US 20130104478A1

(19) **United States**

(12) **Patent Application Publication**

Meersseman et al.

(10) **Pub. No.: US 2013/0104478 A1**

(43) **Pub. Date: May 2, 2013**

(54) **PANEL FOR FORMING A FLOOR COVERING**

(75) Inventors: **Laurent Meersseman**, Kortrijk (BE); **Martin Segaert**, Ieper (BE); **Bernard Thiers**, Eine (BE)

(73) Assignee: **FLOORING INDUSTRIES LIMITED, SARL**, Bertrange (LU)

(21) Appl. No.: **13/805,405**

(22) PCT Filed: **Jun. 21, 2011**

(86) PCT No.: **PCT/IB2011/052714**

§ 371 (c)(1),
(2), (4) Date: **Dec. 19, 2012**

Related U.S. Application Data

(60) Provisional application No. 61/426,734, filed on Dec. 23, 2010, provisional application No. 61/429,845, filed on Jan. 5, 2011, provisional application No. 61/432,021, filed on Jan. 12, 2011.

(30) **Foreign Application Priority Data**

Jul. 9, 2010	(BE)	BE2010/0420
Jul. 15, 2010	(BE)	BE2010/0441
Oct. 12, 2010	(BE)	BE2010/0602
Nov. 25, 2010	(BE)	BE2010/0705
Nov. 29, 2010	(BE)	BE2010/0713
Dec. 2, 2010	(BE)	BE20100719
Feb. 23, 2011	(BE)	BE2011/0128
Apr. 28, 2011	(BE)	BE2011/0247

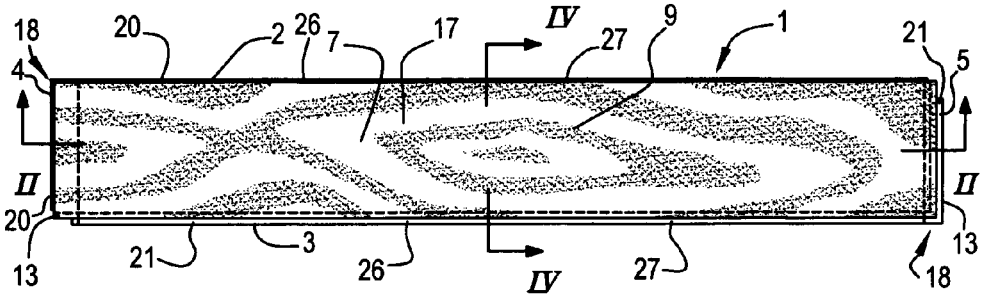
Publication Classification

(51) **Int. Cl.**
E04C 2/30 (2006.01)
E04C 2/20 (2006.01)

(52) **U.S. Cl.**
CPC ***E04C 2/30*** (2013.01); ***E04C 2/20*** (2013.01)
USPC **52/309.1**; 52/578

(57) **ABSTRACT**

A panel for forming a floor covering includes a substrate and a top layer, and is provided with coupling means defined at the edges. The substrate at the respective edges defines a profile, and a moisture-repellent or sealing covering layer is provided on the profiles. The covering layer extends over the profiles at least up to a lateral surface of the top layer. The covering layer, at least at one of the edges, is at least partially provided in an undercut performed in the lateral surface.



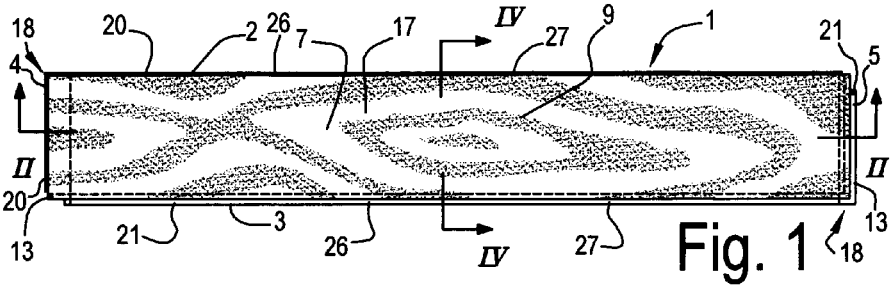


Fig. 1

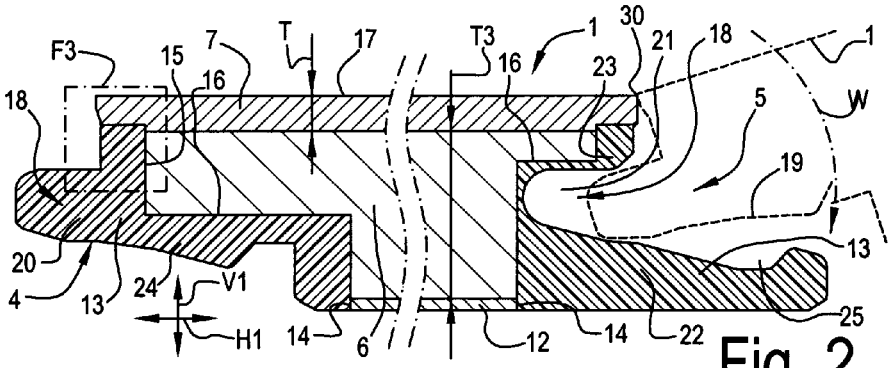


Fig. 2

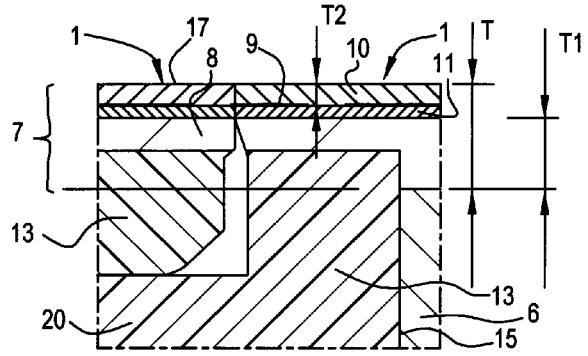


Fig. 3

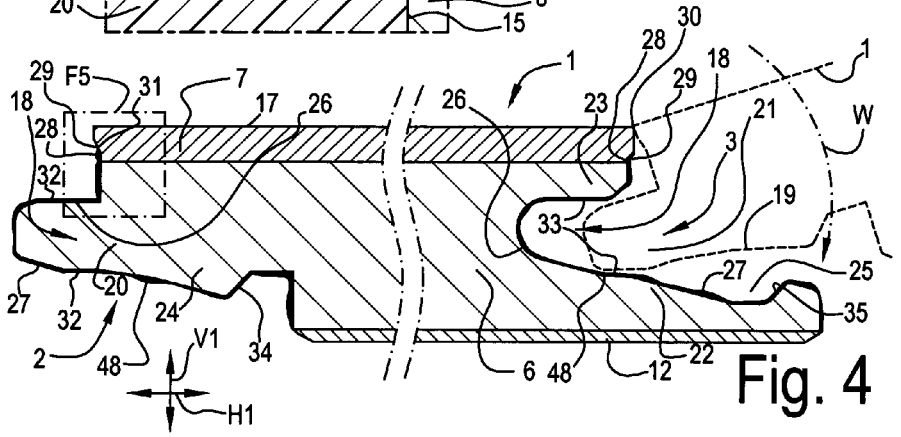


Fig. 4

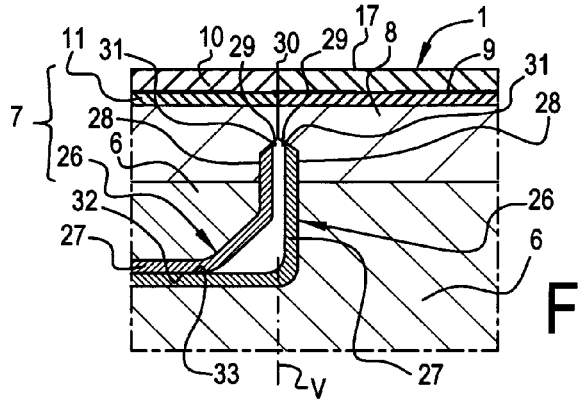


Fig. 5

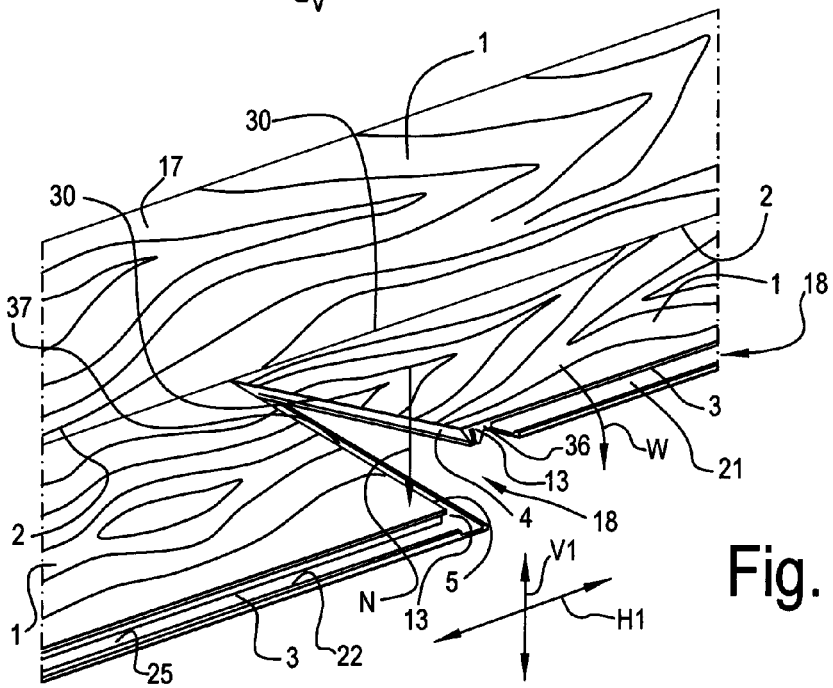


Fig. 6

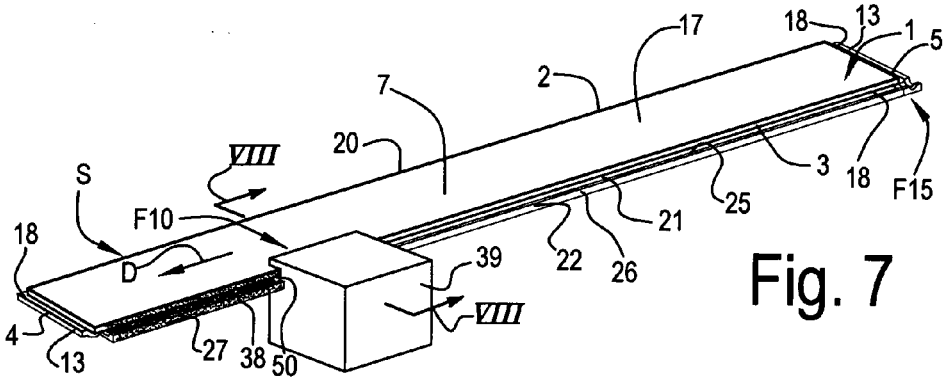


Fig. 7

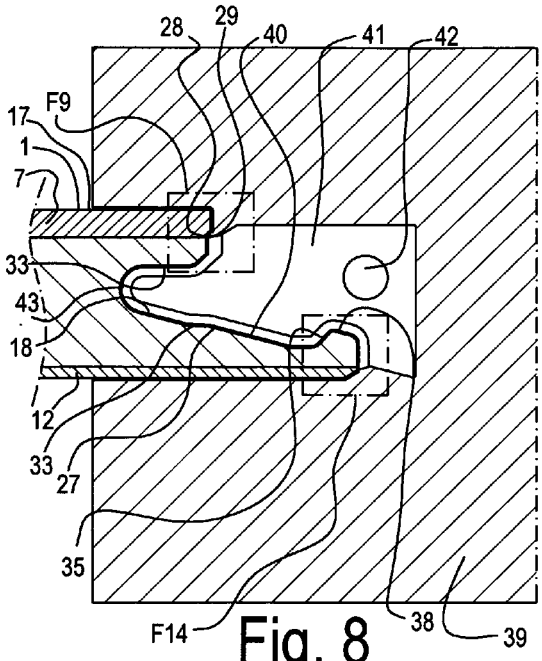


Fig. 8

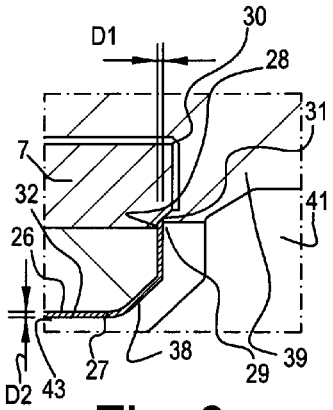


Fig. 9

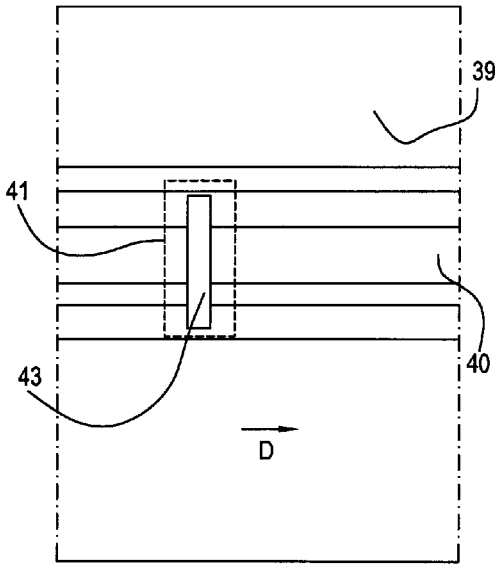


Fig. 10

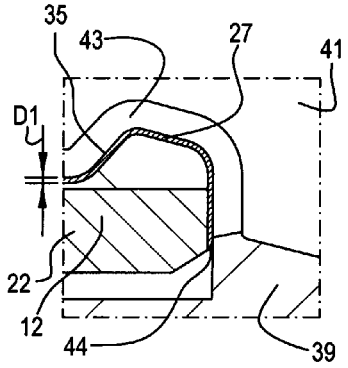


Fig. 14

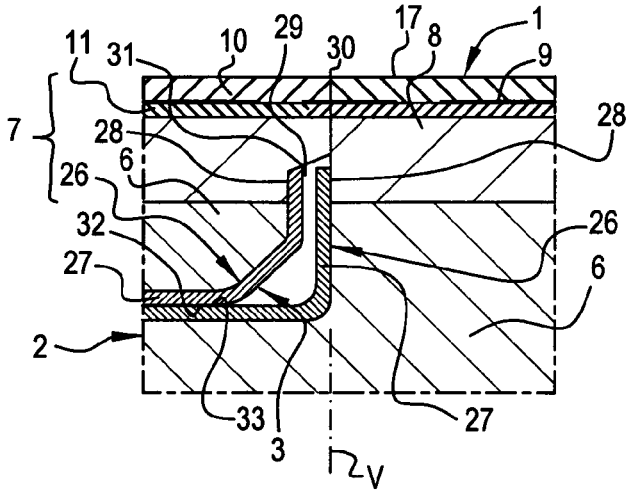


Fig. 11

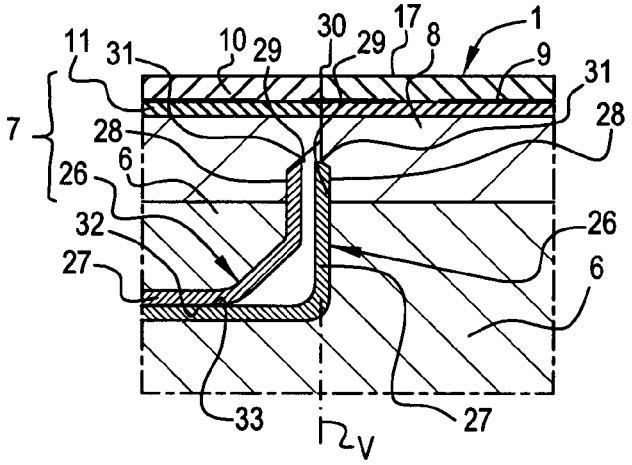


Fig. 12

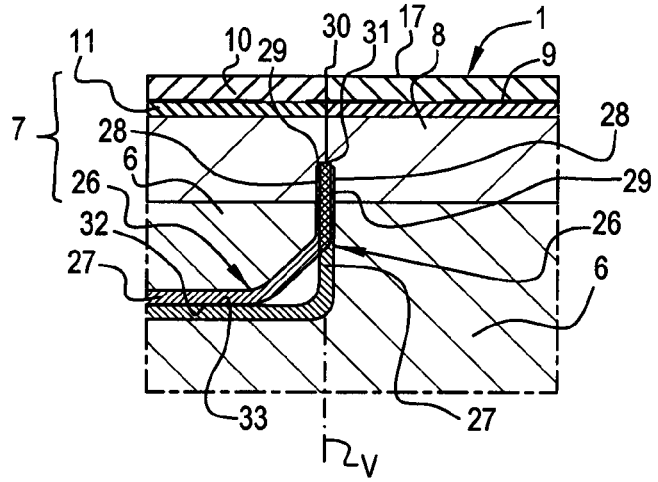


Fig. 13

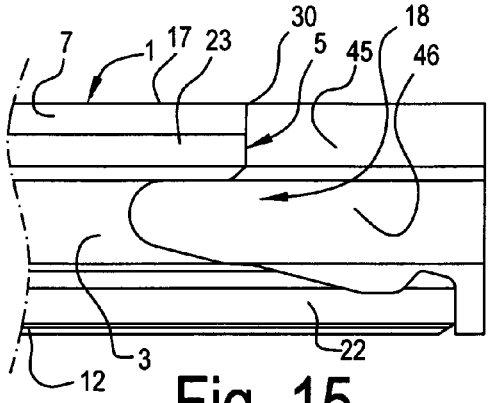


Fig. 15

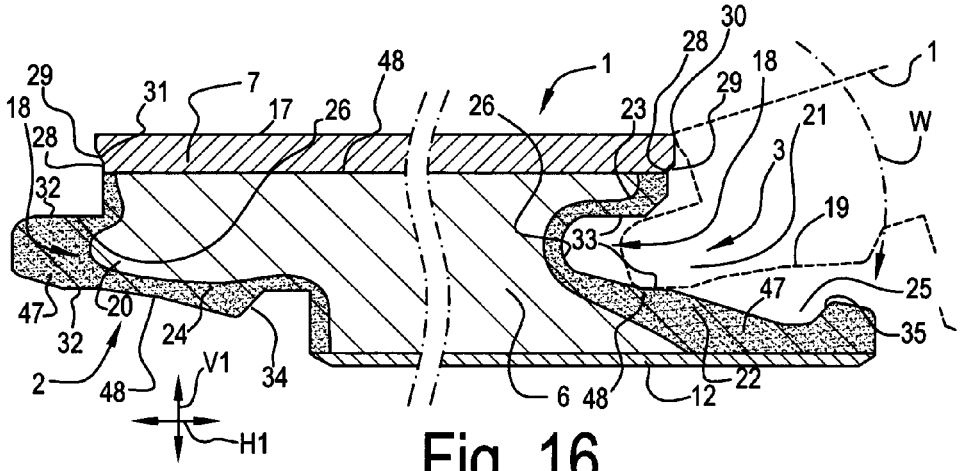


Fig. 16

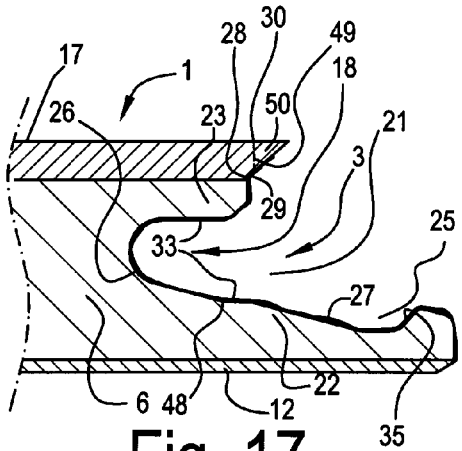


Fig. 17

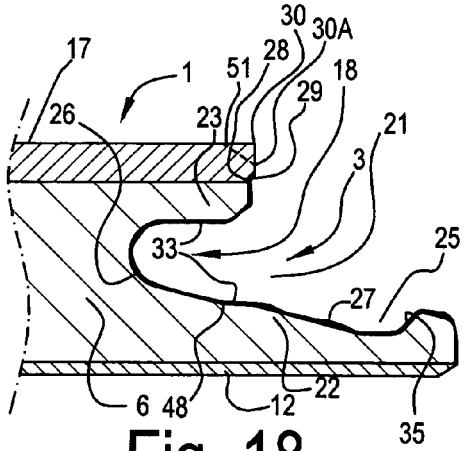


Fig. 18

PANEL FOR FORMING A FLOOR COVERING

[0001] This application claims the benefit under 35 U.S.C. 119(e) to the U.S. provisional applications No. 61/426,734 filed on Dec. 23, 2010, No. 61/429,845 filed on Jan. 5, 2011, and No. 61/432,021 filed on Jan. 12, 2011.

[0002] This invention relates to panels for forming a floor covering, as well as to a method for manufacturing panels

[0003] More particularly, the invention relates to panels which comprise a substrate and a top layer provided thereon, wherein said top layer preferably comprises a motif. As known, above such motif a transparent or translucent synthetic material layer can be provided, which then forms part of said top layer.

[0004] In particular, the present invention relates to panels which, at least at two opposite edges, are provided with coupling means allowing to couple two of such panels at the respective edges to each other, such that in the coupled condition the panels are locked in a horizontal direction perpendicular to the respective edge and in the plane of the panels, as well as in a vertical direction perpendicular to the plane of the coupled panels. Such floor panels can be applied for composing a so-called floating floor covering, wherein the floor panels are connected to each other at their edges, however, lie freely on the underlying surface.

[0005] From WO 97/47834, laminate floor panels are known for forming a floating floor covering. However, laminate floor panels have the disadvantage that they mostly are provided with a moisture-sensitive substrate, namely, MDF or HDF (Medium Density Fiberboard or High Density Fiberboard), and that the top layer provided in this substrate, when the floor covering is in use, leads to the occurrence of ticking noises. The top layer, to wit, is composed of thermo-hardening resin and leads to the development of a very hard surface layer. The substrate, too, is hard due to the high density of MDF or HDF. On average, laminate floor panels have a thickness situated between 6 and 12 millimeters, wherein the thickness of the top layer mostly is less than 0.5 millimeters or even is 0.2 millimeters or less, depending on the thickness and the number of the component layers in the top layer.

[0006] From WO 2007/113676 and WO 2007/078181, on which the preamble of claim **1** is based, it is known to cover the coupling systems of laminate floor panels with various substances, which can result in a moisture-repellent effect or a local sealing. These substances always interfere with the coupling of the floor panels. They are present as a layer between the upper edges of the coupled panels. Here, they can be visually annoying or can result in undesired effects, such as dust accumulation and the like.

[0007] From EP 1 262 609, also sealing systems are known for panels composed in layers. The systems disclosed here respectively leave portions of the substrate or even complete edges untreated. Also, the interference of the respective substance with the coupling means still leaves much to be desired.

[0008] From US 2008/078181, sealing systems are known for panels composed in layers, wherein use is made of an expanding substance, which, in the coupled condition, leads to a connection of the panel edges. Although in this manner an effective sealing can be obtained, such system still leads to uncertainties, difficulties during installing. Also, it is impossible to recuperate the floor panels and to re-install them.

[0009] From DE 200 02 744 U1 and BE 1 011 466, it is known to realize the edges of laminate floor panels with a HDF core impregnated with polyurethane, respectively MDI (Methylene Diphenyl di-Isocyanate) for obtaining a certain water-repellency on these edges. Due to the limited thickness of the laminate top layer, problems will arise with obtaining a good treatment directly below the laminate top layer.

[0010] The present invention relates to an alternative panel, which in first instance is intended as a floor panel for forming a floating floor covering. According to various preferred embodiments of the invention, also a solution is offered for one or more problems with the floor panels of the state of the art.

[0011] To this aim, the invention, according to its first independent aspect, relates to a panel for forming a floor covering, wherein said panel comprises a substrate and a top layer provided thereon, wherein the panel, at least at two opposite edges thereof, is provided with coupling means allowing to couple two of such panels to each other at the respective edges, such that in the coupled condition, the panels are locked in a horizontal direction perpendicular to the respective edge and in the plane of the coupled panels, as well as in a vertical direction perpendicular to the plane of the coupled panels, wherein the substrate at both respective edges comprises a profile and on these two profiles a moisture-repellent or sealing covering layer is provided, wherein this covering layer extends over the profiles concerned at least up to a lateral surface of said top layer, with the characteristic that said covering layer, at least at one of said edges, is at least partially provided in an undercut performed in said lateral surface of the top layer. In that the lateral surface offers room to a portion of the covering layer, the interference of such layer with the coupling means can be minimized. Moreover, a good moisture-repellent treatment of the substrate material directly underneath the top layer is obtained. By "at least partially", it is meant here that not necessarily the entire thickness of the covering layer is countersunk into said undercut. Preferably, however, this is in fact the case.

[0012] Preferably, said covering layer extends maximally up to a distance from the upper edge. In this manner, the risk of undesired effects of the covering layer at the upper surface of the floor covering is restricted. Preferably, said covering layer and/or said recess extends exclusively underneath the possible motif of the top layer. Hereby, it is obtained that they are visually not or less discernable on the surface of the floor covering.

[0013] In the cases where said covering layer in fact extends up to the upper edge or even beyond it, at the respective edge preferably a lowered edge region is provided, for example, in the form of a bevel or other chamfer. The covering layer possibly may be continued over a part of such lowered edge region or over the entire surface thereof. In this manner, too, the presence of the covering layer at the surface of the floor covering is masked or possibly usefully applied for achieving visual effects, such as the imitation of gaps.

[0014] The portion of the substance of the covering layer which is situated on a surface, for example, a lateral surface, the surface of a lowered edge region, or the upper surface of the top layer, does not necessarily have to be water-repellent. Possibly, this portion of the substance may have another color, such that a decorative effect can be achieved on the final surface of the panels.

[0015] It is also possible that the covering layer, which is applied on the profile, is interrupted at the height of the upper edge in order to obtain a good adjoining among the panels, and then continues beyond the upper edge, for example, on the surface of a chamfer.

[0016] Said covering layer preferably has a point situated closest to the upper edge of the panel, wherein said covering layer at that point is at least partially countersunk into said recess. Preferably, said point is situated in said recess of the lateral surface of the top layer.

[0017] Preferably, the actual lateral edges or lateral surfaces of the top layers of two of such panels touch each other in the coupled condition. If they do not do this, they are preferably 0.2 millimeters or less apart from each other. Hereby, it is obtained that the floor surface is free from objectionable gaps, which also attract water or other moisture. An adjoining of the lateral edges or lateral surfaces of the top layers can be obtained, for example, when the respective covering layers are completely countersunk in the respective undercut. This can also be achieved, when the respective covering layers are only partially countersunk, however, are compressible as such.

[0018] According to a particular preferred embodiment, the lateral surfaces of the top layers of two of such panels are pressed against each other in the coupled condition. Such embodiment can be obtained, for example, when use is made of coupling means which show the so-called "pretension". Coupling means which allow to develop, in the coupled condition, a force which forces the panels towards each other, are known, for example, as such from EP 1 026 341. Such force can be obtained, for example, by a portion of the coupling means, such as a groove lip in the case of coupling means substantially realized as a tongue and groove connection, wherein this portion in the coupled condition is elastically deformed and, due to its attempt to spring back, develops said force.

[0019] According to a preferred embodiment, the top layer is compressible, preferably in that it has a Young's modulus of less then 5 GPa or still better of less than 1 GPa. The compressibility of the top layer can be applied in coupled condition for realizing an extra tight connection at the height of the adjoining upper edges of the coupled panels. In combination with coupling means which show a so-called "pretension", the panels can be well pressed against each other at their upper edges.

[0020] Preferably, a top layer is applied which is based on thermoplastic synthetic material, for example, based on a vinyl compound such as PVC (Polyvinyl chloride). According to other examples, the thermoplastic synthetic material can be based on polypropylene (PP), polyethylene (PET) or polyurethane (PU). Further, use may also be made of biological alternatives, such as elastomers based on linseed oil, soya oil and/or castor oil.

[0021] Compressible top layers and/or thermoplastic top layers can lead to a better acceptable ticking noise than this is the case with a hard laminate layer.

[0022] Preferably, said top layer has a thickness of 0.3 millimeters or more. Preferably, the top layer has a thickness of maximum 4 millimeters. Still better, the top layer has a thickness situated between 0.5 and 2 millimeters. Such top layer allows a good functioning of the covering layer. Preferably, the top layer substantially consists of thermoplastic synthetic material. However, it is not excluded that a wooden top layer or other top layers might be used.

[0023] Preferably, a backing layer is provided on the lower side of the substrate, preferably of similar thickness as the top layer, for example, also having a thickness situated between 0.3 and 4 millimeters or between 0.5 and 2 millimeters. It is not excluded that a backing layer may be used which is thinner than the top layer. This is possible in particular when an annealed thermoplastic top layer is applied.

[0024] According to a particular preferred embodiment, the top layer as such comprises a plurality of layers, amongst which a decor layer with a motif and a provided there above transparent wear layer. For the decor layer, use can be made of a printed synthetic material film, for example, a PVC film, a PP film, a PU film or a PET film. For the transparent wear layer, preferably use is made of one or more layers of transparent synthetic material, such as transparent PVC. The top layer may further comprise a back layer, which is situated underneath the decor. Such back layer preferably also comprises PVC. Such back layer preferably is at least partially composed of recycled PVC, which possibly can comprise fillers, such as chalk. Preferably, on the lower side of the substrate, a backing layer is applied, which also is realized on the basis of synthetic material. Herein, this may also relate, for example, to PVC. Preferably, for the backing layer a layer of recycled PVC is applied, which possibly comprises fillers, such as chalk.

[0025] For an optimum effect of the present invention, preferably a moisture-sensitive substrate is applied, such as a wood-based substrate. Preferably, use is made of particle board, MDF or HDF (Medium or High Density Fiberboard).

[0026] Preferably, a covering layer is applied which has a global or average thickness of at least 100 micrometers. Preferably, the thickness of the covering layer is 300 micrometers or less. Preferably, any variation in the thickness of the covering layer over the profile of the respective edge is limited to a maximum of half of the average thickness. In this manner, it is obtained that the covering layer is and/or remains completely covering.

[0027] Preferably, said covering layer extends uninterruptedly from on the lateral surface of the top layer downward to at least a portion of said profile, on which, in the coupled condition of two of such panels, a contact surface is formed. Preferably, this relates to a portion of the profile, on which a contact surface is formed which takes part in the locking in vertical direction of the edges concerned. In the case of coupling means which substantially are realized as a tongue and groove connection, this preferably relates to a contact surface formed between the upper side of the tongue and the lower side of the lowermost groove lip.

[0028] Preferably, said covering layer extends over at least 75% of said profile of the substrate, and preferably over the entire profile thereof. In the case that a backing layer is provided on the lower side of the substrate, the covering layer preferably extends up onto a lateral surface of this backing layer.

[0029] With the same intention as with the first aspect, the present invention, according to a second independent aspect, relates to a panel for forming a floor covering, wherein this panel comprises a substrate and a provided thereon top layer, wherein the panel, at least at two opposite edges thereof, is provided with coupling means allowing to couple two of such panels at the respective edges to each other, such that in the coupled condition the panels are locked in a horizontal direction perpendicular to the respective edge and in the plane of the coupled panels, as well as in a vertical direction perpendicular to the plane of the coupled panels, wherein the substrate shows a profile on both edges concerned and on these two profiles a moisture-repellent or sealing covering layer is applied, wherein this covering layer extends over the respective profiles at least up onto a lateral surface of said top layer,

characterized in that said top layer has a thickness of 0.3 millimeters or more. Such thick top layer allows to form a covering layer which seals the transition between the top layer and the substrate very well, whereas the risk of soiling the upper surface of the panel can be minimized. The thickness of the top layer in fact allows the smooth forming of a covering layer which stops at a distance below the upper surface. It is clear that the present aspect is not limited to such covering layers. Preferably, the second aspect in fact relates to panels which, at their upper surface, are free from the material of the covering layer.

[0030] Preferably, for the top layer, in this second aspect, use is made of one or more layers, which substantially consist of thermoplastic synthetic material, such as PVC, PP, PET or PU. According to the most preferred embodiment thereof, the top layer comprises at least three synthetic material layers, namely, a printed decor-forming synthetic material film, a transparent wear layer provided thereon, and a back layer situated underneath the decor. According to another example, the top layer can consist substantially of wood, such as of a wooden layer with a thickness of 1.5 to 5 millimeters, or substantially of a composition of paper and thermo-hardening resin, such as of a HPL laminate board (High Pressure Laminate).

[0031] Also according to the above most preferred embodiment, said top layer preferably relates to an annealed thermoplastic layer. By "annealed" (English: annealed) is meant that the respective top layer is treated in order to minimize possible residual tensions. This can be performed, for example, by heating the respective top layer up to or above the glass transition temperature, mostly indicated as Tg, and by letting this top layer cool down slowly. By this process, the present internal tensions in the material of the top layer can at least partially relax. Preferably, annealing is performed tension-free, such that the remaining tensions are at least 90 percent lower than the original residual tensions or even are negligible. Because the top layer is annealed, it is obtained that the risk of migration effects of the edge of the edge portion towards the surface of the panel is minimized. In that the possible residual tension after annealing is smaller, it is achieved that the top layer is pulling less at the substrate.

[0032] Of course, it is not excluded that the panel of the second independent aspect shows one or more of the characteristics of the first aspect and/or the preferred embodiments thereof.

[0033] As aforementioned, said covering layer preferably extends maximally to a distance from the upper edge. In this manner, the risk of undesired effects of the covering layer on the upper surface of the floor covering is restricted.

[0034] Preferably, the covering layer does not or almost not interfere with the coupling means. This can be obtained by completely or partially providing the covering layer in an undercut, for example, an undercut in the lateral surface of the top layer. Preferably, the covering layer stops at a distance underneath the upper surface, for example, in a recess provided for this purpose.

[0035] According to all aspects, said covering layer preferably is thicker than 100 μm, however, preferably also thinner than 10% of the thickness of the substrate material at the height of the respective edge of the panel.

[0036] Preferably, the covering layer follows the respective profile. This means that the covering layer has an almost uniform thickness and therefore has a surface which maintains an almost constant distance to said profile.

[0037] Preferably, the covering layer is provided calibrated on at least a portion of said profile. Preferably, it is at least provided calibrated on the portions where in the coupled condition a contact surface is created between the edges of the coupled panels, with the exception of the preferred contact surface at the coupled upper edges.

[0038] Preferably, a certain thickness variation in the covering layer in the longitudinal direction of the respective edge is limited to a maximum of 20% or less.

[0039] Preferably, the panels of the invention allow that they can be separated from each other without considerable damage, or at least without a damage which would prevent re-installing them. Separating them can be performed, for example, by shifting the panels in the longitudinal direction of the edges along each other, or by separating the panels from each other by means of a turning movement along the respective edges.

[0040] It is clear that the covering layers of the invention preferably are provided at the edges at the factory. This preferably relates to covering layers which are made integrated with the substrate in that they are adhered to the substrate, preferably without additional attachment means. For example, for the covering layers use can be made of a substance which will harden after the application thereof on the profile of the substrate.

[0041] For the substance of the covering layers, use can be made, for example, of hot-melt glue, such as with a hot-melt glue based on polyurethane, a thermoplastic polyurethane glue or an irreversibly hardening polyurethane glue, and/or with a synthetic material which is formed on the basis of a plurality of components, and/or with a polyamide-based synthetic material or hot-melt glue. Preferably, use is made of an irreversibly hardening, for example, thermo-hardening, substance, which is provided on the respective edge to be covered in liquid or paste-like form and hardens there.

[0042] For the application of the substance of the covering layers, use can be made of jetting and/or spraying techniques.

[0043] With the same intention as with the first and second aspect of the present invention, the present invention, according to a third independent aspect, relates to a panel for forming a floor covering, wherein this panel comprises a wood-based substrate and a top layer provided thereon, wherein the panel, at least at two opposite sides thereof, is provided with coupling means allowing to couple two of such panels to each other at the respective edges, such that in the coupled condition, the panels are locked in a horizontal direction perpendicular to the respective edge and in the plane of the coupled panels, as well as in a vertical direction perpendicular to the plane of the coupled panels, wherein the substrate comprises a profile on both respective edges and the substrate, at the location of these profiles, is impregnated with a moisture-repellent or sealing substance, with the characteristic that for said top layer, use is made of one or more layers substantially consisting of thermoplastic synthetic material. Preferably, the substrate, at least at the location of said profiles, is impregnated with an isocyanate-based impregnating agent, such as with an agent on the basis of MDI (methylene diphenyl diisocyanate). Preferably, the top layer has a thickness of at least 0.2 millimeters and still better of 0.3 millimeters, 0.5 millimeters or more.

[0044] When applying thicker top layers, the impregnation of the substrate can be obtained in a more certain manner also directly underneath the top layer. A thicker top layer allows, when providing the impregnating agent, working partially

overlapping with the top layer, such that the underlying substrate material is practically certainly treated. According to another possibility, the top layer can also be provided after having performed the impregnation. In both cases, the thicker top layer minimizes or prevents any migration or showing of the underlying impregnated zone in the surface of the panel.

[0045] It is clear that for the thermoplastic layer, similar layers can be applied as in the case of the first and/or the second aspect.

[0046] Preferably, the top layer is provided on the substrate by means of a separate adhesive layer, which preferably comprises polyurethane glue, such as polyurethane dispersion glue. In combination with an impregnation with isocyanate-containing impregnating agent, such as MDI, herein very advantageous effects are obtained, in particular in respect to the quality of the adherence of the top layer on the impregnated areas. In this manner, the risk of the occurrence of delamination during production, for example, during treatment of the respective edges, or during the use, for example, during installing, of the panels can be minimized. Delamination namely is frequent with coupling means allowing a coupling by means of a substantially downward movement, namely in so-called "push-lock" couplings, and/or when loaded by office chairs and other material on castors.

[0047] Preferably, the treated surface of the substrate does not comprise any covering layer worth mentioning, but relates to an almost pure impregnation. Preferably, at least the volume of treated material internally within the substrate is larger than the volume of the possibly present superficial covering layer. If a covering layer is already present, it preferably has a global or average thickness of less than 30 micrometers. It is clear that such impregnation does not or practically not interfere with the function of the coupling means.

[0048] Preferably, said treated surface, which is impregnated according to the third aspect, extends uninterruptedly from the lower side of the top layer downward at least to a part of said profile on which in coupled condition of two of such panels a contact surface is formed. Preferably, this relates to a part of the profile on which a contact surface is formed which participates in the locking in vertical direction of the respective edges. In the case of coupling means which substantially are realized as a tongue and groove connection, this preferably relates to a contact surface formed between the upper side of the tongue and the lower side of the lowermost groove lip.

[0049] Preferably, said impregnation extends over at least 75% of said profile of the substrate, and preferably over the entire profile thereof. In the case that a backing layer is provided on the lower side of the substrate, the treated substrate surface preferably extends to the upper side of this backing layer.

[0050] According to all aspects of the invention, in the coupled condition of the panels preferably contact surfaces are formed on the covering layer or the impregnated or treated surface of the substrate, respectively. Preferably, all contacts between the coupled panels are formed on the covering layer or the impregnated or treated surface, with the exception of the desired direct contact between the upper edges.

[0051] It is clear that, in the case of quadrangular panels, coupling means can also be provided on the other pair of opposite edges. At this other pair, thus, also measures can be performed for minimizing the negative influence of an exposure to water or moisture. For example, similar measures can be performed on all edges. According to another example, on the other pair of edges an edge portion of synthetic material is applied, different from the substrate material, wherein the synthetic material extends at least over 80 percent of the thickness of the substrate. Preferably, the attachment of the edge portion to the substrate and/or to the top layer is obtained at least partially by hardening said synthetic material. Due to the fact that the synthetic material extends at least over 80 percent of the thickness of the substrate, the moisture-sensitiveness of the respective edge already is limited to a considerable extent. In combination with the attachment by hardening, separate glue layers can be avoided. Moreover, such attachment can lead to a local impregnation of the substrate at the respective edge, such that also on the substrate side of the interface between substrate material and edge portion a reduced moisture-sensitiveness can be obtained. By this, the moisture-sensitiveness of the possible substrate material on the edge, i.e. 20 percent of the thickness or less, is restricted as well. Preferably, the synthetic material extends over 90, 95% or more of the thickness of the substrate material, such that the moisture-sensitiveness is restricted even more.

[0052] Preferably, the synthetic edge portion also extends at least over 80 percent, 90 percent, 95 percent or more of the contour of the possibly profiled edge region. Preferably, the entire edge of the substrate material is covered by the synthetic edge portion, such that no exposed surfaces of the substrate material are present on the edge concerned.

[0053] Preferably, at least the attachment of the edge portion to the substrate is obtained by hardening said synthetic material. Preferably, this herein relates to a direct attachment without intermediate material layers and/or substances, such as glue. Preferably, in combination therewith, also the attachment of the edge portion to the top layer is obtained by hardening said synthetic material, preferably this here also relates to a direct attachment.

[0054] Preferably, the synthetic material extends at least over the entire thickness of the substrate material. In this manner, moisture-sensitiveness of possibly remaining substrate material on the respective edge is excluded to a maximum, and additional covering layers with water-repellant substance of remaining substrate material on the respective edge are not required.

[0055] Preferably, said synthetic material relates to a polyurethane, preferably obtained on the basis of a two-component system, such as on the basis of polyol and isocyanate. Polyurethane can be adapted to different hardnesses and is a flexible material in respect to business possibilities. For example, it is easy to pour. By means of such two-component system, a chemical adherence to wood particles can be obtained, which possibly can be present in the substrate material. A chemical adherence is to be preferred over a mechanical adherence in respect to the strength thereof.

[0056] Preferably, said synthetic material relates to a thermo-hardening synthetic material, for example, a material on the basis of polyurea, epoxy or polyurethane. Thermo-hardening materials require no extrusion process for processing them and allow smoother production processes.

[0057] Preferably, the panel of the invention, according to all aspects thereof mentioned herein above and also herein below, has a printed decor. Herein, this may relate to a decor printed on a carrier material, such as on a paper or synthetic material sheet, or to a decor which, with the possible intermediary of primer layers, is obtained by performing a print on said substrate. For the synthetic material sheet, use can be

made of PVC (PolyVinyl Chloride), PE (PolyEthylene) or PUR (PolyURethane) film. Of course, it is not excluded that use should be made of another decor than a printed decor, such as cork, linoleum, a wood veneer or other wooden top layer.

[0058] Preferably, the top layer, according to all aspects of the invention mentioned herein above and also herein below, has a thickness of at least 0.5 millimeters. Such top layer is ideal for obtaining a water-repellent effect immediately underneath the top layer, by means of a covering layer extending up to a lateral surface of the top layer, without necessarily having to extend up to the upper edge of the panel.

[0059] According to all aspects of the invention mentioned herein above and also herein below, the coupling means preferably are performed as a male coupling part at one of said edges and a female coupling part on the opposite edge, wherein these coupling parts can be provided in each other by means of a turning movement along the respective edge, by means of a shifting movement in substantially horizontal direction of the panel edges towards each other and/or by means of a downward movement of the male coupling part towards the female coupling part. Preferably, said female coupling part is formed at a flange which extends at the respective edge in horizontal direction, preferably beyond the top layer, and forms a seat for the male coupling part, whereas said male coupling part is formed at a flange which is situated at the upper side of the panel and comprises a profile at the lower side, which can cooperate with said seat. Preferably, the male coupling part substantially is performed as a tongue, whereas the female coupling part substantially is formed as a groove, flanked by an upper and a lower lip, wherein said lower lip then forms part of said flange. In such case, the tongue and groove are performed such that they, by their cooperation, effect at least said locking in vertical direction. Preferably, the upper and/or the lower lip has locking parts, which cooperate with corresponding locking parts on said tongue, such that hereby said locking in horizontal direction can be obtained.

[0060] It is clear that according to all aspects mentioned herein above and also herein below, preferably a moisture-sensitive substrate is applied, such as a substrate which comprises wood particles, such as wood chips and/or wood fibers, bonded by a binding agent. Such substrate materials are, for example, wood particle board, wood fiberboard, such as MDF or HDF (Medium or High Density Fiberboard). The moisture-sensitiveness of substrates with wood particles substantially is determined by the weight ratio between wood particles and binding agent. Practically, it has been found that a certain moisture-sensitiveness already manifests itself when this weight ratio is 5:95 (wood:binding agent). With such weight ratio, we would rather speak of synthetic material filled with wood particles, such as so-called WPCs (Wood Plastic Composites). This moisture-sensitiveness rises when the amount of wood particles is increased. In the case of MDF and HDF, at least 75 percent by weight of wood are applied, by which a high moisture-sensitiveness arises, even when we talk about MDF or HDF of the waterproof type. The moisture-sensitiveness of all these substrates manifests itself by the capacity of absorbing water and, as a result of this absorption, of showing a swelling in thickness, either homogenous or exclusively at the edges.

[0061] For the substrate, preferably use is made of a board material having a thickness situated between 3 and 10 millimeters, and still better between 4.5 and 8 millimeters.

[0062] Where in the first and in the second aspect, as well as in the herein below also mentioned fourth aspect, a water-repellent substance is mentioned, preferably use is made of a substance applied in liquid or paste-like form, which hardens or dries on the panel. For example, use can be made of a substance comprising paraffin, wax, UV lacquer, a fluorinated polymer or copolymer, or hot-melt glue. Preferably, use is made of an irreversibly hardening, for example, thermo-hardening substance, which is provided on the respective edge to be covered in liquid or paste-like form and hardens there, such as a polyurethane- or polyamide-based synthetic material and/or hot-melt glue.

[0063] In the case that for the water-repellent substance, a hot-melt glue is applied, preferably a hot-melt glue, such as a thermo-hardening hot-melt glue based on polyurethane or polyamide, is applied, having a setting time of less than half a minute or still better of less than 10 seconds, for example, 5 seconds or less.

[0064] Where in all aspects mentioned herein above and also herein below, an edge portion is mentioned, a structural edge portion is intended. Preferably, such edge portion extends perpendicular to the profiled edge portion, over a distance of at least 1 or 2 millimeters.

[0065] According to all aspects, the application of the water-repellent substance or the impregnating agent can be performed by means of a method wherein the respective panels, at least at one edge, are provided with a removable auxiliary piece and the method comprises at least the step of covering or impregnating, with a water-repellent substance, an edge extending transverse to the edge with the removable auxiliary piece. Preferably, the auxiliary piece, after performing the covering operation or impregnation, is removed again and possibly is re-used.

[0066] The presence of the auxiliary piece on at least one edge allows obtaining the covering layer or the impregnation on the transverse edge in a more reliable manner. Namely, applying the covering layer or the impregnating agent can be performed with a run-up and/or run-down on the lateral surface of the auxiliary piece. Preferably, such lateral surface shows a profile which corresponds to the profile of the edge to be covered. In the case that the edge where the auxiliary piece is provided, is provided with a profile, for example, with a profile of at least a portion of a coupling means, use can be made of an auxiliary piece which is complementary to or anyhow at least can cooperate with this profile. In such case, the auxiliary piece can also relate to an equal or similar floor panel, which comprises the complementary coupling means of the respective edge. In this manner, it is possible that not each time a run-up and/or run-down is required, for example, when in this manner, floor panels which are coupled together, for example, snapped together glue-free floor panels, are treated in a train of two or more one after the other with said water-repellent substance.

[0067] The presence of such auxiliary piece can also minimize or reduce the risk of staining of the edge in which it is provided. Such staining might occur, for example, with the absence of the auxiliary piece, during the run-up and/or run-down on protruding parts of the edge which extends transverse to the edge to be covered. Examples of such protruding parts are tongue parts or groove lips of coupling means present at this edge. A staining of this edge, more particularly of the coupling means present there, can lead to difficulties when coupling two of such panels at this edge and therefore best will be avoided. Preferably, an auxiliary piece is applied

on two opposite edges of the panel, and the covering by means of the water-repellent substance or the impregnation preferably extends uninterruptedly between the lateral surfaces of both auxiliary pieces.

[0068] According to a fourth independent aspect thereof, the present invention also relates to a method allowing, amongst others, realizing the floor panels of the first, second, and/or the third aspect in a smooth manner. To this aim, the invention relates to a method for manufacturing panels, wherein these panels comprise at least a substrate and a top layer provided thereon, and wherein these panels, at least at two opposite edges, are provided with a profile and the profile comprises coupling means by which these panels can be coupled to other similar panels, such that in the coupled condition of two of such panels, on the respective edge, a locking is obtained in a horizontal direction perpendicular to the edge and in the plane of the panel, as well as in a vertical direction perpendicular to the plane, wherein the method comprises at least the step of, with a water-repellent substance, covering or impregnating at least one of said profiled edges, with the characteristic that said substance is applied at least on a part of the profiled edge region before the final upper edge of the respective edge region is formed. As the final upper edge is realized only after applying the substance, any staining of the upper surface when forming the upper edge can be removed. Preferably, the final upper edge is formed by means of a cutting treatment, such as a milling treatment or laser cutting treatment, wherein at least a material portion of said top layer and possibly of the underlying substrate is removed. In such case, possible staining of the top layer near the respective edge region also can be removed by means of the same cutting treatment. In the case of a covering, this latter preferably extends from on the substrate onto a lateral surface of the top layer, for example, such as in the first and/or the second aspect, before the final upper edge is formed. In this manner, the removal of any staining is enhanced even more. Still better, such covering extends at least up to or even onto the upper surface of the top layer, before said upper edge is formed. Preferably, by means of said cutting treatment, a straight or approximately straight lateral surface of the top layer is obtained. According to an alternative, also a chamfer, such as a bevel, can be formed.

[0069] It is noted that by "final upper edge" the upper edges of the panel are intended, which adjoin each other when two of such floor panels are coupled to each other at the respective edges.

[0070] Preferably, in the case of a covering, this covering is provided calibrated on at least a portion of the profiled edge region and/or that the obtained covering is post-treated at least on a portion of the profiled edge region. By the calibrated applying and/or the post-treating of the covering layer, an increased accuracy of the coupling means is obtained. Preferably, said portion of the profiled edge region relates at least to a portion which, in a coupled condition of two of such panels, forms a contact surface, such as, for example, the contact surfaces responsible for the vertical locking and/or the contact surfaces responsible for the horizontal locking. Preferably, in coupled condition a locking without play is obtained, such that the upper edges of the coupled panels as well as all aforementioned contact surfaces, preferably at least the contact surfaces responsible for the horizontal locking, adjoin against each other. Possibly, a certain tension force can be applied, such as the tension force described in WO 97/47834 and known better as "pretension".

[0071] Preferably, the calibrated application of said moisture-repellent substance is realized by applying a liquid or paste-like substance, which is dosed by means of a template or form mold on the respective portions of the edge region. The excessive material on the portions to be calibrated preferably is collected on adjacent portions of the profiled edge region and/or on the lower side of the panel. Preferably, the respective adjacent portions, where the excessive material is collected, in coupled condition of two of such panels define a space or air chamber between the respective coupled edge regions.

[0072] Preferably, the fourth aspect is applied for manufacturing floor panels, the top layer of which substantially consists of thermoplastic synthetic material, such as a top layer which is composed of one or more thermoplastic layers. According to an alternative, use can also be made of a laminate top layer comprising one or more paper layers provided with thermo-hardening synthetic material, amongst which, for example, a paper layer with a printed motif.

[0073] With the intention of better showing the characteristics of the invention, hereafter, as an example without any limitative character, some preferred embodiments are described, with reference to the accompanying drawings, wherein:

[0074] FIG. **1** represents a panel with the characteristics of the invention;

[0075] FIG. **2**, at a larger scale, represents a cross-section according to the line II-II represented in FIG. **1**;

[0076] FIG. **3**, at a still larger scale, represents a view on the area indicated by F**3** in FIG. **2**;

[0077] FIG. **4**, at the same scale as FIG. **2**, represents a cross-section according to the line IV-IV represented in FIG. **1**;

[0078] FIG. **5**, at the same scale a FIG. **3**, represents a view on the area indicated by F**5** in FIG. **4**;

[0079] FIG. **6** represents the installation of some panels with the characteristics of the invention;

[0080] FIG. **7** in perspective represents how the panels of the invention can be manufactured;

[0081] FIG. **8**, at a larger scale, represents a cross-section according to the line VIII-VIII represented in FIG. **7**;

[0082] FIG. **9**, at a larger scale, represents a view on the area indicated by F**9** in FIG. **8**;

[0083] FIG. **10** represents a view according to the direction F**10** indicated in FIG. **8**;

[0084] FIGS. **11** to **13** represent a view similar to FIG. **5**, however, for variants;

[0085] FIG. **14**, at a larger scale, represents a view on the area indicated by F**14** in FIG. **8**;

[0086] FIG. **15** represents a view according to the arrow F**15** represented in FIG. **7**;

[0087] FIG. **16**, in a view similar to that of FIG. **4**, represents an embodiment having, amongst others, the characteristics of the third aspect of the invention;

[0088] FIGS. **17** and **18**, in a view similar to that of the right-hand part of FIG. **4**, schematically demonstrate the method of the fourth aspect of the invention.

[0089] FIG. **1** represents a floor panel **1** with the characteristics of, amongst others, the first aspect of the invention. In this case, this relates to a rectangular and oblong floor panel **1** with a pair of long sides or edges **2**-**3** and a pair of short sides or edges **4**-**5**.

[0090] FIG. **2** represents that the floor panel **1** is of the type which comprises at least a substrate **6** and a top layer **7**

provided thereon. In the example, the top layer **7** has a thickness T of at least 0.3 millimeters, in this case even 0.5 millimeters or more. Here, specifically an annealed thermoplastic top layer is concerned, which substantially consists of PVC.

[0091] FIG. **3** shows that the thermoplastic top layer **7** preferably as such is composed of a back layer **8**, a provided thereon motif **9** and a transparent or translucent wear layer **10**. Herein, the back layer **8** preferably covers a thickness T**1** of less than 45 percent of the overall thickness T of the top layer **7**. In this case, the back layer **8** consists of a layer of soft recycled PVC, which possibly is filled with chalk. In this case, the back layer **8** as such has a higher density than said transparent or translucent layer **10**. In this case, the motif **9** is provided on a carrier **11**. This relates to a printed PVC film. For the transparent or translucent wear layer **10**, preferably a PVC layer with a thickness T**2** of minimum 0.2 millimeters is applied. Preferably, the PVC layer is not thicker than 0.6 millimeters. The inventors have found that a thickness T**2** of 0.3 to 0.4 millimeters effects a good war resistance. The common thickness T of said top layer **7** preferably is between 1.5 and 3 millimeters, wherein a thickness T of 1.7 to 2.5 millimeters is desirable.

[0092] For the substrate **6** of the floor panel **1** of FIG. **1**, use is made of a substrate **6**, which comprises wood particles, in this case, wood fibers, bonded with a binding agent, such as MDF or HDF. Preferably, the applied substrate material has a residual moisture content of less than 10 percent by weight. Instead of MDF or HDF, also a substrate having a low density can be chosen, for example, of less than 600 kilograms per cubic meter. This may relate, for example, to a wood-based material, which comprises wood fibers which are obtained from recycled wood and which also are bonded with a binding agent. Also, it may be opted for a wood particle board.

[0093] At the lower side of the substrate **6**, there is an underlying layer **12** or backing layer. In this case, the backing layer comprises thermoplastic synthetic material. Preferably, for the backing layer or underlying layer **12**, PVC, preferably recycled PVC, is applied, possible filled with chalk. In principle, for the backing layer or underlying layer **12**, a similar composition can be applied as for the back layer **8** situated in the top layer **7**. The backing layer or underlying layer **12** illustrated here is made thinner than said back layer **8**. The inventors have found that this can be obtained, amongst others, when use is made of an annealed or relaxed thermoplastic top layer **7**. It is not excluded that the backing layer or underlying layer **12** has a thickness which is less than half of the thickness of the back layer **8**, also in cases where use is made of a not annealed thermoplastic top layer **7**.

[0094] The floor panel **1** from FIGS. **1** to **4** shows an edge portion **13** of synthetic material on at least one edge **4**, in this case on both opposite edges of the short pair of sides **4-5**, wherein said synthetic material is different from the substrate material **6**. Herein, the synthetic material extends at least over 80 percent of the thickness T**3** of the substrate. The attachment of the edge portion **13** to the substrate material **6** is obtained by hardening said synthetic material on the respective portion of the substrate material **6**. In this case, by the hardening of the synthetic material, also an adherence is obtained to the lower side of the top layer **7** and to the lateral edges **14** of the backing layer **12**.

[0095] FIG. **2** represents that the connection between the edge portion **13** and the substrate material **6** is performed over a boundary surface **15**, which comprises partial surfaces **16** extending transverse to the normal of the surface **17** of the panel **1**. In this case, the respective partial surfaces **16** respectively extend approximately horizontal. However, this is not necessarily so, and use can be made of inclined partial surfaces and/or bent boundary surfaces.

[0096] In the example, the respective edge **4** of the substrate material **6** is formed exclusively from said edge portion **13**.

[0097] For the synthetic material of the edge portions **13**, use is made of a material obtained on the basis of a two-component system, such that also the characteristics of the second aspect are met. Preferably, a polyurethane is applied, obtained on the basis of the components polyol and isocyanate. By means of this material, a chemical bond to the wood particles of the substrate **6** can be obtained. Moreover, the polyurethane preferably has the features of a thermo-hardening polymer.

[0098] FIG. **2** represents that the respective edges **4-5** are made with a profile and that this profile comprises coupling means **18**, with which this panel **1** can be coupled to other similar panels **1**, as represented in dashed line **19**. In the coupled condition, not represented here, a locking is effected in a horizontal direction H**1** perpendicular to the edge and in the plane of the panel **1**, as well as in a vertical direction V**1** perpendicular to the plane. The coupling means **18** represented here substantially are made as a tongue **20** and a groove **21**, bordered by a lower lip **22** and upper lip **23**. For obtaining the locking in horizontal direction H**1**, the tongue **20** and groove **21** are provided with cooperating locking parts **24-25**, in this case in the form of a protrusion **24** on the lower side of the tongue **20** and a recess **25** in the lowermost groove lip **22**. In this case, the tongue profile can be introduced into the groove **21** at least by means of a turning movement W along the respective edge for obtaining the coupled condition. Preferably, the coupling means **18** also allow other coupling movements, such as a coupling by means of a substantially horizontal shifting movement of the panels **1** towards each other.

[0099] FIG. **4** represents that on the other pair of opposite edges **2-3**, in this case on the long sides **2-3** of the floor panel **1**, measures are performed for reducing the water-sensitiveness thereof, in accordance with the present invention. The substrate has a profile **26** on the respective edges **2-3**, and on this profile **26**, a moisture-repellent or sealing covering layer **27** is applied, in this case a hot-melt glue, which can be based, for example, on polyurethane.

[0100] In the example, this covering **27** extends along the long sides **2-3** of the floor panel **1** at least over the entire distance between the edge portions **13** of the short pair of edges **2-3**. Herein, this relates to a covering **27**, which has been applied calibrated at least on a portion of the profiled edge region or profile **26**, such that the present thereon coupling means **18** and locking parts **24-25** are not or almost not hindered when performing the coupling movement. A particularity of the covering layer **27** represented here is that it extends over the profile **26** up to a lateral surface **28** of said top layer **7**. Moreover, the covering layer, at least on one of the long edges, in this case on both long edges **2-3**, is provided in an undercut **29** performed in said lateral surface **28**. By means of this measure, it is effected that in coupled condition a gap of less than 0.2 millimeters is obtained between the upper edges **30** of the panels **1**, and in this case even no gap. Preferably, in coupled condition a height difference between the upper edges **30** is obtained of less than 0.2 or 0.1 millimeters, and still better no height difference, it is to say, a height difference of 0.05 millimeters or less.

[0101] The covering **27** maximally extends to a point **31** at a distance from the upper edge **30** or decor side **17** of the respective panel **1**. At this point **31**, the covering **27** is countersunk at least partially, in this case even completely, in said recess **29**.

[0102] Generally, the point **31** preferably is situated in said recess **29** provided in the lateral surface **28** of the top layer **7**. Preferably, said recess extends substantially or even entirely underneath the motif **9** of the top layer **7**, such as it is the case here.

[0103] In the example of FIG. **4**, the covering **27** is applied at least calibrated on a portion of the profiled edge region or the profile **26**, which, in a coupled condition of two such panels **1**, forms a contact surface **32-33-34-35**. In the present case, this is provided at least calibrated on the contact surfaces **32-33** responsible for the vertical locking V**1** and on the contact surfaces **34-35** responsible for the horizontal locking H**1**.

[0104] According to the example of FIG. **4**, on the long pair of opposite edges **2-3** similar coupling means **18** are applied as on the short pair of opposite edges **4-5**, in that they also allow a coupling at least by means of a turning movement W along the respective edges. However, this is not necessarily so, and it is possible that coupling by turning is only possible on the long pair of edges **2-3**, whereas the short pair of edges **4-5**, for example, allows at least a coupling by means of a substantially horizontal or downward coupling movement N of the respective edges **4-5** towards each other. Such embodiment is represented on FIG. **8**.

[0105] The floor panel **1** of FIG. **6** is provided, on the short pair of edges **4-5**, with coupling means **18**, which allow a coupling by means of a downward movement N of the coupling means on the one edge **4** in the coupling means on the other edge **5**. Herein, the coupling means **18** are realized as a male coupling part **36** and a female coupling part **37**, wherein the male coupling part **36** can be provided in the female coupling part **37** by means of said downward movement N.

[0106] FIG. **6** illustrates how these panels **1** can be coupled, wherein these panels **1**, on the long sides **2-3**, are provided with coupling means **18**, which at least allow a coupling by means of a turning movement W, and, on the short sides **4-5**, are provided with coupling means **18**, which allow at least a coupling by means of a downward movement N. As represented, they can be engaged into each other by means of a single fold-down movement N, wherein the long sides **2-3** are turned into each other and automatically a downward coupling movement N is created on the short sides **4-5**.

[0107] FIG. **7** schematically illustrates a method for realizing a covering layer in accordance with the method of the invention. The method comprises the step S of covering an edge **3**, which extends transverse to the edge **4** with the synthetic edge portion **13**, with a water-repellent substance **38**. This method allows a certain play when starting and stopping the covering device **39**. To with, the starting and stopping can take place on the lateral surfaces of the synthetic edge portions **13**. Preferably, such method is performed in continuous cycle, wherein the panel **1** moves along the covering device **39**, as indicated by arrow D. Such covering device **39** can be integrated, for example, into an edge processing machine, which provides the profiled edge regions or profiles **26** on the same edges **2-3**, for example, by means of two or more successive milling treatments, as known from WO 97/47834. Preferably, such covering device **39** is situated on both opposite edges **2-3** for realizing a covering **26** with water-repellent substance **38** according to the invention.

[0108] FIG. **8** represents a cross-section of the covering device **39**. Herein, this relates to a covering device **39**, which applies the substance **38** at least on a portion of the profiled edge region or profile **26** in a calibrated manner.

[0109] FIGS. **9** and **10** represent that the covering device **39** comprises a portion which, for this purpose, is performed as a form mold **40**, along which the respective profiled edge region, or at least the portions thereof chosen for the calibrated application, can slide with a well-defined intermediate distance D**1**, for example, of less than 0.3 millimeters. In this manner, an equivalent thickness D**2** of the covering layer **27** is obtained. In this case, the water-repellent substance **38**, for example, a hot-melt glue, is applied in a calibrated manner over the entire contour of the profiled substrate material **6**. Preferably, a covering layer **27** is applied, which has a global or average thickness D**2** of at least 100 micrometers. Preferably, the thickness of the covering layer is 300 micrometers or less. Preferably, a certain variation in the thickness of the covering layer over the profile of the respective edge **2-3** is limited to a maximum of half of the average thickness D**2**. In this manner, it is obtained that the covering layer **27** is and/or remains completely covering on the treated portion of the profile **26**, in this case on the entire portion of the profile **26** of the substrate **6**.

[0110] The covering device **39** comprises an internal chamber **41**, in which, via an entrance opening **42**, water-repellent substance **38** is applied. The water-repellent substance **38** exits the internal chamber **41** via a slot-shaped opening **43**.

[0111] FIG. **10** represents that immediately after the slot-shaped opening **43**, the respective profiled edge region again slides along the form mold **40**, such that calibration can be obtained on the desired portions of the profiled edge region or the profile **26**.

[0112] FIG. **11** represents another embodiment, wherein the covering layer **27** is countersunk in a recess **29** on only one of two opposite edges **2-3**. In the example, the recess is provided on the groove side **3**. Of course, it is not excluded that it might be provided on the tongue side **2**.

[0113] FIG. **12** represents a variant, wherein the covering layer **27** on one of two opposite edges **2-3**, in this case on the tongue side **2**, is only partially countersunk in the recess **29** provided in the lateral surface **28** of the top layer **7**.

[0114] FIG. **13** represents a variant, wherein the covering layers **27** on both opposite edges **2-3** are only partially connected. As the covering layers **27** applied here are realized compressible, still a close adjoining between the upper edges **30** is obtained.

[0115] It is noted that according to all aspects of the invention, preferably coupling means **18** are applied which are realized in one piece in the substrate material **6** and/or the material of the synthetic edge portion **13** and/or the material of the covering layer. However, it is not excluded that use shall be made of separate material portions, which are part of the coupling means. For example, in the case of coupling means **18**, which allow a coupling by means of a downward movement N, use can be made of one or more plastic strips, which are provided in a recess provided for this purpose and which, for example, take part in the locking in the vertical direction V**1**, either automatically when performing the coupling movement N, or by means of a separate action following said downward movement N.

[0116] Further, it is also noted that, when above a "countersunk" covering layer **27** is mentioned, it is intended that at least a portion of the thickness D**2** of the covering layer **27**, and still better at least an essential portion of the thickness D**2** or the entire thickness D**2** of this covering layer **27**, is situated, in respect to the panel, proximally from the vertical plane V through the upper edge **30**. Preferably, the covering layer **27** is countersunk at least at the location of the top layer **7** and/or at least at the location of said point **31**.

[0117] Generally, it is also noted that, although certain ideas of the invention are described on one edge or one pair of opposite edges only, they can be applied, of course, at choice on all edges, and such at choice. Ideas of the invention, which are described by means of an application on the short or long edges only, of course can also be applied, mutatis mutandis, for the long, the short edges, respectively.

[0118] It is clear that the profile **26** of the substrate at the location of the panel edges, where the covering layer **27** is applied, preferably shows the profile of the coupling means **18**, however, taking into account the thickness D**2** of the covering layer **27** forming part of the final profile of the respective panel edge, and preferably of the final coupling means **18** as well.

[0119] FIG. **14** represents that the form mold **40** of the covering device **39** preferably comprises an outlet opening **44**, which allows the excess material of the water-repellent substance **27** to flow off towards the lower side of the panel **1**. Such embodiment allows performing the calibrated application of the covering **27** on the entire contour of the profiled edge region or parts thereof in a reliable and smooth manner.

[0120] FIG. **15** gives an illustrative example of the preferred embodiment of the invention mentioned in the introduction, wherein an auxiliary piece **45** is provided on the edge **5** which extends transverse in respect to the edge **3** which has to be covered with the water-repellent substance. The figure clearly shows that the lateral surface **46** of this auxiliary piece **45** is made profiled, wherein the profile corresponds approximately completely to the profile of the edge **3** to be covered. By the presence of the auxiliary piece **45**, the run-up and/or run-down of the covering device **39** is simplified, and staining of the edge **5** as a result of edge effects at the run-down of the covering operation on the projecting parts formed by the lower groove lip **22** and upper groove lip **23** is minimized or prevented. It is clear that instead of an auxiliary piece **45**, also an extra floor panel could be used which is locked to the floor panel by means of the coupling means **18**.

[0121] Although represented otherwise in FIGS. **7** to **10**, **14** and **15**, the panel **1** preferably is oriented with its decorative side or surface **17** downward when applying the covering **27** and/or applying the coupling means **18**.

[0122] FIG. **16** represents an example of a floor panel having, amongst others, the characteristics of the third aspect of the present invention mentioned in the introduction. Substantially, herein, compared to FIG. **4**, the covering layer **27** is exchanged for an impregnation **47** of the profiles **26** with a moisture-repellent substance, in this case with MDI. The treated surface of the profiles **26** extends from the lower side of the top layer **7** to the upper side of the underlying layer or backing layer **12**, wherein the lateral surfaces of the actual top layer **7** and underlying layer **12** are untreated or substantially untreated. The entire contour or the essential part of the profiles **26** of the substrates in fact is treated. This relates to a floor panel **1** having a top layer **7** which comprises one or more layers substantially consisting of thermoplastic synthetic material. In this case, a top layer has been chosen which substantially consists of PVC. The top layer **7** is connected to the substrate at least by means of a separate adhesive layer **48**. In this case, a polyurethane dispersion glue has been chosen.

[0123] FIG. **17** shows that the covering layer **27** initially can be formed on an incompletely profiled edge region. In this case, the final upper edge **30** of the respective edge region still must be formed by cutting the final lateral surface **28** of the top layer **7** according to the dashed line **49** for removing in this manner an excess material portion **50** from this top layer **7**. FIG. **18** shows the obtained result and, with dashed line **51**, further represents a variant wherein the floor panel at the respective edge is provided with a final upper edge **30**A situated lower than the global surface **17** or decorative side, in that in this case use is made of a chamfer in the form of a bevel. In both cases, embodiments are obtained which further show, amongst others, the characteristics of the first and the second aspect.

[0124] FIG. **17** clearly shows that the covering layer **27**, in this case, initially, i.e. prior to performing the cutting treatment which forms the final upper edge **30**-**30**A, extends at least from on the substrate **6** onto the lateral surface **29** of the top layer **7**. By the cutting treatment, which has to be performed subsequently, for forming the final upper edge **30**-**30**A, an excess portion of this covering layer **27** is removed. It is noted that the edge of the top layer **7** extends distally over the final upper edge **30**-**30**A. Hereby, the top layer **7** forms a barrier against possible staining of the surface **17** or decorative side, and is it possible to achieve a smoother production of such floor panels **1**.

[0125] It is self-evident that on the edge **4** opposite to the edge **3** represented in FIGS. **17** and **18**, preferably a similar treatment will take place as described by means of the fourth aspect, however, with the difference that this opposite edge **4** preferably shows the complementary coupling means **18**, in this case a coupling means in the form of a tongue.

[0126] The present invention is in no way limited to the herein above-described embodiments; on the contrary, such panels may be realized according to various variants without leaving the scope of the present invention. Moreover, the panels, instead of as floor panels, also can be realized as wall panels or ceiling panels or even as furniture panels.

1-**15**. (canceled)

16. A panel for forming a floor covering comprising:

a substrate;

a top layer provided on the substrate;

wherein the panel, at least at two opposite edges thereof, is provided with coupling means arranged to couple two of such panels to each other at the respective edges, such that in the coupled condition, the panels are locked in a horizontal direction perpendicular to the respective edge and in the plane of the coupled panels, and in a vertical direction perpendicular to the plane of the coupled panels;

wherein the substrate defines a profile at both of said respective edges and a moisture-repellent or sealing covering layer is provided on the profile of said respective edges, said covering layer extends over said profiles at least up to a lateral surface of said top layer, said covering layer, at least at one of said respective edges, is at least partially provided in an undercut defined along said lateral surface.

17. Panel for forming a floor covering comprising:

a substrate;

a top layer provided on the substrate;

wherein the panel, at least at two opposite edges thereof, is provided with coupling means arranged to couple two of such panels to each other at the respective edges, such that in the coupled condition, the panels are locked in a horizontal direction perpendicular to the respective edge and in the plane of the coupled panels, and in a vertical direction perpendicular to the plane of the coupled panels;

wherein the substrate defines a profile at both of said respective edges and a moisture-repellent or sealing covering layer is provided on the profile of said respective edges, said covering layer extends over said profiles at least up to a lateral surface of said top layer;

wherein said top layer has a thickness of at least 0.3 millimeters.

18. The panel of claim **16**, wherein said covering layer extends maximally up to a distance from the upper edge.

19. The panel of claim **16**, wherein the lateral surfaces at the upper edges of the top layers of two of such panels are arranged to touch each other in the coupled condition or are 0.2 millimeters or less apart from each other.

20. The panel of claim **19**, wherein the lateral surfaces at the upper edges of the top layers of two of such panels are pressed against each other in the coupled condition.

21. The panel of claim **16**, wherein said covering layer has a global thickness of at least 100 micrometers.

22. The panel of claim **16**, wherein said top layer is compressible.

23. The panel of claim **16**, wherein said top layer is based on thermoplastic synthetic material.

24. The panel of claim **16**, wherein a backing layer is provided on the lower side of the substrate.

25. The panel of claim **16**, wherein said covering layer extends over at least 75% of the profile of the substrate.

26. The panel of claim **16**, wherein for said covering layer, use is made of a hot-melt glue.

27. The panel of claim **16**, wherein in said coupled condition, cooperating contact surfaces are formed between the coupled edges, wherein at least one pair of cooperating contact surfaces is formed by said covering layers.

28. The panel of claim **16**, wherein on the lower side of said substrate, a backing layer is provided and wherein said covering layer extends in one piece up to a lateral surface of said backing layer.

29. The panel of claim **16**, wherein the panel is rectangular and wherein on the other pair of opposite edges other measures are made for obtaining a certain water-repellent effect.

30. The panel of claim **16**, wherein the top layer comprises a transparent wear layer, a synthetic material film including a printed decor, and a back layer formed from thermoplastic synthetic material and situated underneath the printed decor.

31. The panel of claim **16**, wherein said covering layer extends over the entire profile of the substrate.

* * * * *