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(54) **WATER RESISTANT TONGUE AND GROOVE FLOORING**

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(57) **ABSTRACT**

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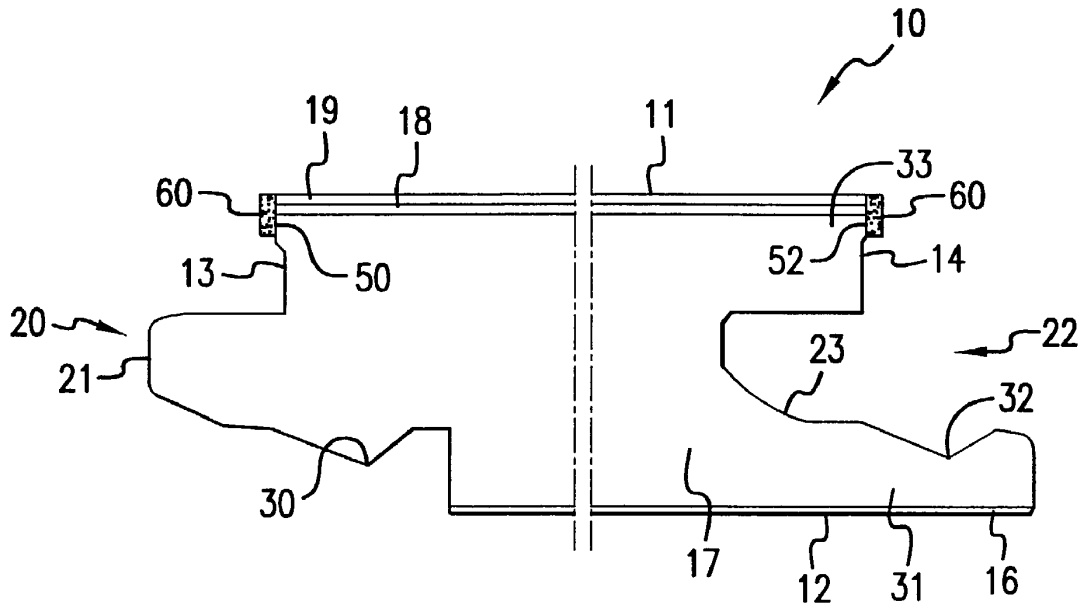
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The invention provides a new floor covering panel and floor covering system in which the floor covering panels include first and second generally planar surfaces, first and second side edges containing first and second complementary coupling members, respectively, and a barrier composition selectively applied to at least a portion of at least one of the first and second coupling members for providing a moisture barrier to prevent water penetration below the first surface of the floor covering panel. The barrier composition may be applied to at least one of the first or second coupling members during the floor covering manufacturing process.



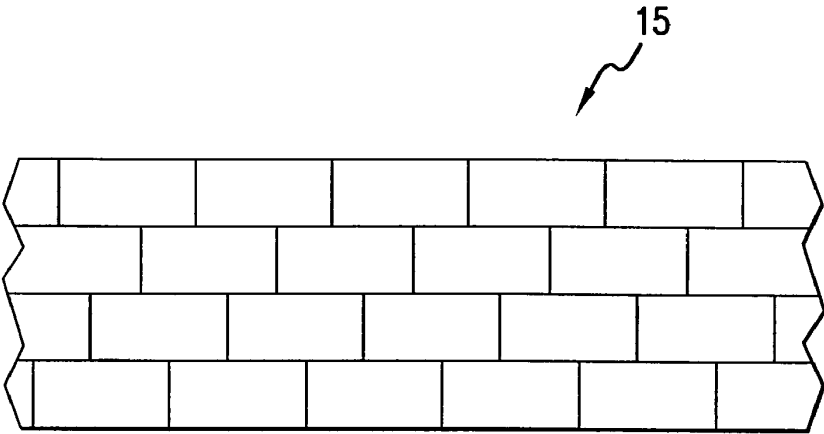


FIG.1

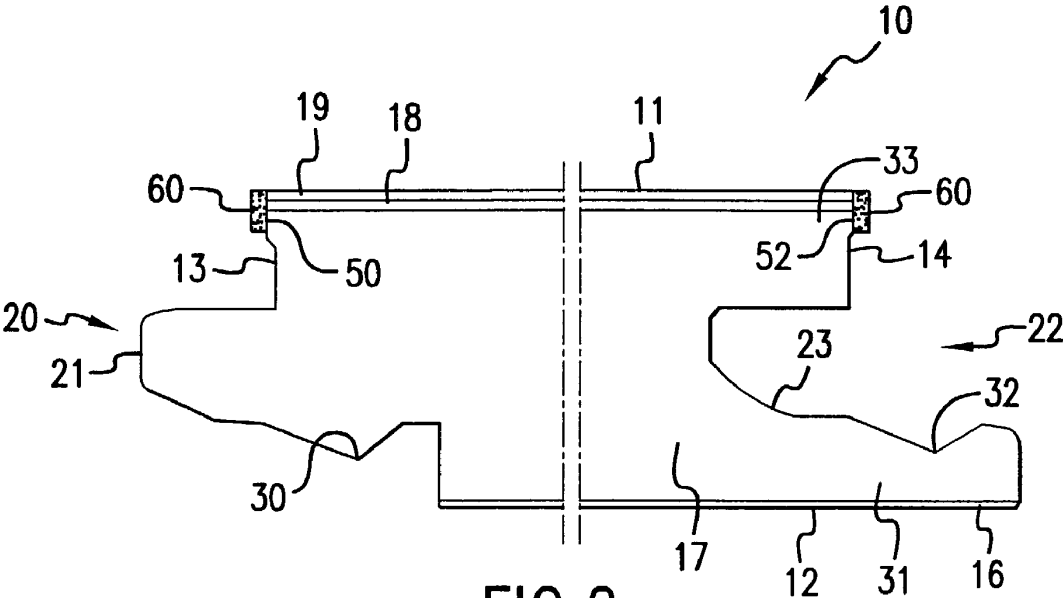


FIG.2

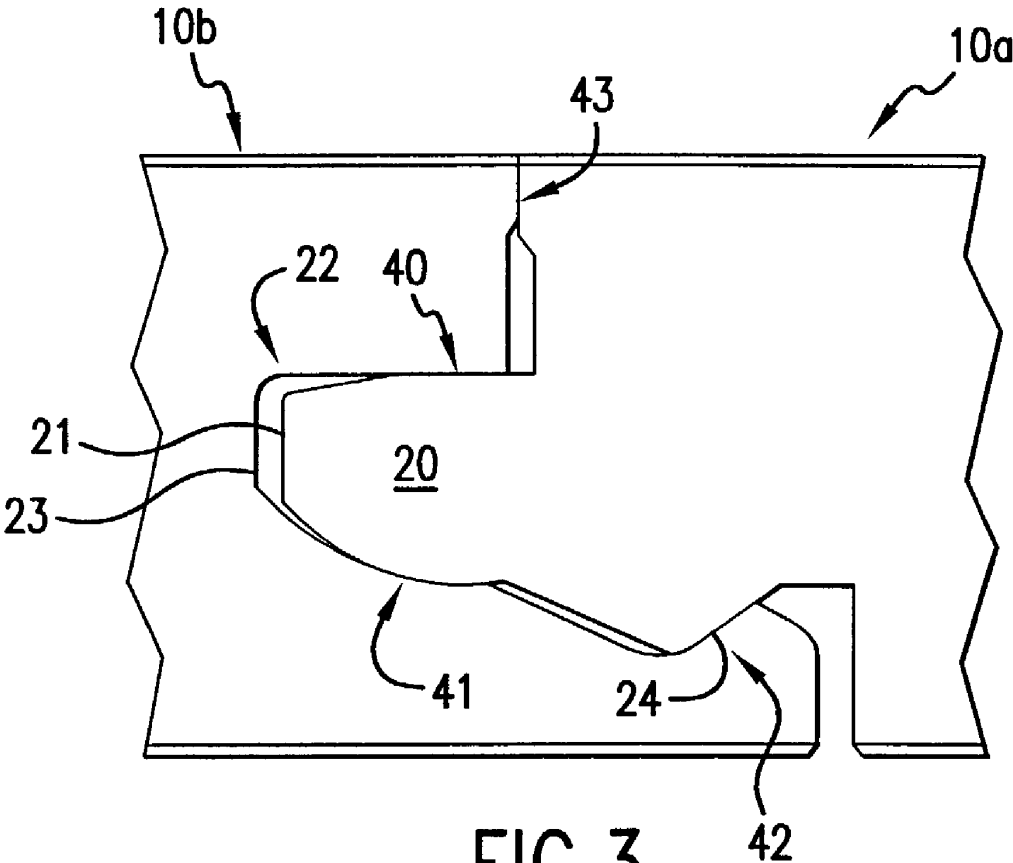


FIG.3

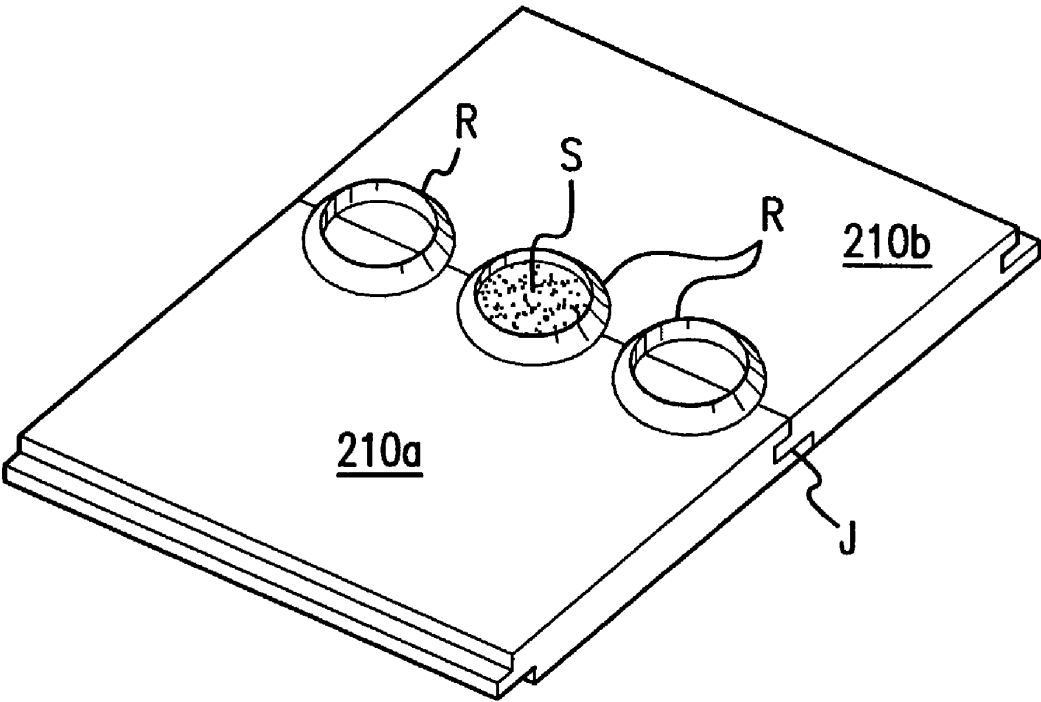


FIG.4

WATER RESISTANT TONGUE AND GROOVE FLOORING

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] This invention relates generally to floor covering panels for use in commercial, industrial or residential environments. More particularly, this invention relates to a floor covering panel having complementary coupling members with a barrier composition applied to the side edges of the floor covering panel.

[0003] 2. Background Art

[0004] It is generally known in the art to use various laminates, including high pressure laminates and fiberboard core laminates, in flooring applications. Fiberboard core laminates used to manufacture flooring products typically include a plurality of layers, including a fiberboard or organic composite core layer, a decorative layer, and a hard and flat protective wear layer of resin-impregnated melamine material. These layered constructions are typically formed into standard-sized panels which are joined together at an installation site to create a floor covering system.

[0005] Though the uppermost layer of such flooring systems is frequently manufactured from a water resistant or water tight material, the floor covering systems may be vulnerable to water damage at the joints between adjacent floor covering panels that make the floor covering system. Slight imperfections in the fit (seam) between adjacent floor panels may allow water or other liquids to penetrate into the joints between floor panels, which may, in turn, result in damage, warpage, accelerated wear, or deteriorated fit of individual floor panels. Moreover, cleaning materials generally comprise surfactants that may accelerate the seepage of water into the seam. Because the materials that make up the inner layers of the floor panels may not be completely impervious to water, those layers may absorb water or other fluids, resulting in damage or decreased product life.

[0006] In actual residential and commercial settings, laminate and wood floorings are often contacted with liquids, either deliberately or through accident. Cleaning of floors with a detergent solution may cause up to as much as a 35% swelling of the flooring at the seam. Accidental wetting may also occur from spills or animal or child urine. Each of these liquids has a lower surface tension than water and will be likely to migrate into the seam formed by the mating of two floor covering panels so as to cause swelling.

[0007] Manufacturers commonly apply paraffin-based materials to floor covering panels in an attempt to improve the water resistance of these products. However, such materials generally are not durable and, as such, do not provide a good water resistance for the useful life of a floor covering system. Moreover, such materials also do not provide enough barrier when, for example, cleaning agents are repeatedly used on the floor covering materials or when low surface tension materials are spilled on the floor.

[0008] As a result, a need exists in the industry for a floor covering panel and a floor covering panel system having strong and reliable joints that are resistant to water and other

liquids. Moreover, there is a need for floor covering panels and floor covering systems that provide a durable water barrier.

SUMMARY OF THE INVENTION

[0009] In accordance with the invention, as embodied and described herein, this invention, in one aspect, relates to a floor covering panel. In this aspect, the invention includes a first generally planar surface and a second generally planar surface opposed to the first surface. Between the first and second surfaces are a first side edge and an opposed second side edge, respectively. Within the first edge of the panel is a first coupling member, which includes a protrusion extending therefrom and a first abutment surface between the protrusion and the first surface. A complementary second coupling member is defined within the second edge of the panel and includes a recess sized and shaped to receive the first protrusion therein and a second abutment surface between the recess and the first surface. A barrier composition may be selectively applied to at least a portion of at least one of the first and second abutment surfaces.

[0010] In use, a first coupling member of a first panel is received within a second coupling member of a second panel such that the barrier composition is positioned between the respective first and second abutment surfaces of the two panels. A water resistant barrier is thereby formed between the two coupling members in association with the barrier composition applied thereto. A plurality of panels may be joined together in this manner to form a floor covering system.

[0011] In particular, the barrier composition may be applied to at least one of the first or second abutment surfaces at a point in the floor covering manufacturing process. In a further aspect, a barrier composition may be applied to the entire surface of one or both of the first and second abutment surfaces. Still further, the barrier composition provides a water resistant barrier that substantially reduces the possibility of water or other liquids penetrating the seam of two mated floor covering panels under normal use conditions.

[0012] Additional advantages of the invention will be set forth in part in the description which follows, and in part may be learned from the description, or may be learned by practice of the invention. The advantages of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a top plan view of a plurality of floor covering panels connected together to form a floor covering panel system.

[0014] FIG. 2 is a cross-sectional side view of an embodiment of the floor covering panel according to the present invention.

[0015] FIG. 3 is a partial cross-sectional side view of a pair of the floor covering panels according to FIG. 2, particularly illustrating a first coupling member engaging a second coupling member.

[0016] FIG. 4 is a schematic illustration of a testing fixture used to test water resistance associated with the floor covering panel of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0017] The present invention is more particularly described in the following examples that are intended as illustrative only since numerous modifications and variations therein may be apparent to those skilled in the art. As used in the specification and in the claims, “a,” “an,” and “the” can mean one or more, depending upon the context in which it is used. Several aspects are now described with reference to the figures, in which like numbers indicate like parts throughout the figures.

[0018] Referring to FIGS. 1 and 2, the present invention, in one embodiment, is a floor covering panel 10. The panel 10 includes a first generally planar surface 11 and a second generally planar surface 12 opposed to the first surface 11. Extending between the surfaces 11, 12 are a first side edge 13 and an opposed second side edge 14, respectively, each of which runs the length of the floor covering panel. Defined within the first side edge 13 is a first coupling member 20, which includes a protrusion 21 extending therefrom. The first coupling member 20 further comprises a first abutment surface 50 between the protrusion 21 and the first surface 11. The second side edge 14 includes a second complementary coupling member 22 defined therein that includes a recess 23 sized and shaped to receive the protrusion 21 of a second one of the floor covering panels therein. The second coupling member 22 also includes a second abutment surface 52 between the recess 23 and the first surface 11. A barrier composition 60, described in greater detail below, is selectively applied to at least a portion of at least one of the first or second abutment surfaces 50, 52 as desired. A plurality of floor covering panels may be joined together to form a floor covering system 15 as shown in FIG. 1.

[0019] The present invention includes floor covering panels of various constructions known in the industry or that may be developed in the furtherer. For example, the floor covering panels may be manufactured from a laminated material having a fiberboard core. Additionally, the present invention may be constructed of other types of laminates such as high pressure laminates, which have been marketed under such trade names as Formica® and Wilson Art®. Other materials may also be used to construct the floor panel such as natural organic, recycled or synthetic materials. Still further, the floor covering panel may be a tongue and groove wooden flooring material, such as those manufactured by Bruce Hardwood Floors, a division of Armstrong Flooring, Inc. (Lancaster, Pa.). Still further, the present invention is suitable for use on any flooring substrate that may benefit from formation of a non-refastenable bond as set forth in more detail herein.

[0020] Referring to FIG. 2, a typical laminate floor panel is constructed of a plurality of discrete layers, which may include some or all of the following: a backing layer 16, a core layer 17, a decorative layer 18, and a wear layer 19. The various layers may be adhered, joined, or coupled to one another by a chemical adhesive, mechanical connection, or other means known in the art for forming the panel. In an embodiment including each of the above listed layers, the

first generally planar surface 11 is usually the upper surface of the wear layer 19 while the second generally planar surface 12 is typically created by the lower surface of the backing layer 16 as shown in FIG. 2. When the panel 10 is installed, the backing layer 16 faces the underlying subfloor (not shown).

[0021] While the backing layer 16 is optional, it may provide an improved moisture resistance to the floor panel 10 because the core layer 17 typically is not completely impervious to moisture or contaminants. Additionally, the backing layer 16 may improve the structural integrity of the floor panel 10 by increasing overall thickness and reducing the warp and wear tendencies of the uncoated core material. The construction of the backing layer 16 may, for example, comprise a clear sheet of melamine reinforced with aluminum oxide (AlO₂) and impregnated with a suitable thermosetting resin. In other embodiments, backing layers 16 may be constructed of other materials providing suitable moisture resistance, such as phenolic resins or other natural, synthetic or recycled materials.

[0022] The next layer in a typical laminate floor covering panel is the core layer 17. In one embodiment, the core layer 17 may be formed from medium density or high density fiberboard, such as those marketed by companies such as Louisiana Pacific, Georgia Pacific, Temple Inland, and Weyerhaeuser. One fiberboard core material found to produce acceptable results is a high density fiberboard, which is a hardwood/softwood fiber compound compressed at 900-960 kg/m³. Such fiberboard core material is usually available in 4 or 5 feet widths (1.22-1.52 meters) and lengths of up to 18 feet (5.49 meters). In other embodiments, core layers 17 constructed of different materials or having different properties may be utilized, including but not limited to other timber-based products, such as plywood, chipboard or particleboard.

[0023] In one embodiment, the decorative or “décor” layer 18 comprises a sheet of paper that substantially covers the top surface of the core layer 17. The visible side of the decorative layer 18 displays a desired aesthetic appearance, such as a color or pattern. For example, some currently contemplated patterns include simulated hardwood flooring and simulated ceramic tile, each in a variety of styles, shades and colors. Currently contemplated simulated hardwood styles include pine, heart pine, cheny, maple, beech, oak and mahogany. Simulated tile appearances are contemplated in a range of styles, including a variety of marble and ceramic tile colors, including grout lines in ceramic tile styles. Other currently contemplated patterns include floral patterns, abstract designs, geometric designs and company logos. Other patterns may be selected by the manufacturer or user according to their aesthetic preference or design objectives.

[0024] The decorative layer 18 may be manufactured from paper that is impregnated with a thermosetting resin and provided with the desired aesthetic color and/or pattern. Other materials may make up the decorative layer 18, such as real wood veneer, pulverized stone, or other materials. Additionally, it is possible to achieve a similar decorative appearance by applying a direct or indirect printing process onto the top surface of the core layer 17. In such an embodiment, the decorative layer 18 comprises the ink, dye, pigment or other marking substances applied to the core layer 17. Alternatively, the decorative appearance may be

provided by etching, burning or otherwise marring the top surface of the core layer 17. Any such treatment that supplies such a decorative appearance on the top surface of the core layer 17 is contemplated to comprise the decorative layer 18 as defined herein. Alternatively, a decorative appearance may be imparted directly to the upper surface of the wear layer 19, which may remove the need for a decorative layer 18 within the floor panel 10.

[0025] The wear layer 19 may be adhered, joined, or coupled to the decorative layer 18 to protect the panel from the ambient environment. In one embodiment, the wear layer 19 is substantially transparent so that the aesthetic appearance of the decorative layer 18 is unobstructed by the wear layer 19. Though a wear layer 19 is optional, the resistance of the floor panel 10 to wear, staining or fading of the aesthetic image imparted to the decorative layer 18 may be generally improved by the inclusion of a wear layer 19 in the floor covering panel 10. The wear layer 19 may comprise a melamine sheet which is reinforced with AlO_2 and impregnated with a thermosetting resin. Alternately, the wear layer 19 may comprise a layer of varnish or other UV curable scratch resistant coating. Moreover, the wear layer 19 may be made from any material providing suitable moisture resistance and resilience to loads and wear to which a floor is subjected, such as phenolic resins or other natural, synthetic or recycled materials.

[0026] The coupling members 20 and 22 of the present invention provide a means for joining two adjacent floor covering panels 10a, 10b together as illustrated in FIGS. 1 and 3. One illustrative example of such a means for adjoining adjacent panels is set forth in U.S. Pat. No. 6,006,486 to Moriau et al. (which is incorporated herein in its entirety by this reference).

[0027] In the embodiment illustrated in FIGS. 2 and 3, the first edge 13 of the panel 10 includes the first coupling member 20. The first coupling member 20 includes a protrusion 21 with a rib 30 formed on the underside thereof. On the second edge 14, the second coupling member 22 includes an upper lip 33, a lower lip 31, and a detent 32 formed within the lower lip 31. The recess 23 is sized and shaped to accept the protrusion 21, and the detent 32 is sized and shaped to accept the rib 30. In this embodiment, the detent 32 and the rib 30 represent a locking structure, which will be discussed in greater detail below.

[0028] Referring to FIGS. 2 and 3, the coupling of floor covering panel 10a to adjacent panel 10b is achieved by placing the first coupling member 20 of panel 10a into the second coupling member 22 of panel 10b. In the illustrated embodiment, the tip of the protrusion 21 of panel 10a is inserted into the recess 23 of panel 10b at an angle above the horizontal, and the panel 10a is then rotated clockwise until the panels 10a and 10b are within substantially the same horizontal plane, as illustrated.

[0029] In the illustrated embodiment, contact is made between the complementary coupling members 20, 22 of the two panels 10a, 10b in four contact zones as shown in FIG. 3. The protrusion 21 of panel 10a contacts the upper lip 33 and the lower lip 31 of panel 10b at contact zones 40 and 41, respectively. Contact zones 40 and 41 help locate the panels into substantially the same horizontal plane. The rib 30 (FIG. 2) of panel 10a engages the detent 32 of panel 10b at contact zone 42. In this embodiment, the contact zone 42 is

substantially planar; however, any contact zone may be formed in any shape depending on the profile desired. The angle formed by the substantially planar contact zone 42 and the substantially planar second surface 12 forms an acute angle therebetween, when measured from the second surface 12 counterclockwise to the plane of the contact zone 42. This configuration ensures that the contact force between the adjacent panels 10a, 10b at the contact zone 42 urges the panels together and promotes a tight joint. This locking structure defined by the rib 30 of panel 10a and the detent 32 of panel 10b prevents substantial separation of the two panels 10a and 10b in a direction perpendicular to the side edges 13, 14 of the panels 10a, 10b and parallel to the respective first surfaces 11. An additional contact zone 43 is present in the embodiment illustrated in FIG. 3, adjacent the first surface 11 of each of the panels at the juncture between the first abutment surface 50 of panel 10a and the second abutment surface 52 of panel 10b.

[0030] It should be noted that floor covering panels 10 may be manufactured in a variety of shapes and sizes, commonly including square, rectangular and other polygonal embodiments. In the case of square and rectangular panels, each panel has four side edges. Thus, according to the invention, each panel 10 may include two first side edges 13, and two opposed second side edges 14, each edge extending between the top and bottom surfaces 11, 12 of the panel 10.

[0031] It should also be noted that the embodiments shown in FIGS. 2 and 3 are for illustrative purposes only, and that the present invention is equally applicable to other coupling profiles known in the industry or that may be developed in the future. In other embodiments, the quantity, size and location of the contact zones may vary with the profile as desired, but the different profiles still fall within the scope of the present invention. For example, a tongue and groove profile without a locking structure would benefit from, and fall within the scope of the present invention. As a further example, a tongue and groove profile in which substantially full contact is maintained along the entire mating edges of the panels is also contemplated as being within the scope of the invention.

[0032] The barrier composition 60 may be selectively pre-applied to the floor covering panels at the factory, at any desired location and in any desired amount, using one of a number of methods known to one of skill in the art. In one illustrative example, the barrier composition may be applied in spray form at the desired location. According to the present invention, the barrier composition 60 may be selectively applied to at least a portion of at least one of the first or second abutment surfaces 50, 52, as desired, for example the contact zones 40-43. Still further, the barrier composition 60 may be selectively applied to at least a portion of the first abutment surface 50. Yet still further, the barrier composition 60 may be selectively applied to at least a portion of the second abutment surface 52. In a still further aspect, the barrier composition 60 may be selectively applied to at least a portion of both the first and the second abutment surfaces 50, 52, which portions may correspond with, or be separate of, one another, as desired.

[0033] In the embodiment shown in FIGS. 2 and 3, the barrier composition 60 may be selectively applied only to substantially all of the first abutment surface 50 at a location

corresponding to the contact zone 43. By "selectively applied" it is meant that the barrier composition 60 is applied only to the intended area of application, and that the barrier composition 60 is not applied to neighboring areas or any other areas besides the selected and intended area of application.

[0034] When adjacent panels 10a, 10b are assembled together as illustrated in FIG. 3, the barrier composition 60 forms a moisture barrier between the first and the second abutment surfaces 50, 52, such that water and other liquids along the first surface 11 of the adjacent panels 10a, 10b are substantially prevented from seeping past that moisture barrier. In another embodiment, the barrier composition 60 may be selectively applied only to substantially all of the second abutment surface 52 at a location corresponding to contact zone 43. In yet another embodiment, the barrier composition 60 may be selectively applied to substantially all of both the first and second abutment surfaces 50, 52 at a location corresponding to contact zone 43.

[0035] In other embodiments, the barrier composition 60 may be applied to some portion of, or the entirety of, one or both of the coupling members 50, 52. As set forth above, in various embodiments, the barrier composition 60 may be selectively applied only to locations on the first abutment surface 50. Alternatively, the barrier composition 60 may be selectively applied only to locations on the second abutment surface 52. In yet another embodiment, the barrier composition 60 may be selectively applied to locations on both the first abutment surface 50 and the second abutment surface 52.

[0036] In yet a further embodiment, the barrier composition 60 may be applied to substantially the entire first edge 13, second edge 14, or both, as desired.

[0037] Various methods can be used for applying the barrier composition 60 to the floor covering panels 10, as known. In a first aspect, a vacuum coating process may be utilized. In this aspect, a floor covering panel is passed through a machine that applies the barrier composition under pressure to one side of a respective edge of a floor covering panel. A vacuum is applied at an opposite side of the edge of the panel to remove excess barrier composition from the floor covering panel. Excess barrier composition is returned to a vessel for re-use. Use of such a vacuum coating method allows for precise application of the barrier composition to a floor covering panel by way of adjusting the pressure/vacuum ratios.

[0038] A further method that may be utilized to apply the barrier composition to the floor covering panel is the use of a roll coat applicator. In this method, several large diameter rollers are made to match the area to be coated on the floor covering panels. The barrier composition may be applied to the floor covering panels by a transfer roller that is supplied with the barrier composition from a supply reservoir. The application of the barrier composition can be precisely controlled by adjusting the parameters used in the application.

[0039] A further method of applying the barrier composition to the floor covering panels is achieved by use of a multi-spray head applicator. This method will allow application of the amount of barrier composition to the flooring profile with precision and accuracy. In this method, multiple

spray applicators may be fitted with nozzles and situated to spray the barrier composition on selected portions of the side edges of a floor covering panel. The spray applicators may pulse at a high frequency to apply the barrier composition to the desired position on the floor covering panel, which pulsing action may also assist in keeping the spray head clean. The barrier composition is supplied to the spray head by means of a conventional pump system that draws the composition from a supply tank. Such spray application systems are known to those skilled in the art, and the spray applications are commercially available from manufacturers including Spraymation, Inc. (Ft. Lauderdale, Fla.).

[0040] Other methods of applying the barrier composition may be utilized according to the invention, including other existing methods of applying the barrier composition, and including methods of applying the barrier composition that may be developed in the future.

[0041] The amount of barrier composition applied to the floor covering material is not critical, as long as the desired water barrier qualities are provided. Generally, about 0.1, 0.5, 1.0, 2.0, or 5.0 g of composition per 8"x48" (0.20x1.22 meters) board may provide the desired water barrier quality in the finished floor covering material.

[0042] As used herein, "barrier composition" means the composition comprising the active ingredient, i.e., the chemical material providing the primary barrier properties, and any solvent or diluent and other ingredients. In one aspect where the barrier composition is to be selectively applied to the floor covering panel, the active ingredient may be any material that is suitable for use to provide water resistance or oil resistance to a surface. To this end, the following non-exclusive list of materials may be utilized as the active ingredient in the barrier composition: a fluorochemical, metal stearate, oil, paraffin wax, acrylate (latex) polymer or a silicone polymer. In a further aspect, the active ingredient for the barrier composition does not comprise a paraffin wax. In yet a further aspect, the barrier composition does not comprise a synthetic isoparaffinic hydrocarbon. Still further, the active ingredient for the barrier composition consists essentially of a fluorochemical.

[0043] As would be recognized by one of ordinary skill in the art, application of a barrier composition comprising one or more of the active ingredients disclosed herein will result in a reduction of the wettability of the surface of a floor covering panel. Since the wettability of the floor covering panel is lower, there will be a lesser possibility for water or other damaging materials to migrate through the seam of a mated pair of floor covering panels. This water barrier property is very important so as to allow floor covering materials to be used in locations that are commonly subjected to contact with water, such as bathrooms, kitchens and other areas.

[0044] In accordance with the present invention, it has been found that by localizing a barrier composition toward an upper portion of the vertical edges of a mated pair of floor covering panels that define a floor covering system, durable and effective water barrier or water resistance may be obtained. Such selective application of the barrier composition is not known in the prior art.

[0045] In one aspect, the barrier composition for application to the floor covering panels comprises a fluorochemical

as an active ingredient. Suitable fluorochemicals are those that can have been used to provide water repellent qualities to textiles and other materials. Such materials are well known to one of ordinary skill in the art. Any fluorochemical that is suitable for use in imparting stain or oil resistance to textile materials may be used in the present invention.

[0046] The fluorochemical may comprise unbranded generic fluoropolymers. Suitable fluorochemical textile treating agents include, but are not limited to, commercially available fluorochemical compositions. Commercially available fluorochemical compositions may be used in the invention herein such as SCOTCHGUARD FC 255, SCOTCHGUARD FC 214-230, products of 3M Corp. (St. Paul, Minn.) and TEFLON, TEFLON 8070, and TEFLON 8787 and Zonyl 8412, available from DuPont (E.I. DuPont de Nemours Corp., Wilmington, Del.). Further suitable fluorochemical compounds include the following: FX-1367F and FX-1355 both from 3M Specialty Chemicals Division, NRD-372 from DuPont Flooring Systems, TG-232D from Advanced Polymers, Inc. (Carlstadt, N.J.) and Nuva 3555 from Hoechst Celanese (Munich, Germany). Other similar fluorochemical compounds from these and other manufacturers may also be suitable.

[0047] In one aspect of the present invention, the barrier composition does not comprise an organic solvent. Still further, the diluent for the active ingredient of the barrier composition comprises water or, in a further aspect, consists essentially of water. Yet further, the barrier composition comprises an emulsion or dispersion of the active ingredient in water. In a further aspect, the barrier composition is substantially non-flammable and may be utilized in an industrial setting without the use of explosion and fire proof equipment.

[0048] In particular, to obtain a durable barrier composition, use of a polymeric material may be desirable for use as the active ingredient. Non-exclusive examples of suitable polymers include silicone polymers, acrylate (latex) polymers and fluoropolymers. Such materials will generally have higher molecular weights and, as such, may allow a more durable deposition of the barrier composition to the floor covering panels. In separate aspects, the barrier composition provides a treatment that makes a floor covering material durable for at least about 6 months, or at least about 1 year, or at least about 5 years, or at least about 7 years, or at least about 12 years, or for the entire useful life of the floor covering system.

[0049] In one suitable aspect of the present invention, the barrier composition comprises a fluoroalkyl acrylate copolymer. The fluoroalkyl acrylate polymer may be formulated in an emulsion. Specific examples of such an emulsion for use in the barrier composition compositions of the present invention are Unidyne TG-572 and TG-472 (Daikin America, Signal Mtn., TN). TG-472 is believed to comprise about 30% by weight fluoroalkyl acrylate copolymer and emulsifiers, about 5.4% tripropylene glycol, with a balance of the composition comprising water. The composition of TG-572 is believed to be similar.

[0050] The barrier composition may comprise about 100% by weight of a composition comprising the active ingredient as supplied by the vendor, i.e. neat. The composition as supplied by a vendor may comprise any amount of active ingredient. However, such compositions are normally sup-

plied as solutions or dispersions of water barrier chemicals in water or other solvents. As contemplated, the concentration of barrier chemicals as supplied by a vendor is not significant as long as the appropriate dilution may be obtained to provide the barrier compositions suitable for use in the present invention. Alternatively, the composition as provided may be diluted prior to use on the floor covering panels. Any suitable solvent may be used for the dilution but water results in a lesser environmental impact from industrial use of the active ingredient. Accordingly, the barrier composition may comprise water as a primary solvent.

[0051] The active ingredient for the barrier composition may, in some aspects, be crosslinkable. "Crosslinkable" means the active ingredient reacts with or condenses with itself to result in a final product with a molecular weight of at least about 1.5 times or about 2 times or about 3 times the molecular weight of the non-crosslinked active ingredient. The active ingredient may also be crosslinkable in conjunction with a second material, such as melamine/formaldehyde resin.

[0052] The active ingredient may be crosslinkable by application of energy to the barrier composition after application of the barrier composition to the floor covering panel. The energy can be applied by heat, infrared lamps or microwave energy. The active ingredient may also be crosslinkable by inclusion of a crosslinker in the barrier composition. In separate aspects, the active ingredient is substantially crosslinked at the conclusion of the application of heat, however, it will be recognized that with time, some additional crosslinking may occur.

[0053] The final amount of active ingredient in the barrier composition may vary within a wide range. In particular, the amount of active ingredient (that is, the water barrier chemical) in the barrier composition may be about 1, 2, 5, 10, 15, 20, 25, 30, 40 or 50% or by weight of the barrier composition, with any value forming the upper and lower endpoint, as appropriate. The balance of materials in the barrier composition may primarily be water, along with a minor amount of other materials.

[0054] The barrier composition may include additives as are known to one of ordinary skill in the art. In particular, the barrier composition may include one or more of: surfactants, viscosity modifiers, preservatives, surface tension modifiers or opacifiers.

[0055] As would be recognized by one of ordinary skill in the art, any dilution of the active ingredient will depend in large part on the type and amount of active ingredient in the composition as supplied by a manufacturer.

[0056] An important aspect of the present invention is that the barrier composition provides a durable water resistance or barrier treatment to a floor covering panel or floor covering panel system. "Durable" is used herein to mean that the barrier composition provides a treatment that will substantially reduce the possibility that water or other liquids will penetrate the seam of two mated floor covering panels. The barrier composition should provide a water barrier that lasts at least 2 times as long as the barrier provided by a paraffin-based composition. Still further, the barrier composition of the present invention should reduce the amount of water penetrating a top seam by at least $\frac{1}{2}$ or $\frac{3}{4}$, even when the water comprises a small amount of

surfactant, i.e., 1 weight percent of the water or less. Such reduction should last for at least about 10, or about 20, or about 40, or about 100 normal mopping cycles, where "normal mopping" corresponds to the cleaning that a floor covering panel system will undergo during normal residential use. Yet still further, the barrier composition of the present invention will provide a durable water barrier for one normal mopping cycle per week for about 1 year, or about 2 years, or about 5 years, or about 7 years, or about 12 years, or about as long as the normal useful life of the particular floor covering panel system.

[0057] Moreover, it has been found possible to apply other materials to the floor covering panels along with this barrier composition. In particular, prior art methods of application of water resistance compositions to, for example, tongue and groove flooring materials, rely on a general and non-specific application of the water resistance composition to the tongue and groove profile. This general and non-specific application may prevent the subsequent application of other materials, such as adhesive, because the water barrier composition may prevent durable adherence of the adhesive (or other material) to the surface of the tongue in groove profile. In some circumstances, it is desirable to have a floor covering panel that not only has a water barrier property, but to which an adhesive may also be applied.

[0058] In accordance with such an objective, the present invention may also be utilized in conjunction with an invention relating to selective application of an adhesive composition to a floor covering panel. The invention relating to this adhesive is described in detail in a U.S. Patent Application filed concurrently herewith (Attorney Docket Number 19133.0026U1), the disclosure of which is incorporated herein in its entirety by this reference.

[0059] Upon application of the barrier composition to the floor covering panels, heat may be applied to remove the solvent from the barrier composition and/or to provide crosslinking i.e., curing, of the active ingredient. In separate aspects, the barrier composition may be dried for about 5 seconds, about 10 seconds, about 30 seconds, about 1 minute, about 3 minutes, about 5 minutes, about 10 minutes, or about 20 minutes, with any value forming an upper or lower endpoint, as appropriate. The temperature applied to dry and/or crosslink the active ingredient may be from about 100° F. (37.8° C.), about 120° F. (48.89° C.), about 140° F. (60° C.), about 160° C.), (71.1° C.), about 180° F. (82.2° C.), about 200° F. (93.3° C.), or about 220° F. (104.4° F. where any value may form an upper and lower endpoint, as appropriate. In some aspects, it is important to heat the floor covering panels to at least about 180° F. (82.2° C.) for at least 10 seconds.

[0060] The barrier composition may include additives as are known to one of ordinary skill in the art. In particular, the barrier composition may include one or more of: surfactants, viscosity modifiers, preservatives, surface tension modifiers or opacifiers.

[0061] When it is only desired that the floor covering panel be waterproof and not, for example, pre-glued in the factory, such as disclosed and claimed in co-pending patent application, Attorney Docket Number 19133.0026U1, the barrier composition can be applied to the entire profile of the floor covering panel so as to provide an exceptionally complete waterproofing to the panel, e.g., waterproofing will

be applied from both above and below. In such an aspect, crosslinked polymer forms the active ingredient of the barrier composition of the present invention, the barrier composition may be applied to an entire portion of the first or second abutment.

[0062] In this aspect, the active ingredient of the barrier composition must be crosslinkable or, put another way, crosslinked when the floor covering panels are assembled for use in a commercial or residential establishment. In accordance with this aspect of the present invention, the crosslinkable material may be a silicone polymer, an acrylic polymer or a fluoropolymer. When a fluoropolymer, the crosslinkable material may be a fluoroacrylate polymer as described elsewhere herein.

EXAMPLES

[0063] The following examples are put forth so as to provide those of ordinary skill in the art with a complete disclosure and description of how the apparatus and composition, claimed herein is made and evaluated, and are intended to be purely exemplary of the invention and are not intended to limit the scope of what the inventor regards as the invention. Efforts have been made to ensure accuracy with respect to numbers (e.g., amounts, temperature, etc.) but some errors and deviations should be accounted for. Unless indicated otherwise, parts are parts by weight, temperature is in ° F. (° C.) or is at ambient temperature, and pressure is at or near atmospheric.

Seam Seepage & Swelling Test

[0064] Equipment:

- [0065] 1. Plumber's putty
- [0066] 2. Digital caliper
- [0067] 3.2% liquid detergent solution Ivory with Red dye 40 (much lower surface tension than H₂O) (very harsh test)
- [0068] 4. 10 ml graduated cylinder
- [0069] 5. Flat Horizontal surface
- [0070] 6. Saw with a blade for cutting laminates

[0071] Procedure for Seam Test (FIG. 4):

- [0072] 1. Mark 12 inch cuts down the length of the panel as samples to be tested.
- [0073] 2. Mark placement for three two-inch rings R about 1.5 inches apart on the edge of the upper lip on the groove side.
- [0074] 3. Within each ring R make three marks about half inch apart.
- [0075] 4. With a digital caliper measure the thickness of the panel at each of the marks.
- [0076] 5. Join together two panels **210a**, **210b** and cut samples apart.
- [0077] 6. Allow to sit in a flat horizontal location for the desired amount of time.
- [0078] 7. Place a ring R of plumber's putty around each set of marks.

[0079] 8. At the desired time after joining the panels, pour 10 ml of a red detergent solution S into each ring R and allow to sit undisturbed in a flat horizontal position until all the solution has passed through the joint J or evaporated.

[0080] The detergent solution comprises 2% liquid Ivory® or liquid Ajax® dishwashing detergent with a small amount of real food coloring added.

[0081] 9. Separate the two panels and remeasure the same marked locations. Also observe how far into the joint the red dye solution has penetrated. A spraymaton head was used. About 1 g or less of a 25% TG 472 or 571/75% water composition. Laminate floor covering material of 8"x48 (0.20x1.22 meters)". Barrier composition applied at location 50/52

Seam Seepage & Swelling			
		4 Hour %	72 Hour %
B	Flexipel XPC Only (comparative)	9.96	2.98
D	Unidyne TG-571	16.70	4.31
E	Unidyne TG-472	1.84	0.87
G	Virgin Control (comparative)	24.45	23.68
H	Paraffin Control (comparative)	30.66	25.63
I	Competitive floor covering material (comparative believed to be treated with paraffin wax)	21.17	21.49

[0082] Flexipel XPC (Innovative Chemical Technologies, Cartersville, Ga.) is a synthetic hydrocarbon (97-98%) and a perfluorinated polymer (2-3%). Unidyne 571 and 472 are fluoroacrylate polymer emulsions. After application to the floor covering panels, the floor covering panels were treated at 180° F. (82.2° C.) for 10-30 seconds.

[0083] Seam seepage and swelling measured as a % change of the thickness of the flooring material after application of liquid as indicated.

[0084] From the above results, it is apparent that the fluoroacrylate polymer provides a markedly improved water barrier over the other materials tested.

[0085] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.

What is claimed is:

- 1. A floor covering panel, comprising:
 - a. a first generally planar surface,
 - b. a second generally planar surface,
 - c. a first side edge and an opposed second side edge, each respective side edge extending between said first and second surfaces, respectively,

d. a first coupling member defined within the first edge of the panel and comprising a protrusion extending therefrom and a first abutment surface between the protrusion and the first surface,

e. a second coupling member defined within the second edge of the panel and comprising a recess sized and shaped to receive said protrusion therein, and further comprising a second abutment surface between the recess and the first surface, and

f. a barrier composition selectively applied to at least a portion of at least one of the first abutment surface and the second abutment surface

2. The floor covering panel of claim 1, further comprising a first and a second one of said floor covering panels, respectively, the first coupling member of the first panel being received within the second coupling member of the second panel, and at least a portion of the first abutment surface of the first panel contacting at least a portion of the second abutment surface of the second panel, wherein the barrier composition is positioned between said first abutment surface and said second abutment surface and creates a relative barrier against moisture penetrating into the respective floor covering panels beyond the first surface.

3. The floor covering panel of claim 1, wherein the barrier composition is applied along substantially all of the first abutment surface.

4. The floor covering panel of claim 1, wherein the barrier composition is applied along substantially all of the second abutment surface.

5. The floor covering panel of claim 1, wherein the barrier composition is applied along substantially all of the first abutment surface and along substantially all of the second abutment surface.

6. The floor covering panel of claim 1, wherein the barrier composition is selectively applied along a portion of the first abutment surface adjacent the upper surface.

7. The floor covering panel of claim 1, wherein the barrier composition is selectively applied along a portion of the second abutment surface adjacent the upper surface.

8. The floor covering panel of claim 1, wherein the barrier composition is selectively applied along a portion of the first abutment surface adjacent the upper surface and along a portion of the second abutment surface adjacent the upper surface.

9. The floor covering panel of claim 1, wherein the barrier composition comprises an active ingredient that comprises one or more of a fluorochemical, metal stearate, oil, wax, acrylate polymer or a silicone polymer.

10. The floor covering panel of claim 9, wherein the active ingredient is crosslinkable.

11. The floor covering panel of claim 9, wherein the active ingredient comprises the fluorochemical.

12. The floor covering panel of claim 11, wherein the fluorochemical comprises a fluoropolymer.

13. The floor covering panel of claim 12, wherein the fluoropolymer comprises a fluoroacrylate polymer.

14. A floor covering panel suitable for mating with a second floor covering panel, wherein the floor covering panel has a crosslinkable polymer applied to at least part of an area defining a tongue and groove profile, thereby pro-

viding a durable water barrier when the polymer is at least partially crosslinked and floor covering panel is mated with at least one second floor covering panel.

15. The floor covering panel of claim 14, wherein the crosslinkable polymer is applied to a vertical edge of the profile, wherein the edge comprises an upper edge of the floor covering panel.

16. The floor covering panel of claim 14, wherein the floor covering panel is mated with a second floor covering panel, thereby providing a floor covering system, wherein the system comprises at least one seam on an upper surface of the system.

17. The floor covering system of claim 16, wherein the second floor covering panel comprises a crosslinkable poly-

mer applied to a vertical edge that is complementary to the vertical edge of the first floor covering panel.

18. The floor covering system of claim 16, wherein the crosslinkable polymer provides a water barrier, thereby substantially reducing water seepage into the system in comparison to seepage in a floor covering system not treated with a crosslinked polymer barrier composition.

19. The floor covering panel of claim 14, wherein the polymer comprises one or more of a silicone polymer, an acrylate polymer or a fluoropolymer.

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