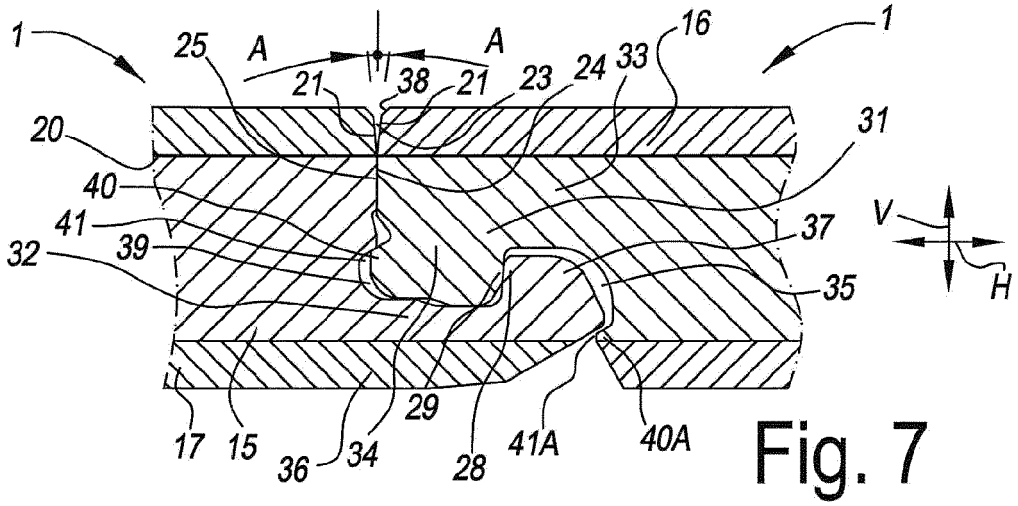

Fig. 7

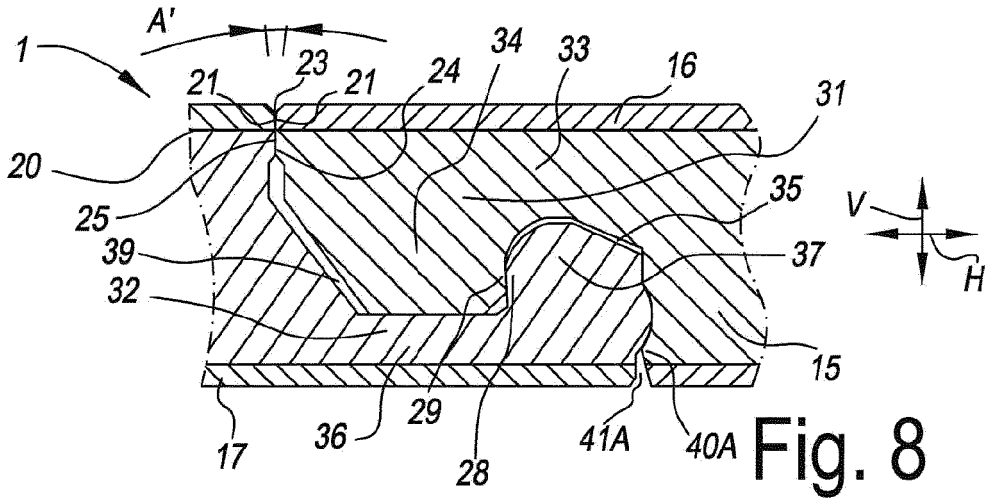

Fig. 8

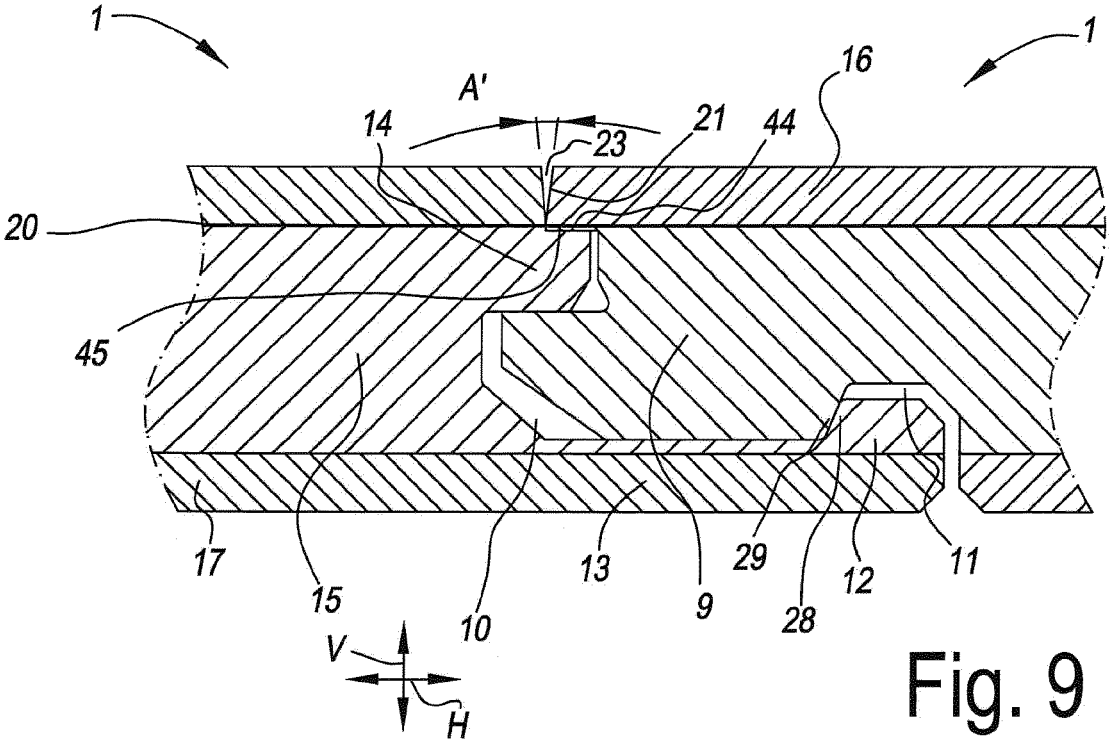
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Fig. 9

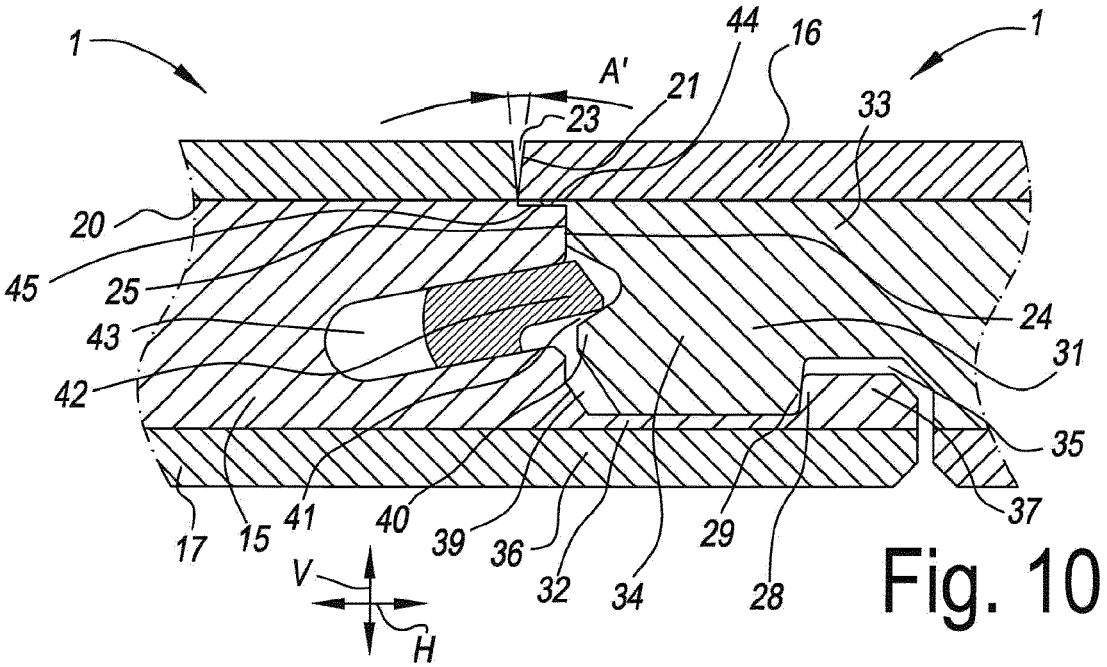
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Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 21 18 9982

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	US 10 745 921 B2 (FLOORING IND LIMITED SARL [LU]) 18 August 2020 (2020-08-18) * figures 10, 12, 13 and relating description * * column 16, line 55 - column 17, line 7 * * column 19, line 48 - line 55 * * column 24, line 16 - line 25 *	1-4	INV. E04F15/04 E04F15/02
X A	ES 2 266 423 T3 (TARKETT SAS) 1 March 2007 (2007-03-01) * figures 3 and 6 and relating description * * column 3, line 52 - line 63 *	1-3 4	
X A	US 2020/181923 A1 (QUIST KARL [SE] ET AL) 11 June 2020 (2020-06-11) * figure 10B and relating description; paragraphs [0012], [0029] - [0031], [0067], [0079], [0087], [0095] - [0096] *	1-3 4	
A	EP 3 708 739 A1 (FLOORING TECHNOLOGIES LTD [MT]) 16 September 2020 (2020-09-16) * figures 2A, 2B, 3A, 3B, 4A, 4B and relating description *	1-4	TECHNICAL FIELDS SEARCHED (IPC) E04F

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	13 January 2022	Warthmüller, Almut

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 (P04C01)

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-4

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-4

Decorative panel, comprising a substrate and a decorative top layer, said decorative top layer comprising a wooden top layer having a thickness of 2.5 mm or more, wherein said decorative panel at at least two opposite edges is provided with coupling means allowing two such panels to be connected at the respective edges wherein a locking is obtained in a vertical direction perpendicular to the plane of the coupled panels, as well as in a horizontal direction perpendicular to the coupled edges and in the plane of the panels,characterized in that at the respective edges, in a coupled condition, the decorative top layers laterally face each other with a clearance in between,
said clearance at the top surface being smaller than 0.2 mm, preferably 0.05 or 0.03 or smaller,
while the panels, in said coupled condition, are connected practically free from play or free from play.
(= claim 1 including all of the optional alternatives "said clearance at the top surface being smaller than 0.2 mm, preferably 0.05 or 0.03 or smaller", i. e. the "third [fourth?] independent aspect" according to description p. 6 l. 9-15)

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2. claims: 5-15

Decorative panel, comprising a substrate and a decorative top layer, said decorative top layer comprising a wooden top layer having a thickness of 2.5 mm or more, wherein said decorative panel at at least two opposite edges is provided with coupling means allowing two such panels to be connected at the respective edges wherein a locking is obtained in a vertical direction perpendicular to the plane of the coupled panels, as well as in a horizontal direction perpendicular to the coupled edges and in the plane of the panels,characterized in that at the respective edges, in a coupled condition, the decorative top layers laterally face each other with a clearance in between,
while the panels, in said coupled condition, are connected practically free from play or free from play (i.e. claim 1 without any of the optional alternatives "said clearance at the top surface being smaller than 0.2 mm, preferably 0.05 or 0.03 or smaller").
Features relating to an improved water resistance of the panels.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 18 9982

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REFERENCES CITED IN THE DESCRIPTION

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