Flooring panels can have a variety of widths. In one embodiment, panels or boards of different widths are packaged together to give the installer a great deal of flexibility in constructing the floor in order to achieve a realistic looking surface. In another embodiment, the panels have locking joints which allow the panels to be maintained in an installed condition until a pre-applied glue is allowed to set.
FLOORING PANEL OR WALL PANEL AND USE THEREOF

[0001] CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. Ser. No. 10/228,065, filed Aug. 27, 2002, which is a continuation of U.S. Ser. No. 09/891,460, filed Jun. 27, 2001, each of which is herein incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

[0003] 1. Field of the Invention

[0004] The present invention relates to a building panel, such as a flooring panel or wall panel and the use thereof, to form floors, walls, cladding, etc., by assembling a plurality of the panels. In one embodiment, the panels have particular utility for flooring or cladding a wet room. The invention additionally relates to a glueable panel for forming a generally planar surface. The invention is also directed to a method of assembling a planar surface from a plurality of panels. While the uses for a planar surface are numerous, the invention will likely be most commonly used as a floor, especially a floating flooring where the floor is not attached to the subfloor.

[0005] 2. Background

[0006] During the last few years laminated floors have achieved increased in popularity and on many markets they are beginning to replace parquet floors and wall-to-wall carpets. In the production of laminated floors a decorative thermosetting laminate is first produced. This laminate usually consists of a base layer of paper sheet impregnated with phenol-formaldehyde resin and a decorative surface layer comprising a decor paper sheet impregnated with melamine-formaldehyde resin. The laminate is produced by pressing the different layers at a high pressure and at an increased temperature.

[0007] The laminate thus obtained is then glued to a carrier of particle board, for instance, or used as such without any carrier and it is then called compact laminate. The laminated panel thus produced is then sawn up to a number of floor boards which are provided with groove and tongue at the long sides and the short sides thereof. Often the floor boards produced have a thickness of about 7 mm, a length of 120 cm and a width of about 20 cm. They can usually be put on top of an existing flooring material at a renovation. According to another alternative, instead one or more of the above decorative sheets can be laminated directly towards a base sheet of particle board for instance.

[0008] At the assemblage of such a flooring, glue is normally applied in the groove when the floor boards are assembled. Therefore, it will be difficult to change a damaged board or to remove a whole flooring and, for instance, install it in another room.

[0009] To avoid the above problem efforts have been made to achieve floor boards which can be assembled without glue. One such construction is disclosed in the U.S. Pat. No. 5,295,341. There the boards are provided with groove and tongue in the usual way, but here a snap-together system is included in the groove-tongue joint.

[0010] These floor boards can be assembled without glue. However, they have the disadvantage that the joints between the boards will be flexible and not rigid. Moreover, the joint between adjacent boards is not tight. This means that if the surface below the floor boards is not completely even, which is usually the case, a gap will be formed between the boards. Into these gaps dirt and water can penetrate. Thus, although glue is not required, it is certainly within the scope of this invention to provide glue during installation, either as a pregluic, i.e., provided at the factory during manufacture, or applied during assembly of the surface.

[0011] Assembly and installation of floor covering is often an arduous task. For example, unlike carpet or wallpaper, the wood covering required skill, precise measurement and specialized tools in order to install it correctly. Unlike carpet or wallpaper, wood flooring could be neither stretched nor folded in order to accommodate the dimensions of a room. Additionally, wood flooring, especially flooring of tile or planks, required precision fitting in order to prevent the occurrence of gaps or cracks which would effect the physical appearance, as well as the durability and wear-resistance of the covering. This was also true of laminated flooring which has become popular in recent years, including the so-called “glueless” floors which have edges framed with interlocking patterns. Such floors cannot generally be assembled by pushing the panels together in the same plane, but must be manipulated through a series of angular motions in a particular sequence to assemble the panels into a floor. Therefore, great care and skill are required to insure that the tiles and panels of the surface covering fit neatly and tightly together. This often proved to be an arduous task, as hundreds of tiles or panels were generally required in order to cover a desired surface.

[0012] In order to properly install a conventional surface covering, one was generally required to carefully install the covering, tile-by-tile, and generally tapping and/or nailing each tile into place, or gluing and adhering the newly-placed tile to the surface to be covered, as well as the previously-placed tile. With the so-called “glueless” floor, the planks required manipulation to assemble them and the floors have been known to fail at the joint since the interlocking patterns at the edges are relatively thin, being machined into these plank edges. Because numerous tiles or panels were often required to be placed, there was the omnipresent danger of one of the tiles or panels becoming unscrewed during installation, which often required an installer to re-do his work to replace the shifted tile or panel. Still further, temporary clamps or installation straps were required to maintain the panels in position until the glue dried.

SUMMARY OF THE INVENTION

[0013] According to the present invention, the last mentioned problem has been solved and a building panel, such as a flooring panel or wall panel, preferably of thermosetting laminate and preferably having two pairs of parallel side edges has been brought about. In such a preferred embodiment, two of these side edges are provided with a locking means in the form of a groove and the other two are provided with a tongue fitting in the groove whereby a tongue/groove joint for assembling of the panels is formed. The groove and the tongue are preferably made of a water resistant or water tight material and formed with a snap-together joint including one or more snapping webs or the like with correspond-
ing cooperating snapping grooves. In one embodiment, the groove in front of the snap-together joint has an entrance opening and continues inside the snap-together joint into a stabilizing groove. The tongue is formed with a rear neck intended to fit in the entrance opening and a forwardly protruding stabilizing part situated in front of the snap-together joint and intended for a tight fit in the stabilizing groove, whereby connecting panels when assembled by the snap-together joints and the stabilizing parts in the stabilizing grooves are held to each other and prevented from unintentional separation while at the same time a rigid floor covering or wall covering respectively with water tight joints and without unintentional gaps between the panels is obtained. In other embodiments, where the effect provided by the stabilizing groove and stabilizing part is not desired, these stabilizing parts can be omitted.

[0014] According to one preferred embodiment two adjacent side edges of the panel are provided with a groove and the other two side edges with a tongue. In this embodiment, the panel is usually quadrilateral, such as rectangular, but it can also be square.

[0015] In square panels it is also possible to provide a pair of parallel sides with a groove and the other pair with a tongue. However, the choice of pattern on the surface layer of the panel is limited with this shape. In other embodiments, the perimeter of the panel comprises three or five, or more, such as six or eight, side edges and the arrangement of the grooves and tongues can be varied. The series of panels which are connected to form a floor, wall, or other system need not all be of the same shape.

[0016] It is preferred that the groove and the tongue are made of a waterproof or water resistant material, such as a thermoplastic, a thermostetting laminate, aluminum or a cellular product such as a wood fiber board (including the so-called HDF and MDF boards), chipboard or particle board or a veneer impregnated or coated with a waterproofing material, such as oil, wax or a thermostable or thermostetting substance including, but not limited to, polymeric resins. It has been found that treating the panel with a liquid plastic substance such as a polyurethane gives excellent results. Of course, also other waterproof, water tight or water resistant materials can be used.

[0017] In another embodiment, the groove, as well as the tongue, are formed as a ledge fixed to the side edges of the panel. Suitably the ledge-formed groove and tongue respectively are then fixed in a recess along the side edges with glue, for instance. Alternatively, the integral tongue and groove portions of the panels can be formed in either the base material, the laminate material and/or both.

[0018] Protrusions which form the snapping webs can be formed on the upper and/or lower side of the tongue while cooperating depressions which form the snapping grooves are formed in the groove.

[0019] In one preferred embodiment one snapping web is formed on the upper side of the tongue and one on the lower side thereof while the groove has two fitting snapping grooves one at the top and one at the bottom of the groove. These snapping webs may be diametrically opposite one another or offset from one another. The corresponding snapping grooves will be positioned according to the position of the snapping webs so as to cooperate therewith. In an alternative, but equally preferred embodiment, the tongue may be provided with an uneven number of snapping webs on the upper and lower side of the tongues, e.g., none above and one below, one above and two below, etc.

[0020] If necessary one pair of snapping webs can be formed on the upper side of the tongue and one pair on the lower side thereof. Of course, you then need two snapping grooves at the top and two snapping grooves at the bottom of the groove to fit with the snapping webs. This construction will give an extremely strong joint.

[0021] Of course, in all these embodiments, the snapping webs can be arranged in the groove and the snapping grooves on the tongue. A greater number of snapping webs may also be positioned above the tongue than below the tongue without departing from the invention.

[0022] In the preferred embodiment using the stabilizing parts, the width of the stabilizing part is 1-10 mm, preferably 2-10 mm, most preferably 4-10 mm. Generally, a wider stabilizing part with fitting stabilizing groove gives a better rigidity of the assembled panels.

[0023] The stabilizing part will also assist in a correct assemblage of the panels. Thus, when the stabilizing part moves into the stabilizing groove you get a correct level of the panels and the panels can easily be pushed into the correct position where you do not have any gap between the panels. Of course, without any substantial gap between the panels, water and dirt are prevented from entering the assembled panels, flooring or wall covering.

[0024] As a safeguard against water penetration a seal might be arranged in the inner part of the stabilizing groove for instance. Alternatively, by selectively engineering the materials used in the tongue and/or groove portions of the panel of water resistant or water proof materials of suitable geometry and elastic modulus, the snapping action can be facilitated by permitting displacement or flexing of the elements defining the tongue and/or groove while the resilience permits snapping of the locking feature to bring said panels into forming a tight joint such that the joint is said to be waterproof or water tight. A joint is water tight when standing water will not significantly penetrate the joint for several hours.

[0025] Notwithstanding that the joint is tight to the point of being waterproof or water tight, the panels may be dismountable from each other after snapping the panels together.

[0026] Preferably the grooves and the tongues run the full length of the side edges of the panels, although they may be intermittently interrupted along the length of the panels.

[0027] The panels can be designed in such a manner that the underside of the groove and/or the tongue are situated in the same level as the underside of the panel.

[0028] The panels can be used for covering floors and walls in ordinary dry rooms. However, due to the tight joints and in other cases due to the rigid and water tight joints, the panels can be used also for wet rooms. For such applications the whole panel is preferably made of plastic or thermostetting laminate of so-called compact laminate type. Such a laminate does not absorb water.

[0029] Another alternative is a water resistant and/or non water-absorbing base with a water tight surface. The surface
may, for instance, consist of a paint, a thermoplastic foil such as polyethylene, polypropylene or polyvinyl chloride, a paper sheet impregnated with a resin, such as a thermosetting or UV-curing resin such as one comprising acrylate and a maleimide, or of a thermosetting laminate.

[0030] One suitable non water-absorbing base is a board produced by pressing and consolidating wood particles or wood chips impregnated with a thermoplastic or other binders.

[0031] In other embodiments of this invention, the panels or boards are cut into smaller sections. Specifically, in order to allow greater flexibility in designing and installing floors or other structures with the boards of the invention, the individual panels may have widths and/or lengths only a fraction of conventional widths and/or lengths. For example, a single package, sold as a single unit, may contain panels having varying widths and/or lengths. As a result, a greater variety of designs may be achieved in the final assembled structure. For example, the different board lengths allow floors to more closely imitate traditional hardwood floors, or in the alternative, achieve a fanciful, non-conventional design. Because the panels of this embodiment may be provided with any type of joining structures, including various of the known tongue and groove joints on any edge, even greater flexibility in installation pattern is achieved.

[0032] The invention is additionally directed to a glueable panel for forming a generally planar surface. The panel includes a first surface, lying substantially in a plane, and a second surface facing opposite the first surface and disposed substantially parallel to and displaced from the first surface. A perimeter of the panel is defined by edges extending between the first and second surfaces. The edges may include male edges and/or female edges.

[0033] In one embodiment, the panels of the invention are provided with edges that are dimensioned as to increase the friction between assembled panels such the glue may dry without the necessity for external clamps or installation straps. In another embodiment, each male edge includes a tongue extending outwardly from the male edge and a longitudinally extending void extending inwardly of the tongue. Each female edge includes a groove having a protrusion positioned within the groove. The protrusion extends outwardly from the groove generally parallel to the first surface. Adjacent panels may be linked to similar panels such that the tongue engages the groove and the protrusion enters into the void.

[0034] Alternatively, the tongue may include a pair of flange-shaped fingers, and the void may extend between the fingers. The void may be formed as a general U-shape. Optionally, the U-shape may be formed with an enlarged bight, and the protrusion may include a bulbous end, such that the bight and the bulbous end are formed to cooperatively engage one another when the protrusion is inserted into the void.

[0035] The foregoing are but exemplary ways of increasing the friction or providing an interlocking joint of strength sufficient to permit assembly of adjacent panels without clamping, and without the need for installation straps, or, hammers and tapping blocks. In fact, the panels of the invention can be installed by using hand and arm pressure alone, without the aid of any tools or machine of any kind. Thus, as used herein, the term “manual” means, “without the aid of tools or machines.” The friction or interlock need only be sufficient to hold the panels together while the adhesive sets. Panels may be formed where all the edges are identical, for example, all male, or all female edges, or the panels may have differently shaped edges of common gender, e.g. two male and two female edges per plank. When more than one male or female edge appears on a single plank, it is not necessary that all single male (or female) edges have the same shape, i.e., the shape of each male edge can differ from other male edges, and each female edge can differ from other female edges. For example, a male edge on a long side of the planking may have a male edge on the short side of the plank which differs in shape. Optionally, adjacent panels are formed to slidingly engage one another along engaged edges. This engagement allows sliding movement but restrains relative movement of the panels transverse to the engaged edges. Such sliding movement facilitates the gluing of the panels, as will be discussed below.

[0036] The panels may be formed of any geometric shape. Commonly, the panels will form rectangles, including squares, and each male edge may be positioned opposite, or adjacent a female edge. Of course, other planar geometric shapes are also possible, such as triangles, pentagons, hexagons, octagons, or the like.

[0037] Typically, the first (or top) surface of the plank is covered with a laminate. The laminate may be selectively chosen for aesthetics to make any type of pattern, such as a wood grain or stone pattern, for example. Laminates may be of the high pressure laminate (HPL) or direct laminate (DL) types. Typically, the laminate includes a decorative paper, hard particles such as alumina, silica, diamond, silicon carbide and the like, to resist abrasion and scratching, and a resin, such as melamine or other thermosetting resin. Additionally, the panel may also include an adhesive positioned along at least one of the male edges or female edges. The adhesive may be one which is placed on the panel when the panel edges are manufactured or formed at the factory. However, the adhesive may alternately be one placed on the edges immediately before joining the edge to an adjacent panel. In one preferred embodiment, the adhesive, placed on the panel at the factory, is contained within or activated by microballoons that are ruptured upon joining of the plank edges. Alternatively, the adhesive may be activated by use of an activator, such as water or a solvent, or perhaps the adhesive may be activated by a chemical reaction that is initiated by friction of the panels contacting one another, i.e., placing one part of two-part system one panel and a second part of the system on an adjacent panel. Alternatively, the adhesive may be actuated after the panels are joined, such as by ultrasonic radiation penetrates the panel and ruptures a membrane, releasing a component of the adhesive.

[0038] The panels are formed to fit together such that when a first surface of a first panel abuts a first surface of the adjacent panel, there remains no gap therebetween when the panels are in an installed condition.

[0039] The invention also includes a method of assembling a planar surface from interlockable panels, such as the ones referred to above. The method includes the steps of providing a plurality of interlockable panels, placing the first surfaces of adjacent panels within a common plane, and manually linking the male edge of a first panel with the
female edge of a second panel, or vice-versa by sliding the panels in a common plane. Such assembly can be done using
hand and arm pressure alone on a horizontal planar surface. The joints do not require lifting or rotating, or a hammer or
tapping block or other tool, that provides leverage to close the joint. An adhesive is applied to the joined edges, which
allows the installer to select a desired position, then allow the adhesive to cure with the panels in position. The edges are
configured to hold the panels in a joined condition until the adhesive cures. Because the edges have sufficient friction or
interlock to hold the panels in place while the adhesive cures, no clamping is needed, and no straps are required.

In one embodiment of the method, the linking step may include the step of aligning the male edge of the first
panel with the female edge of the second panel in a substantially collinear fashion, then engaging the male edge of
the first panel into the female edge of the second panel.

Alternatively, the method includes the step of snap-fitting the male edge into the female edge.

Hand and arm pressure is all that is needed to assemble the friction and interlocking joints of the present
invention.

In the embodiments of the invention, the method may also include the step of sliding the panels along the joint
data until a desired position is reached.

Also, the embodiments of the method include the step of applying adhesive to at least one of the male edges or
the female edges. The adhesive may be applied immediately before joining the panels, or it may be activated (such as,
by a solvent or by the rupturing of microballoons that contains either solvent, adhesive, or reactive components).
Optionally, the adhesive is self-activated so that the adhesive becomes active upon joining adjacent panels, e.g. the male
edges contain one part of a two part adhesive and the female edge contains the other part. The joining of the panels causes
the adhesive to become activated.

The invention will be further explained in connection with the enclosed figures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 schematically shows a panel 1 according to the invention seen from above. The panel is drawn as a
rectangular shape but it can just as well be square or other quadrilateral.

FIGS. 2 and 3 show a cross section through two adjacent edges of two embodiments of a panel where two
such panels are to be assembled.

FIG. 4 is a schematic representation of a joint between two panels containing offset snapping webs on the
tongue.

FIGS. 5-7 are schematic representations of three other embodiments showing different placements, number
and arrangements of snapping webs and snapping grooves on panels.

FIG. 8 is a schematic representation of a joint between two assembled panels in another embodiment of the
invention.

FIGS. 9-12 are schematic representations of four other alternative embodiments showing different place-
ments, number and arrangements of snapping webs and snapping grooves on panels.

FIGS. 13-16 disclose various methods of assembling the panels into a finished structure, such as a floor.

FIG. 17 shows an additional embodiment of the panels of the invention.

FIG. 18 is a perspective view of an additional embodiment, according to the principles of the invention.

FIG. 19 is a perspective view of the embodiment shown in FIG. 18 depicted in the joined condition.

FIG. 19A is a cross-sectional enlarged view of an alternative embodiment of an interlocking joint that juxta-
poses the male edge of one panel and the female edge of another.

FIG. 19B is a cross-sectional enlarged view of an alternative embodiment of increased friction joint.

FIG. 19C is a further cross-sectional enlarged view of a still further embodiment of a joint according to the
invention.

FIG. 20 presents a perspective view of a further embodiment of the invention.

FIG. 21 is a plan view, showing a sliding method of assembly.

FIG. 22 depicts a plan view showing an additional method of joining adjacent panels.

FIG. 23 is a plan view, illustrating the sliding relationship of adjacent panels.

FIG. 24 is a plan view showing an embodiment of the method according to the invention, showing a diagonal
direction of installation.

FIG. 25 is a cross-section of a friction-fit joint.

DETAILED DESCRIPTION OF THE
INVENTION

The panel 1 consists of a base of cellulosic materials, such as wood particles impregnated with a resin, such as
a thermoplastic material, with a decorative thermosetting laminate as a surface layer 17 glued on top.

The panel 1 has two pairs of parallel side edges 2, 3 and 4, 5 respectively (FIG. 1). Two of these side edges are
provided with locking means in the form of a groove 6 and the other two with a tongue 7 fitting in the groove 6, whereby
a tongue/groove joint for assembling of the panels is formed.

The groove 6 and the tongue 7 are made of a water light material and formed with a snap-together joint. In the
embodiment shown in FIG. 2, the snap-together joint consists of two snapping webs 9, one on the upper side of the
tongue 7 and one on the lower side of tongue, these webs 9 cooperating with two fitting snapping grooves 10.

In front of the snap-together joint, which means the snapping webs 9 and the snapping groove 10, the groove 6
has an entrance opening 8. Inside the snap-together joint the groove 6 continues in a stabilizing groove 13.
The tongue 7 is formed with a rear neck 11 intended to fit in the entrance opening 8 of the groove 6. In front of the snap-together joint the tongue 7 has a forwardly protruding stabilizing part 12 intended for a tight fit in the stabilizing groove 13.

The parts 9 and 10 included in the snap-together joint are also adapted to each other to give a tight fit and strong joint. To increase this effect further the snapping grooves 10 are provided with undercut edges 18 which cooperate with the backside of the snapping webs 9 with the same undercut.

In the embodiment of FIGS. 2 and 3, the groove 6 and the tongue 7 are made of thermostetting laminate and formed as a ledge fixed by glue in a recess along the side edges of the panel. The under side 14 of the groove 6 is situated in the same level as the under side 15 of the panel and the under side 16 of the tongue 7 is situated in the same level as the under side 15 of the panel 1. In the embodiments of FIGS. 4-12, the tongue and groove are formed of the same material as the body of the panel. Thus, when the body of the panel comprises a carrier of a resin impregnated cellulosic material, such as fiber board, the tongue and groove are formed of the same material as the carrier of the panel. In other embodiments, the base or carrier itself can be formed of a water repellent material, such as plastic. When pushed together, the panels make a distinctive sound, which we have nicknamed the “click” system.

When connecting panels have been assembled by the snap-together joints and the stabilizing parts 12 inserted in the stabilizing grooves 13, the panels are fixed to each other and prevented from unintentional separation. A rigid floor covering or wall covering with water tight joints and without unintentional gaps between the panels is obtained. The usual rotation of the snapping webs 9 in the snapping grooves 10 is prevented by the stabilizing parts 12 in the stabilizing grooves 13. Accordingly these parts are essential for the possibility to get a rigid joint between the panels.

The embodiment shown in FIG. 3 is very similar to that according to FIG. 2. The difference is that only the under side of the tongue 7 is provided with a snapping web 9. The upper side is lacking a snapping web. Accordingly there is only one snapping groove 10 at the bottom of the groove 6.

The embodiment of FIG. 4, though similar to FIG. 2 in having the upper and lower sides of tongue 7 provided with snapping webs 9, such snapping webs are longitudinal displaced along tongue 7.

The embodiment of FIG. 5 shows the provision of an uneven number of snapping webs 9 on tongue 7 where an upper and lower snapping web are vertically aligned but a third snapping web, positioned on the underside of the tongue 7 is longitudinally displaced at a distance towards the main body of the carrier.

In FIG. 6 is illustrative of a further embodiment, similar to that of FIG. 4 in having longitudinally displaced upper and lower snapping webs 9. However, in FIG. 6 is provided a nose 19 on the upper edge of panel 1, proximate the tongue side of the panel. Such nose 19 assists in providing a tight joint when similar panels are assembled together. The nose may alternatively be provided on the groove side of the panel or further on both the tongue and groove sides of the panel.

FIG. 7 illustrates the same type of nose 19 as in FIG. 6, however, in this embodiment, the lower snapping webs 9 are both longitudinally displaced towards the main body of panel 1 such that the most distal snapping web 9 lies vertically beneath nose 19 and the other snapping web 9 is inwardly positioned.

The embodiment of FIG. 8 illustrates a unique design for both tongue 7 and snapping webs 9 and snapping grooves 10. In this embodiment, tongue 7 is undercut so as to provide a sloping surface 20. Moreover, the walls of the backsides of snapping webs 9 and the corresponding walls of snapping grooves 10 are vertical, or nearly so. This configuration permits at least one of the panels to be tilted relative to the other panel to provide for disassembly of the floor panels. The slope enables the panels to disassemble and thus, the disassembly of the panels. Moreover, the radius covers 21, 22 of the panels edges facilitate the “turning” of the assembled panels away from each other.

As in the embodiments of FIGS. 2 and 3, each of the embodiments of FIGS. 4-8 may comprise an upper surface of a thermostetting laminate, a plastic foil such as an olefin plastic, paper sheets impregnated with a thermostetting or UV-curing resin comprising acrylate and a maleimide or similar materials.

In FIGS. 9-12, a panel 1 comprises a base of cellulosic material 11 with a decorative surface 17. The decorative surface 17 can be a thermostetting laminate, a plastic foil, such as an olefin plastic, paper sheets impregnated with a thermostetting or UV-curing resin comprising acrylate and a maleimide or similar materials. The cellulosic material 11 is the same as or similar to that used in the embodiments of FIGS. 1-8. However, as shown in FIG. 9, groove 16 contains an upper snapping groove 99 and a lower snapping groove 23. While each of groove 99 and 23 are vertically overlapping with each other, they are not coextensive. Snapping groove 99 is positioned proximate the groove edge 31 and snapping groove 23 extends further distal to groove edge 31, though both groove 99 and groove 23 are located with an imaginary vertical plane P extending through the top of panel edge 40. On the tongue side of panel 1 of FIG. 9 are two snapping webs 34, 35, configured and located so as to snap into cooperating grooves 99 and 23 on an identical panel (not shown).

In FIG. 10, is a panel constructed similarly to that of FIG. 9, with the modification that two upper snapping grooves 97, 98 and one lower snapping groove 101 are provided. As can be seen in FIG. 10 the upper and lower snapping grooves engage with corresponding upper snapping webs 103, 104 and lower snapping web 105 when a similar panel 1 is located so as to check or snap into place.

FIG. 11 is similar to FIG. 9 except that the position of upper and lower snapping grooves 199, 123, respectively, are offset as shown. Additionally, lower web 106 of groove edge 31 extends distally beyond plane P which is an imaginary vertical plane extending through the top web 116 of groove 31.

Snapping webs 203, 205 are configured so as to be received with corresponding snapping grooves 199, 123, respectively, when an identical panel is horizontally pushed into place.

FIG. 12 is similar to FIG. 10 except insofar as the lower web 206 extends distally beyond imaginary plane P.
extending vertically from the top edge 216 of groove 31. As in the previous figures, upper and lower snapping webs 303, 304, 305 are configured so as to be matingly received in snapping grooves 297, 298, and 301 of an identical panel.

[0085] FIGS. 13-15 and 257 are illustrative of various ways to assemble the panels according to the invention. In each of these Figs. A and B represent two panels assembled in a first row, C represents a first panel assembled in a second row and D represents a new panel to be assembled so as to adjoin said first and second rows. All of such new panels D are assembled by horizontally pushing the new panel D in one of the following steps:

[0086] In FIG. 13, new panel D is engaged at its “short side” 401 with a short side 402 of panel C and is horizontally pushed in the direction of arrow 501 so as to slide along the short side 402 of panel C with panel D’s respective upper and lower snapping webs are received in the respective upper and lower snapping grooves of panel C and until the “long sides” 403 of panel D engages with the edges 404, 405 of panels A and B.

[0087] In the alternative installation method of FIG. 14, new panel D is engaged at its long side 403 with the long side 405 of panel B and horizontally moved along arrow 602 until panel D’s short side 401 engages with short side 402 of panel C. The horizontal motion does not require that any of the panels be “tilted” or “angled” out of the plane of the paper in order to joint the new panel D with any of the previously laid panels A-C.

[0088] Still further, new panel D may be simultaneously assembled with short side 402 of panel C and the long sides 404 and 405 of panels A and B by exerting a force in the direction of arrow 202 as shown in FIG. 15. A special tapping block (not shown) configured to engage with the tongue and groove segments of new panel D can be used to horizontal urge panel D into simultaneous engagement with each of panels A, B, and C.

[0089] FIG. 16 shows a “double” horizontal push method of assembling a new panel into engagement with previously laid panels. In this embodiment, new panel D is placed with its long side 403 at a distance (for instance, 2 cm) from the long sides 404 and 405 of panels A and B, respectively. Then the new panel D is pushed horizontally in the direction of arrow “a” until the short side of 401 of panel D snaps together with the short side 402 of panel C. Then, panel D is pushed horizontally in the direction of arrow “b” (while still engaged with panel C along the joint formed by short side 402 of panel C and short side 401 of panel D) until the side 403 of panel D snaps together with the long sides 404 and 405 of panels A and B, respectively.

[0090] Thus, we have disclosed not only a configuration of making panels having unique tongue and groove configurations which permit “glueless” assembly of the panels by a click system, but also a method of assembling such panels into a finished structure, such as a floor.

[0091] The body of the panels in some of the embodiments are intended to be assembled without glue, but certainly glue or other sealing substance could be applied to the vicinity of the joint. Especially in the embodiments where the panels are intended to be installed in or proximate wet rooms, but also in ordinary rooms, the panels, especially the tongue and groove portions, can be coated or impregnated with a waterproofing material, such as an oil, wax, paint or other waterproofing material such as a liquid plastic coating, like polyurethane.

[0092] Alternatively, instead of a waterproof or water resistant layer on a carrier, the entire panel body can be made of a waterproof material, such as plastic, in which case the tongue and groove portions may be made of the same material as, and a unitary part of, the panel.

[0093] In still another embodiment of the invention, the joints can be “pre-glued,” i.e., have a glue system applied at the factory which glue system can be activated upon assembly of the panels into a finished structure, such as a floor. For example, the friction applied by assembling the panels as in FIGS. 13-16 can be used to rupture microballoons containing a catalyst or other component of an adhesive system to cause the assembled panels to be adhesively connected at the joint upon assembly.

[0094] Alternatively, the tongue portion of the panels can be pre-coated with one component of a two component adhesive system and the groove portion can be pre-coated with another component of the two component system, such that upon assembly of the tongue and groove portions of two adjacent panels, the adhesive system is activated to cause the panels to be adhesively connected at their joint.

[0095] It is within the scope of this adhesive system to include a blowing agent so as to form a foam filled adhesive. Alternatively, the adhesive may act more as a sealant, sealing the joint against ingress of water or other liquids when the panels are assembled into a structure, such as a floor.

[0096] Other adhesive systems, such as the use of initiators, inclusion of blowing or gas generating agents, multipart systems, such as a two resin system comprising parts one and two, wherein the catalyst or curing agent for part one is included with the part two resin and the catalyst or curing agent for part two is included with the part one resin may be applied at the factory, and initiated when the panels are installed.

[0097] Initiation may also occur when a protective strip is removed from the panel edges just prior to assembly of the panel, the removal of the protective strip exposing reactive components of the adhesive system.

[0098] Such modifications of the above pre-glued system will be apparent to those skilled in the art upon reading this disclosure.

[0099] It should be appreciated that we have provided a building panel and method of assembling the same which will result in tight joints between panels such that the assembled panels, used as flooring or cladding, which will be water repellent, that is, impervious to water standing on the surface of the joint, whether or not a pre-glue system is applied to the panel.

[0100] The panels of each embodiment of the invention may be joined through relative horizontal movement, i.e., movement in a plane parallel to the upper surface of the panels, as disclosed in U.S. Ser. No. 10/195,405, which is continuation-in-part of U.S. Ser. No. 09/637,114, filed Aug. 11, 2000, now U.S. Pat. No. 6,418,683, which in turn is a continuation-in-part of U.S. Ser. No. 08/894,966, filed Aug. 28, 1997, now U.S. Pat. No. 6,101,778, filed as PCT
While the edges of the boards or panels of this embodiment may include a tongue and groove system capable of maintaining a tight joint between the panels without the need for glue, in another embodiment, the panels or boards are provided with a pre-glue system as described herein.

The use of a pre-glue system allows for greater flexibility and greater tolerances when forming the tongue and groove. For example, with conventional glueless tongue and groove joints, the strength of the joint (the “locking strength”) is determined by the particular design of the tongue and groove. When the actual shape of the tongue and groove are altered, even slightly, the resulting joint may fail when used for the intended purpose, e.g., when subjected to stresses normally encountered when used as a floor.

By incorporating a pre-glue system into the horizontally-assembled panels, these tolerances need not be as strict. For example, in one embodiment, the structure of the tongue and groove need only be sufficient to join and hold adjacent panels in place, but only until the pre-glue system actually glues the panels together. In other words, for panels provided with, e.g., the micro-balloons described herein, the locking strength allows the rupture of the micro-balloons and setting of the adhesive or glue maintained herein. While the locking strength is sufficient to hold the panels together, the application of normal stresses, such as foot traffic or the moving of furniture, would likely overcome the locking strength. However, inclusion of a pre-glue system allows such stresses to be applied once the glue has set, as the glue greatly compliments the locking strength.

By utilizing the tongue and groove design of this embodiment, along with the pre-glue system, installation of the panels is significantly simplified. Because the locking strength need not be as great when compared to conventional glueless joints, installation no longer requires the use of a tool. For example, many conventional horizontally-assembled panels require means for applying a great force, e.g., a tapping block and a hammer, in order to fit the tongue into the groove and form the tight joint sufficient to overcome normal stresses. However, because the joint of this embodiment need not designed overcome normal stresses without the use of the pre-glue system, it is possible to form the tongue and groove configurations such that such tools are not required. That is to say, this embodiment permits the assembly of the panels without the need for tools, e.g., blocks, to, hammer panels into place, as only simple hand and arm pressure is required.

The tongue and groove system provided with boards of this embodiment is not limited. For example, while it is possible to include the horizontally-assembled system as described throughout this application on only two sides, it is considered within the scope of this invention to provide the horizontally-assembled system on all four sides, or substitute up to all four sides with any other assembly system, for example, a vertically assembled system. Finally, while this application describes the panels being rectangular, i.e., having two sets of parallel sides, defining right angles there between, such a configuration is not required, as the boards may define any polygonal structure, such as triangles, squares, pentagons, hexagons and dodecahedrons, and such polygons need not be regular, i.e., they can have differing angles and side lengths.
[0111] FIG. 18 shows a view of a first embodiment of the invention. Each panel 100 includes a first surface 512 and a second surface 514. The perimeter of each panel is defined by edges; the edges may comprise a male edge 516 and a female edge 518. Each male edge 516 may include a tongue 520 having a void 521 extending longitudinally thereon. Conversely, the panels may also include a chamfered edge 527 adjacent the intersection of the female edge 518 and the second surface 514.

[0112] Each female edge 518 may include a groove 522 having a longitudinally extending protrusion 524 therein. The protrusion 524 is shown as extending in a plane generally parallel to the first surface 512. Alternatively, the protrusion 524 may be a continuous rib that extends along the groove 522. The protrusion 524 may also comprise a rib that is interrupted at various places along the groove 522.

[0113] A laminate 536 may cover at least one of the first 512 or second 514 surfaces. As shown in FIG. 18, the laminate 536 may cover only the first surface 512; however, a laminate 536 may be applied to both surfaces or neither surface 512, 514. Optionally, the panel, including the portions forming the tongue and groove, can be of one piece, e.g., of plastic, metal, or a resin. Alternatively, the laminate 536 may be substituted with a foil, plastic, or other material, such as a wood veneer. The laminate 536 may be bonded to a substrate 512, 513, such as compressed cellulose particles, e.g., strandboard, plywood, or bonded fibers, such as HDF or MDF. The joint portions may be formed by milling the edges, by molding the edges, or by adhering a separate edge to the substrate. Milling is the preferred method.

[0114] FIG. 19 depicts the embodiment of FIG. 18 except that the adjacent panels 510 are shown in a joined condition. In the joined condition, the tongue 520 of male edge 516 engages and fits within the groove 522 of female edge 518. Additionally, the protrusion 524 engages and fits within the void 521. Groove 522 is shown in FIG. 19, as being substantially larger than the size of the male edge 516 or the tongue 520, however, when a foaming agent is used as a preglue system, upon joining of the male edge 516 to the female edge 518, the foaming agent may fill this void. Additionally, a relief section 532 is provided as a method of ensuring an adequate contact between the adjacent panels 510.

[0115] The terms “male edge” and “female edge” are used herein for illustrative purposes only, in order to give a greater understanding of the invention. Therefore, the definition of these terms, as used herein, is not necessarily identical to the respective definitions that may be used in the art.

[0116] At least one of the male edges or female edges 516, 518, may include an adhesive 530. FIG. 19 shows the adhesive 530 to be on both a male edge and a female edge, although the adhesive 530 may be on only one. The adhesive 530 may be any of several types of adhesive. For example, a conventional glue may be applied to one of the edges shortly before installation. Alternatively, the edge 516, 518, may be pre-formed with an adhesive built onto it. Specifically, the edge 516, 518 may include microballoons filled with an adhesive, or an activator for an adhesive. These microballoons may rupture upon installation, thereby enhancing the strength of the joined panels. The adhesive may also be activated by certain wavelengths of light, for example ultraviolet or infrared, acting upon a photoinhibitor contained within the adhesive.

[0117] The panels may further include chamfered edges 526 adjacent the intersection of the male edge 516 and second surface 514. Conversely, the panels may also include a chamfered edge 527 adjacent the intersection of the female edge 518 and the second surface 514.

[0118] FIG. 19A shows an enlarged view of a cross-section of the embodiment shown in FIG. 19, allowing depiction of the male and female edges 516, 518 in greater detail. The adhesive 530 is generally applied to one of the gluing surfaces 541 on the groove 522, or perhaps to one or more of the gluing surfaces 542 on the tongue 520. The adhesive may also be applied to the protrusion 524 or the recess 521.

[0119] The view shown in FIG. 19A also shows that the protrusion 524 may have a ridge 523 formed to complement a bulge 523 in the recess 521 of the tongue 520. Additionally, the protrusion 524 may have a ridge 525 formed to complement a bulge 525 in the recess 521 of the tongue 520.

[0120] Additionally, the female edge may have a wider area 543 on the tongue 520. The glue need not be applied to all surfaces of the joint edges. In FIG. 19A, glue is applied to surfaces 541, and 542 but is not applied to recess 521 nor protrusion 524. FIG. 19B and 19C illustrate alternative embodiments of the joints of the invention.

[0121] FIG. 20 shows another configuration of the panels 510. The embodiment shown in FIG. 20 differs from the embodiments shown in FIGS. 18 and 19, 19A and 19B; however, elements having similar structure and function have been given identical reference numerals in order to simplify explanation of the invention.

[0122] In this embodiment, each panel 510 comprises a first surface 512 and a second surface 514 facing opposite the first surface 512. The perimeter of the panel 510 is defined by edges; the edges may include male edges 516 and female edges 518. Each male edge will include a tongue 520, and each female edge will include a groove 522.

[0123] Each tongue 520 may include at least two flange-shaped fingers 528, 529 extending outwardly from the male edge 516. A void 521 may extend between the fingers 528, 529. The void 521 may be formed as a general U-shape having an enlarged bight 532. The female edge 518 may include a protrusion 524 extending outwardly from the groove 522. The protrusion 524 may extend generally parallel to the first surface 512, and outwardly from the groove. The protrusion 524 may terminate in an enlarged bulbous end 540. As shown, the protrusion 524 is a rib that continuously extends longitudinally along the groove 522. However, the protrusion 524 may also be interrupted along the longitudinal length of the groove 522.

[0124] The void 521, protrusion 524, enlarged bight 532 and bulbous end 540 may all be cooperatively formed to tightly engage one another when the panels are assembled and interlocked with one another.

[0125] When the embodiment shown in FIG. 20 is assembled, the enlarged bulbous end 540 may actually be too large to fit into the void 521. In order to fit the protrusion 524 into the void 521, the flange-shaped fingers 528 of the tongue 520 may outwardly deform to allow the bulbous end 540 to enter the void 521. When the bulbous end 540 reaches the enlarged bight 532, the flange-shaped fingers 528 may return to their original position, thereby helping retain the
protrusion 524 within the void 521. Alternatively, the bulbous end 540 may compress as it is inserted into the void 521, and then return toward its original size as it reaches the enlarged height 532. The enlarged height 532 also provides a volume which permits excess glue to be captured within the joint and prevents glue from squeezing to the top surface 512 of the panel, where it may be unsightly and would have to be removed in a separate step.

[0126] When the panels 510 are linked with one another, their first surface 512 may abut one another in such a way that no gap exists between the first surfaces 512 of the panels 510.

[0127] FIG. 21 illustrates a first embodiment of a method of assembly for adjacent panels 510. According to this method, the panels 510, 510' are placed in a common plane (i.e., the plane of the paper) such that a male edge 516 of a first panel 510 is aligned in a substantially collinear fashion with a female edge 518 of a second panel 510'. Then, the second panel 510' slidingly engages the first panel 510 by engaging the male edge 516 into the female edge 518. The sliding engagement assists in activating the adhesive.

[0128] FIG. 22 shows an additional method for assembling adjacent panels 510, 510'. In this embodiment, the panels 510, 510' are set in a common plane with the male edge 516 of a first panel facing the female edge 518 of another panel 510'. Then, the respective edges 516, 518 are slid toward one another so the respective edges 516, 518 engage and become interlocked. Generally, an installer will feel when the panels are adjoined using the method depicted in FIG. 22.

[0129] In some embodiments of the method (for example, the method shown in FIG. 21 and the method shown in FIG. 22), the panels become engaged such that relative sliding movement along the engaged edges 516, 518, is allowed, but relative movement transverse to the engaged edges 516, 518 is prevented. In all embodiments, the configuration of the edges allows the installer to move the panels before the adhesive cures, and the edges are configured to remain in contact without the use of clamps or installation straps.

[0130] FIG. 23 shows adjacent panels 510 in an already engaged position such that first surfaces 512 abut one another with no gap there between. In this condition, the panels may be slid, such as in the direction shown, until the panel is in a preselected position.

[0131] FIG. 24 illustrates yet another method of linking adjacent panels. As shown, a rectangular, e.g., square, panel 510 may be installed with other panels 510' by moving the male edge 516 of a first panel 510 into contact with a female edge 518 of another panel 510' by moving the panel 510 at an angle with respect to the male edge 516. As shown in FIG. 24, the panel 510 may be installed diagonally with respect to the edges 516, 516', 518, 518'. The same method of installation may be achieved with rectangular panels, of unequal side dimensions.

[0132] FIG. 25 depicts an embodiment of the invention wherein the joint between adjacent panels is a friction-fit. As is known in the art, a friction-fit joint is formed when a tongue 602 on a first panel 604 is inserted into a corresponding groove 606 on a second panel 606. However, because the size and shape of tongue 602 almost identically matches the size and shape of groove 606, friction between the surfaces of the tongue 602 and groove 604 resist decoupling of the panels.

[0133] Additionally, the embodiment of FIG. 25 includes ridges 610, which can serve a variety of purposes. Ridges 610 can enhance the locking force provided by the tongue 602 and the groove 604. Additionally, depending upon the particular size and configuration of the individual ridges 610, the ridges 610 can be included to assist in activating the preglue. For example, the ridges 610 may be raised or bossed sections of the tongue 602 or groove 604 which assist in bursting microcapsules or micro-balloons containing the adhesive, or may be additional micro-balloons themselves, containing some part of the adhesive system, such as a crosslinking agent, initiator solvent, water or any other component used to activate the preglue. Although ridges 610 are shown only in connection with the friction-fit joint of FIG. 25, it is considered within the scope of this invention to include ridges on the tongue and/or groove of any joint disclosed herein, such as shown in FIGS. 2 and 3. The ridges 610 may additionally take the shape of microridges or micro sharp textures, placed, for example, on the surface of the grooves or on the surface of the tongues or both.

[0134] The invention is not limited to the embodiments shown and described, since these may be readily modified by those of ordinary skill in the art to which this invention pertains without departing from the scope of the appended claims.

We claim:

1. A kit comprising:
   a first laminate panel having a shape, comprising:
   a decorative upper surface;
   a lower surface;
   a core disposed between the upper and lower surface, defining edges about the periphery of the panel;
   a locking element on at least one edge;
   a second laminate panel having a shape, comprising:
   a decorative upper surface;
   a lower surface;
   a core disposed between the upper and lower surface, defining edges about the periphery of the panel;
   a locking element on at least one edge;
   wherein a width of the first panel differs from a width of the second panel and wherein at least one edge of at least one of the first and second panels comprises a preglue.

2. The kit of claim 1, wherein at least two edges of the first panel and at least two edges of the second panel comprise locking elements.

3. The kit of claim 2, wherein all of the edges of at least one of the first panel and the second panel comprise locking elements.

4. The kit of claim 1, wherein the locking element of the first panel and the locking element of the second panel prevent relative horizontal and vertical movement of the panels.
5. The kit of claim 1, wherein the locking elements prevent relative horizontal movement of the panels until after the preglue has set.
6. The kit of claim 1, wherein the locking elements are horizontally joinable without the use of tools.
7. The kit of claim 1, wherein at least one of the locking element comprises at least one ridge.
8. A kit comprising:
   a first laminate panel having a shape, comprising:
      a decorative upper surface;
      a lower surface;
      a core disposed between the upper and lower surface, defining edges about the periphery of the panel;
   locking elements disposed on each one edge;
   a second laminate panel having a shape, comprising:
      a decorative upper surface;
      a lower surface;
      a core disposed between the upper and lower surface, defining edges about the periphery of the panel;
   locking elements on at least one edge;
   wherein a width of the first panel differs from a width of the second panel.
9. A method for forming a surface comprising:
   providing a first laminate panel having a shape, comprising:
      a decorative upper surface;
      a lower surface;
      a core disposed between the upper and lower surface, defining edges about the periphery of the panel;
   a locking element on at least one edge;
   providing a second laminate panel having a shape, comprising:
      a decorative upper surface;
      a lower surface;
   a core disposed between the upper and lower surface, defining edges about the periphery of the panel;
   a locking element on at least one edge;
10. The method of claim 9, wherein the locking element of at least one of the first and second panel comprises a preglue and further comprises activating the preglue.
11. The method of claim 10, wherein the activating step is performed prior to the joining step.
12. The method of claim 10, wherein the preglue is activated by joining the locking elements.
13. A method for forming a surface comprising:
   providing a first laminate panel having a shape, comprising:
      a decorative upper surface;
      a lower surface;
      a core disposed between the upper and lower surface, defining edges about the periphery of the panel;
   a locking element on at least one edge;
   providing a second laminate panel having a shape, comprising:
      a decorative upper surface;
      a lower surface;
      a core disposed between the upper and lower surface, defining edges about the periphery of the panel;
   a locking element on at least one edge;
   joining the locking element of the first panel with the locking element on the second panel by relatively horizontally moving the second panel;
   wherein the locking elements of at least one of the first and second panel comprises a preglue and further comprises activating the preglue.
14. The method of claim 13, wherein the preglue is activated by joining the locking elements.