



(19) **United States**
(12) **Patent Application Publication**
Gallagher et al.

(10) **Pub. No.: US 2010/0251641 A1**
(43) **Pub. Date: Oct. 7, 2010**

(54) **SYSTEMS AND METHODS FOR MODULAR FLOOR INSTALLATION**

Publication Classification

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(51) **Int. Cl.**
E04F 15/10 (2006.01)
E04B 5/00 (2006.01)
E04F 13/09 (2006.01)
E04F 15/22 (2006.01)
(52) **U.S. Cl.** **52/177; 52/582.1; 52/386; 52/403.1**

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(57) **ABSTRACT**
Connectors for joining adjacent modular floor covering units. The connectors include a base or film and one or more attachment members. As an exemplary use of a connector to install tiles, a first tile is placed on the floor and a connector is positioned so that an attachment member faces upward and attaches to the first tile. One or more other tiles are then positioned adjacent the first tile so that the same or other attachment members of the connector attach to the adjacent tiles. In certain embodiments, an attachment member comprises projections that form a mechanical connection with the undersides of the tiles. For example, a connector may comprise a plastic unit with raised ridges that interact with corresponding indentations on the undersides of the tiles. A connector can also or alternatively form a connection with tiles and/or the underlying floor surface by having a high coefficient of friction.

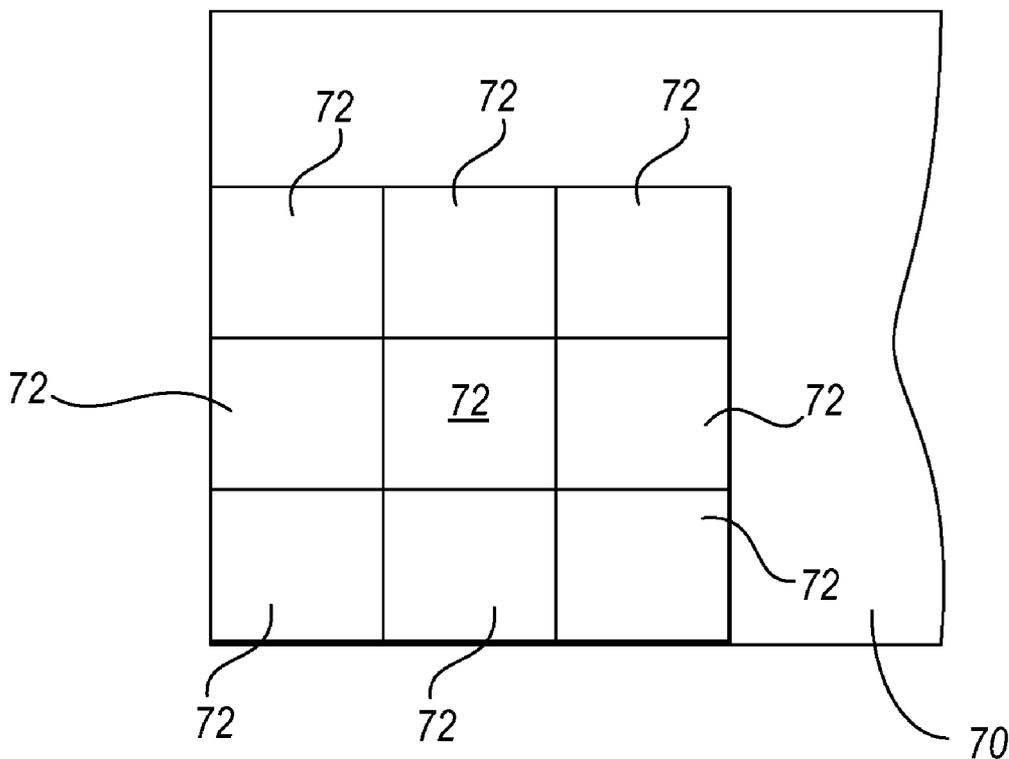
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(21) Appl. No.: **12/754,994**

(22) Filed: **Apr. 6, 2010**

Related U.S. Application Data

(60) Provisional application No. 61/167,305, filed on Apr. 7, 2009.



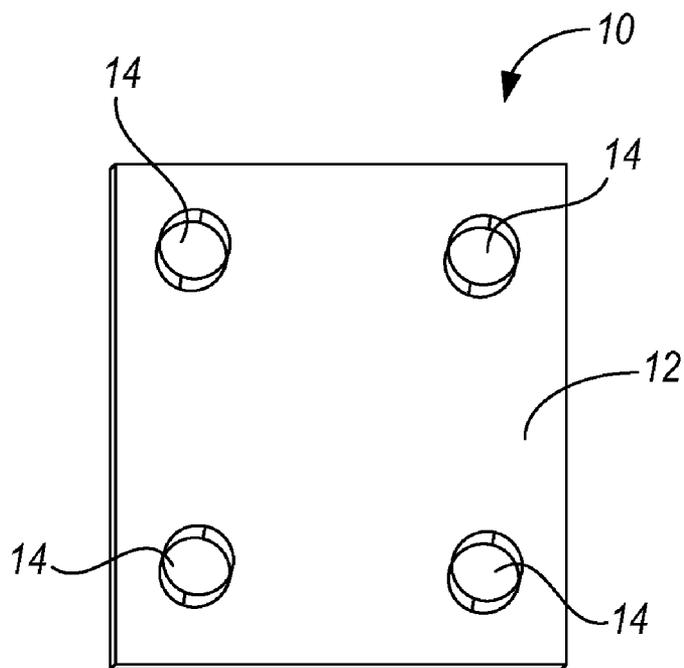


Figure 1A

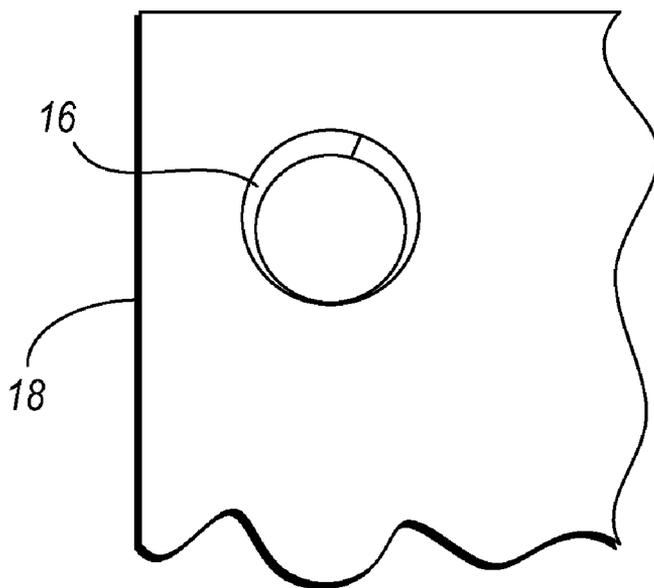


Figure 1B

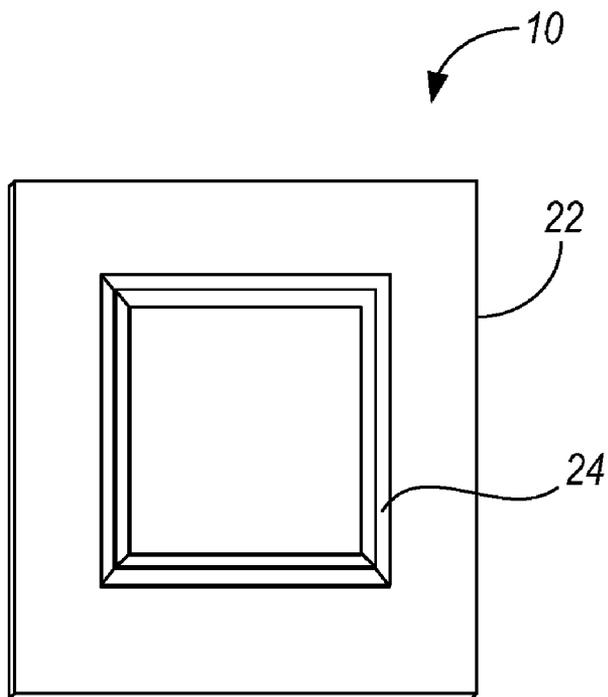


Figure 2A

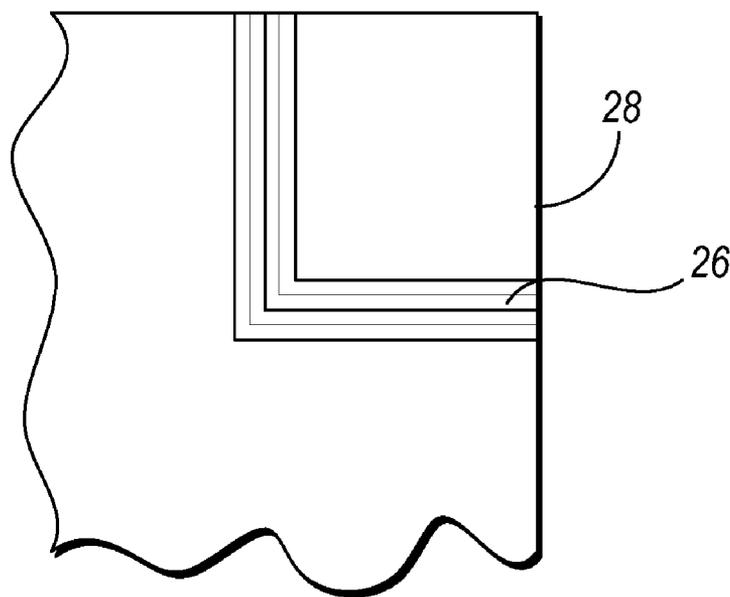


Figure 2B

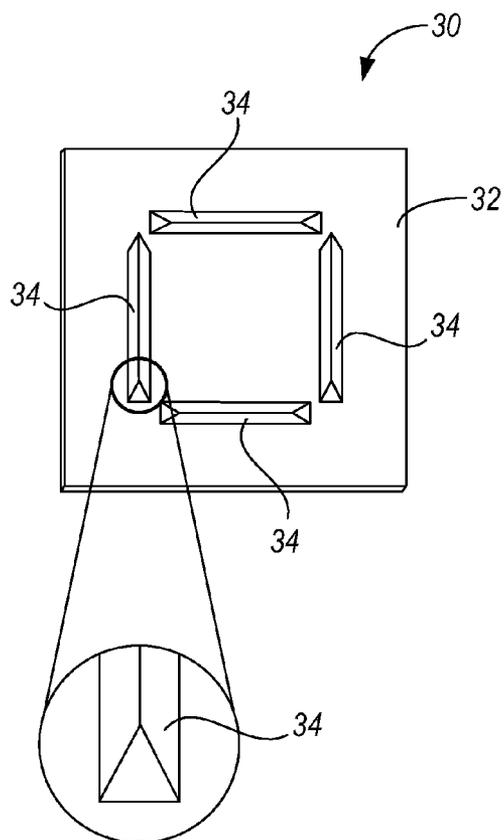


Figure 3A

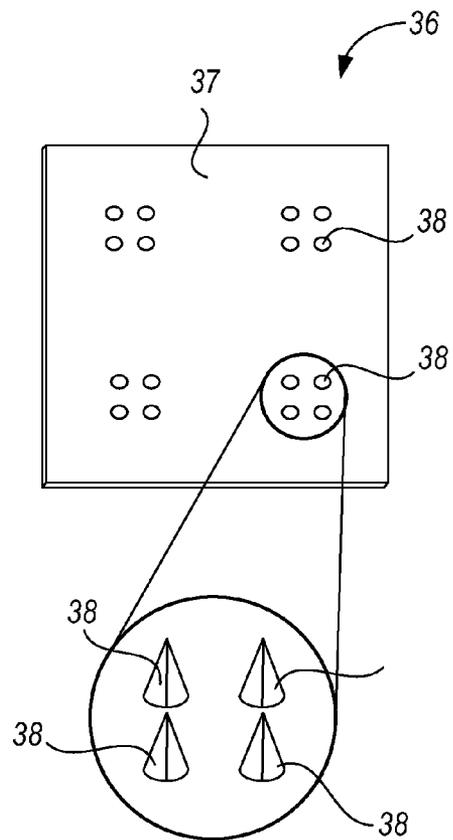


Figure 3C

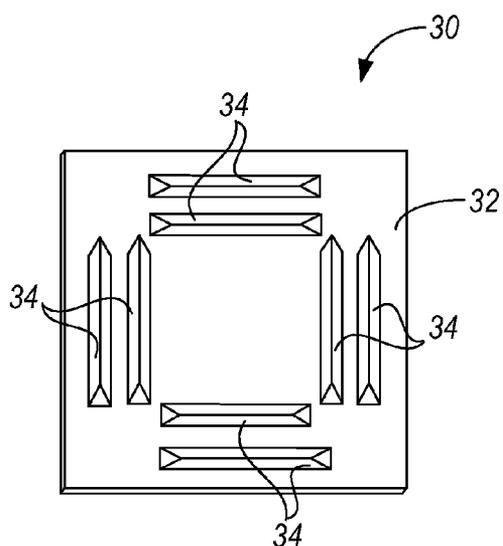


Figure 3B

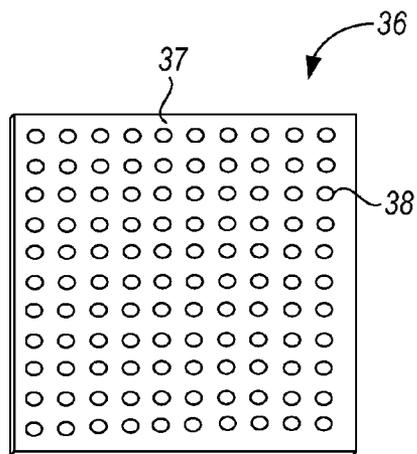


Figure 3D

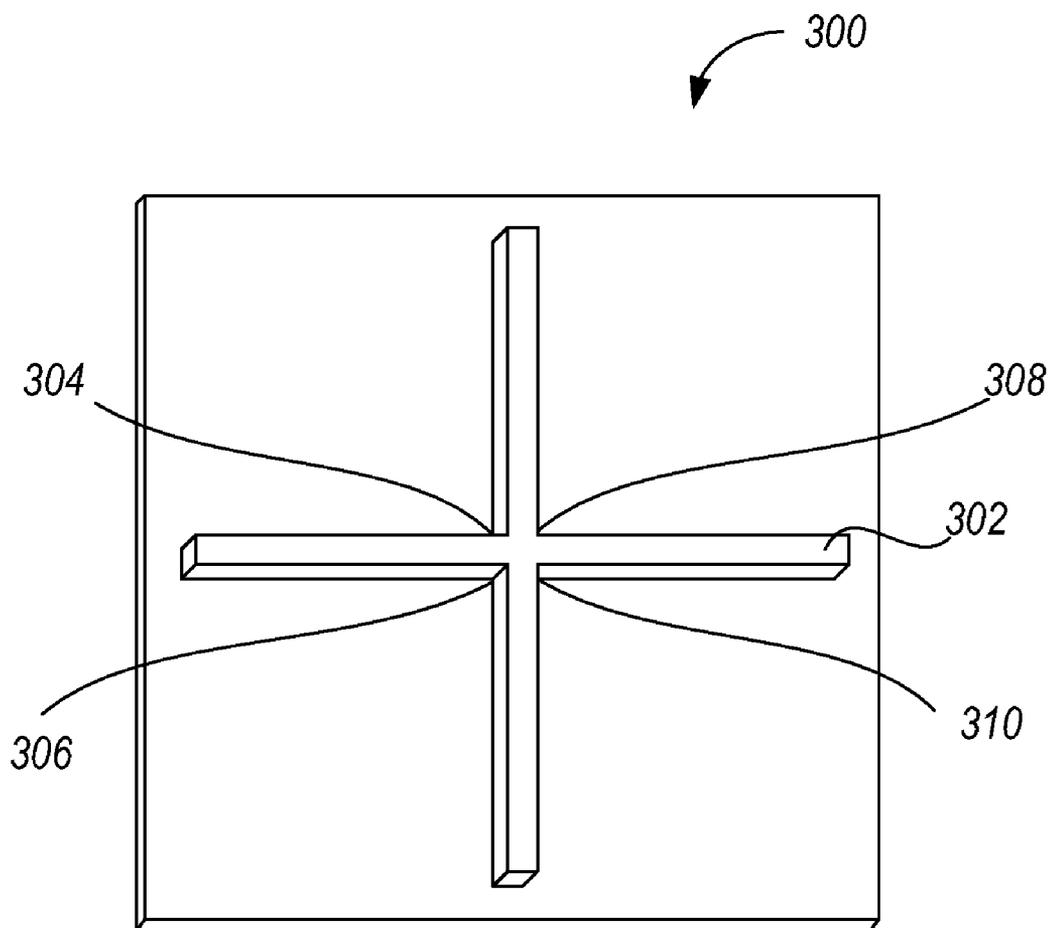


Figure 3E

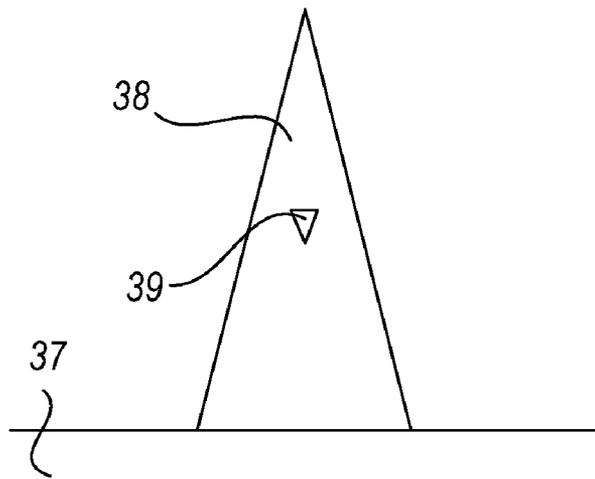


Figure 4A

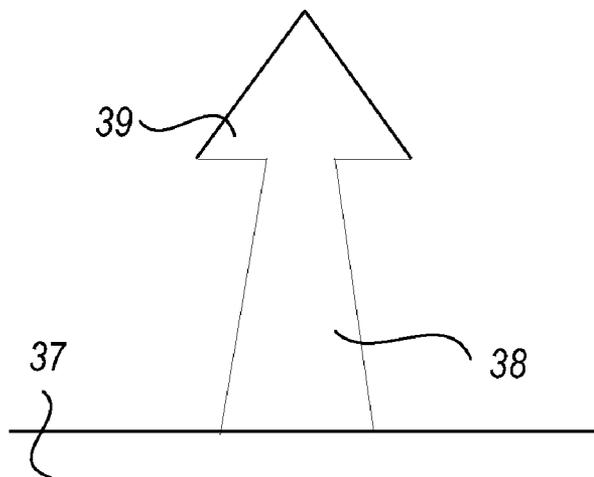


Figure 4B

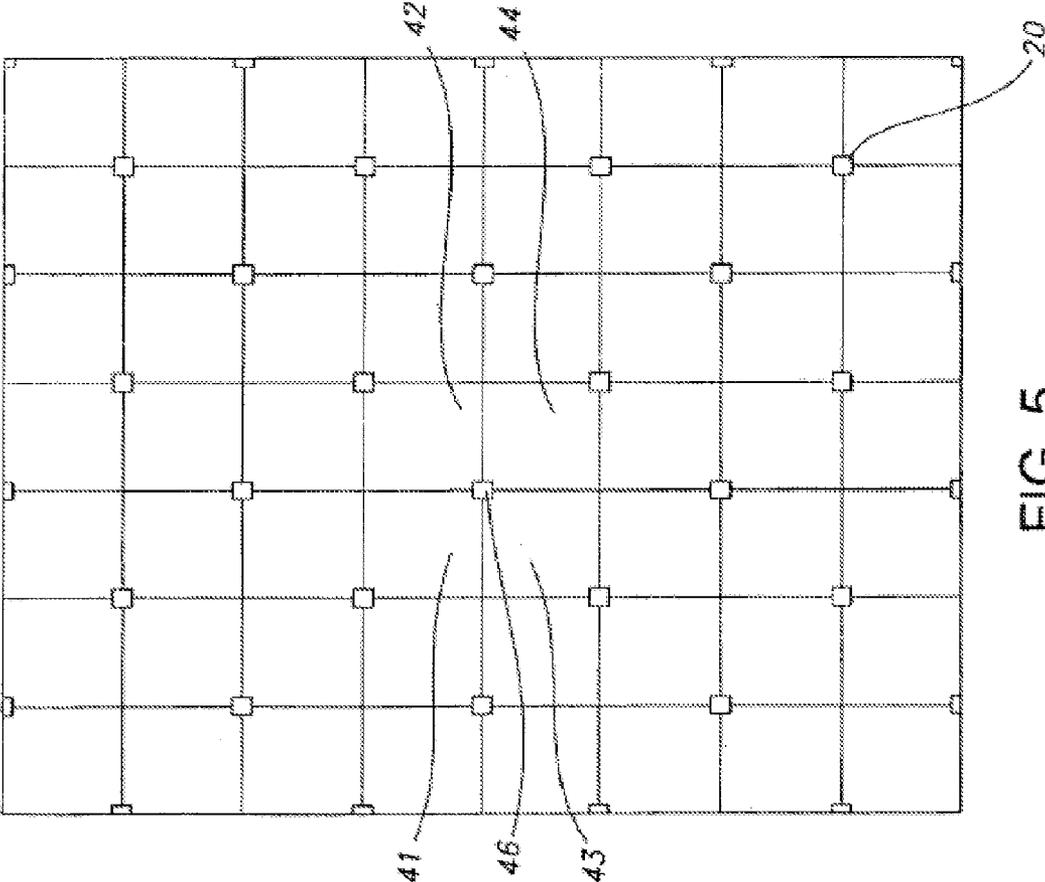


FIG. 5

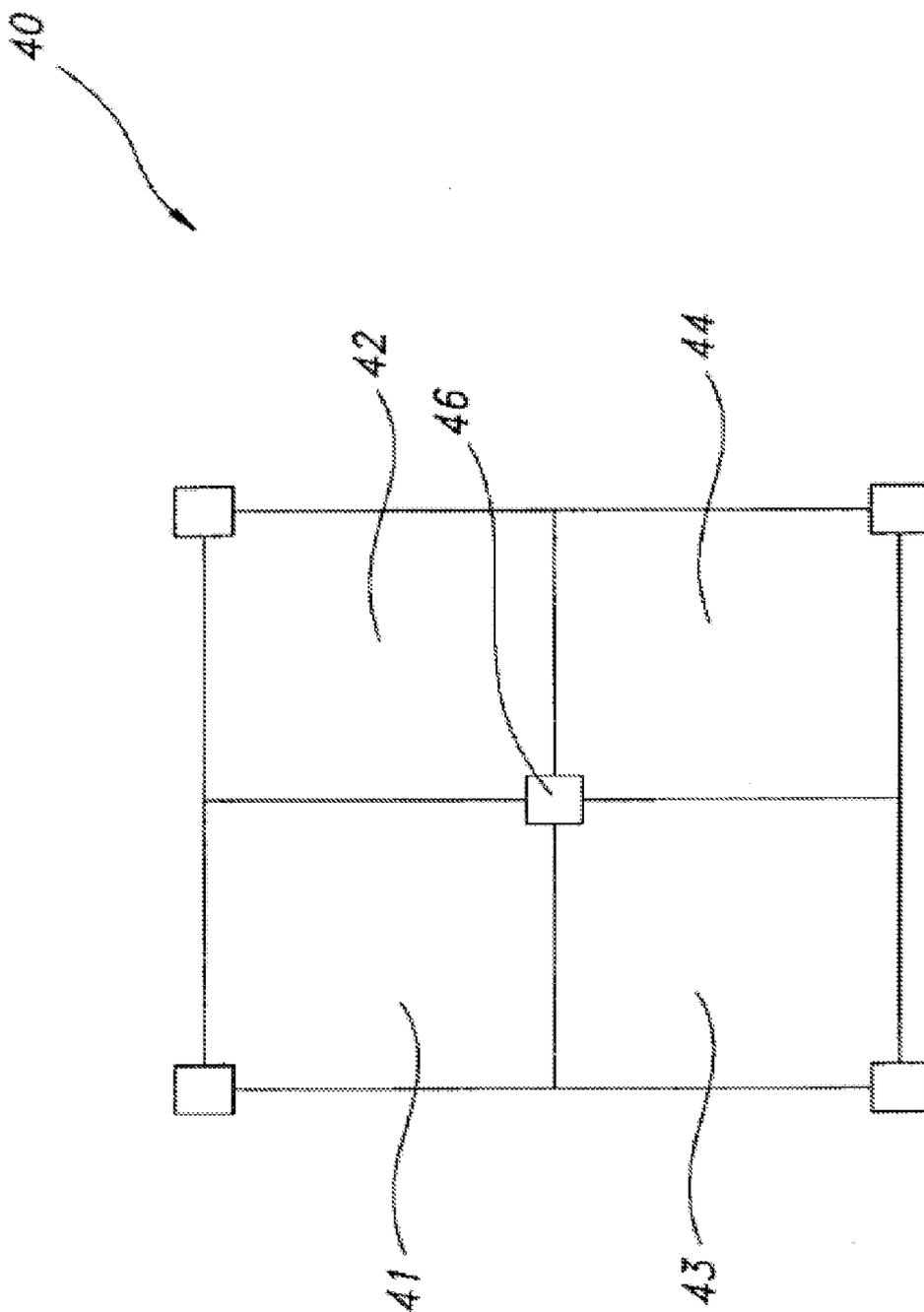


FIG. 6

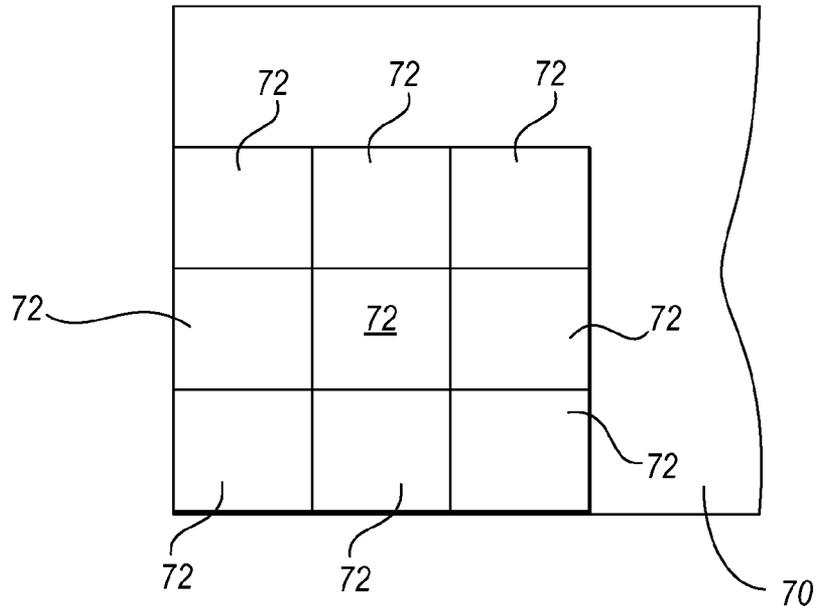


Figure 7A

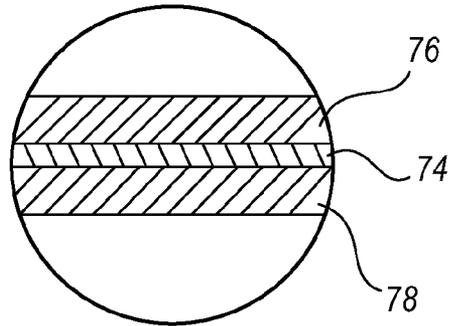


Figure 7B

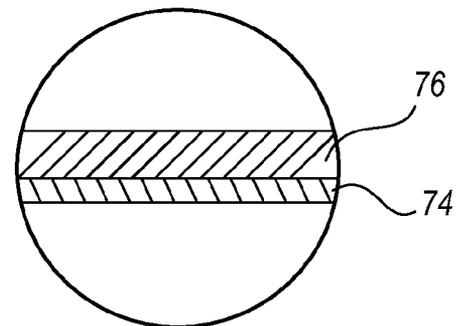


Figure 7C

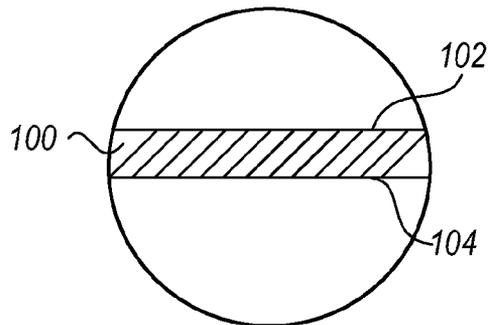


Figure 7D

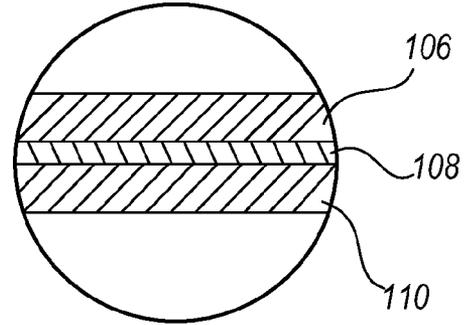


Figure 7E

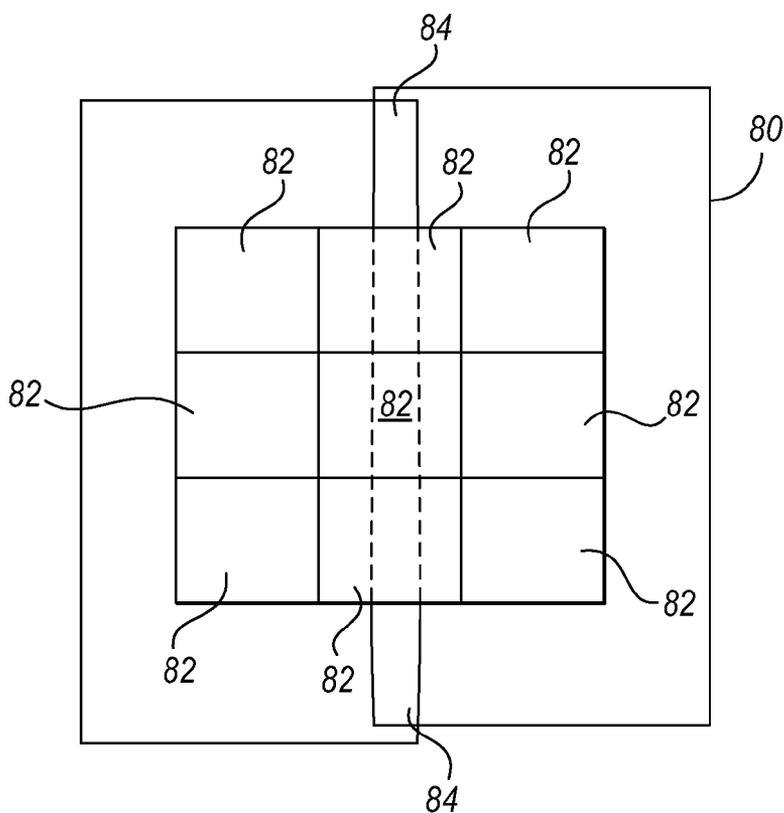


Figure 8

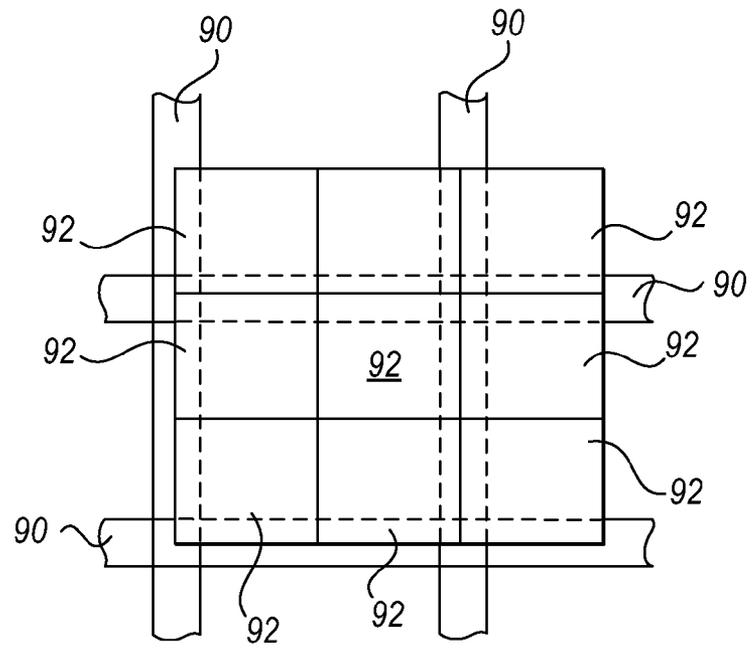


Figure 9

SYSTEMS AND METHODS FOR MODULAR FLOOR INSTALLATION

RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 61/167,305 filed Apr. 7, 2009 entitled "Systems and Methods for Modular Floor Installation," the contents of which is incorporated herein by this reference.

FIELD

[0002] Embodiments of this invention generally relate to systems and methods for installing floor coverings, particularly including carpet tile and other modular floor coverings.

BACKGROUND

[0003] Floor coverings have been in use since before recorded human history. The first such materials were likely animal skins or plant materials like leaves or stems. Later, floor coverings were manufactured, such as by weaving or knotting a variety of naturally occurring fibers, including sisal and wool. Beginning in the twentieth century, such fiber-faced floor coverings began to be manufactured from man-made fibers as well.

[0004] While the first floor coverings were limited in size to the size of an animal skin, later floor coverings expanded to cover entire room floors. Such "wall-to-wall" installations of "broadloom" floor covering came into wide-spread use in the twentieth century. Installations of such materials typically use one or a small number of pieces of broadloom carpeting to cover entire room floors. This type of wall-to-wall floor covering is generally attached to the floor in some manner.

[0005] Later, modular floor coverings utilized smaller, uniform size modules or tiles in both solid surface floor coverings such as vinyl tiles and in textile-faced floor coverings, usually called carpet tiles. As explained in U.S. patent application Ser. No. 10/638,878 for "Re-Configurable Modular Floor Covering," filed Aug. 11, 2003, tiles may be installed as area rugs that do not cover the entire flooring surface. However, the vast majority of tiles are used in wall-to-wall installations. Carpet tiles have traditionally been rectangular or square and installed in aligned rows and columns, with the edges of each tile aligned with the edges of adjacent tiles. However, such modules are not always installed in aligned rows and columns. For example, tiles are also installed in aligned columns that do not form aligned rows of modules so that a column of tiles appears shifted up or down relative to adjacent tile columns.

[0006] While the floor covering modules are generally of relatively substantial size and weight, which facilitates maintenance of the modules in the positions they are placed when the floor covering is assembled, it is desirable to provide a means for further resisting module movement. This has traditionally been accomplished by attaching the modules to the underlying flooring surface in a variety of ways. Modules are often glued to the floor by first applying a layer of adhesive to all or a portion of the underlying flooring surface and then positioning the tiles on top of the adhesive. With this method, adhesive typically contacts the all or a portion of the surface area of the underside of the flooring modules, which increases material costs and often leads to difficulty in re-positioning the tiles if they are positioned incorrectly. When the tiles are eventually removed, adhesive remains on the flooring surface and that adhesive sometimes retains portions of the removed

tiles. The adhesive (and any flooring materials held by the glue) must be removed from the floor to create a smooth surface before installing new tiles. This adds both cost and time to the installation process.

[0007] Modules may also be installed by pre-applying adhesive to the entire underside (or any part) of the module. For example, adhesive may be applied in a relatively narrow strip across each module underside and covered, prior to module installation, by a plastic film or paper strip that is peeled off just before module placement. Again, however, this method involves attaching the modules directly to the floor and can result in the consequent drawbacks discussed above.

[0008] Modules have also be installed using double-sided adhesive tape, whereby one side of the tape is positioned on the back of the module and the other side of the tape is positioned on the floor to thereby secure the module to the floor. Double-sided tape has also been positioned between and along the entirety of adjacent carpet and carpet tile edges. However, as with adhesive, double sided tape can be unforgiving with respect to tile re-positioning and can also leave a residue on the floor upon removal of the tiles. Moreover, the tape has a low tensile strength and is relatively inelastic and consequently is apt to stretch and not regain its shape. This can result in the gaps between adjacent tiles.

[0009] In addition to direct attachment to the floor, modules have also been indirectly attached to the underlying flooring surface, such as with mechanical fasteners or adhesive covered pads. For example, hook and loop fasteners have been used whereby a sheet of either the hook or the loop is secured to the floor and the other of the hook or the loop is provided on the back of the modules. The hook or loop on the modules then engages the hook or loop on the floor to secure the modules to the floor. Pads covered with adhesive have also been used. For example, a foam pad pre-coated on both sides with a releasable adhesive has been used. During installation, release paper or film is removed from both sides of the pad to expose the adhesive, and the pad is attached to the floor. Carpet tiles are then positioned on top of the pad and held in place by the adhesive. While these systems and methods may improve the installers' ability to re-position the tiles, they significantly increase the material cost of the installation. Moreover, with these installation methods, the tiles are more likely to move relative to each other and thereby create gaps in the installation.

[0010] Other installation methods exist whereby the tiles are neither directly nor indirectly attached to the floor. For example, one-sided adhesive tape, such as duct tape, has been used to secure adjacent tiles together. The tiles are positioned face down, and the tape is secured along the entirety of the adjacent edges of the tiles. The tiles must then be carefully turned over to expose their wear surfaces without breaking the connection between adjacent tiles. This method requires a significant amount of time to position the tape on the tiles as well as a significant material investment to tape adjacent tile edges together along the entirety of the seams. Moreover, such adhesive tape is relatively flimsy, making it challenging to position the tape as desired on the underside of tiles, and, as with double-sided adhesive tape, suffers from low tensile strength and inelasticity, rendering it likely to permanently stretch or break when subjected to stress and thereby create permanent gaps between adjacent tiles.

[0011] In addition, U.S. Pat. No. 7,464,510 to Scott et al., issued Dec. 16, 2008, entitled "System and method for floor covering installation," the entirety of which is incorporated

herein by this reference, discloses connectors used to join adjacent floor covering units. It discloses connectors with an adhesive layer coated on one side of a film and that are positioned so that the adhesive layer faces upward and does not contact the floor. A connector can be positioned so that only a portion of the adhesive layer adheres to the underside of the tile, leaving the remainder of the connector extending from the underside of the tile. Tiles are then positioned adjacent the first tile so that a portion of the connector adheres to the adjacent tiles. In this way, connectors can span adjacent edges of adjacent tiles. Tiles can be assembled on a underlying floor surface without the need to attach them to the floor surface. Rather, the tiles are linked to each other with the connectors, so that the tiles create a floor covering that “floats” on the underlying floor surface.

SUMMARY

[0012] Connectors for joining adjacent modular floor covering units are disclosed. The connectors include a base or film and one or more attachment mechanisms. As an exemplary use of a connector to install tiles, a first tile is placed on the floor and a connector is positioned so that an attachment surface faces upward and attaches to the first tile. One or more other tiles are then positioned adjacent the first tile so that the same or other attachment surface of the connector attaches to the adjacent tiles. In certain embodiments, an attachment surface comprises projections that form a mechanical connection with the undersides of the tiles. For example, a connector may comprise a plastic unit with raised ridges that interact with corresponding indentations on the undersides of the tiles. In certain embodiments, an attachment surface forms a connection with one or more tiles and/or the underlying floor surface by having a high coefficient of friction. Only one side of a connector can have a high coefficient of friction, or both sides of the connector (top and bottom) can provide friction.

[0013] Connectors may be relatively small with respect to tiles. In some cases, connectors are positioned at corners or edges at which multiple tiles abut. Connectors can be large enough to form an underlay spanning multiple tile edges, tiles, and potentially larger areas. For example, one exemplary embodiment involves a plastic underlayment sheet that covers a large portion of a flooring surface upon which multiple tiles are then placed. In other exemplary embodiments, such a plastic underlayment instead forms a grid, parallel lines, or other configuration partially covering the floor, including some or all of the locations at which tile edges will abut. Generally, sheets, ribbons, and other shaped connectors may abut, overlap, and/or connect to one another in a variety of ways. For example, connector sheets may be connected to one another by tape, pads, adhesive, or otherwise. A sheet or other form of connector that covers an entire flooring surface can also perform additional functions. For example, such a sheet could be used as a moisture barrier layer or cushion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1A is perspective view of one embodiment of a connector.
 [0015] FIG. 1B is a perspective view of a corner of a tile with an indentation for connection to the connector of FIG. 1.
 [0016] FIG. 2A is perspective view of another embodiment of a connector.

[0017] FIG. 2B is a perspective view of a corner of a tile with an indentation for connection to the connector of FIG. 2.
 [0018] FIGS. 3A-3B illustrate perspective views of exemplary connectors comprising various sharp attachment members.
 [0019] FIG. 4 illustrates a side schematic view of an exemplary sharp attachment member with a barb.
 [0020] FIG. 5 is a bottom plan view of an installation of tiles.
 [0021] FIG. 6 is a bottom plan view of a basic unit of four tiles of the installation of FIG. 5.
 [0022] FIG. 7A is a top plan view of an installation of tiles over a connector sheet.
 [0023] FIG. 7B is a side cross sectional view of a two-sided connector sheet.
 [0024] FIG. 7C is a side cross sectional view of a three-sided connector sheet.
 [0025] FIG. 8 is a top plan view of overlapping connector sheets.
 [0026] FIG. 9 is a top plan view of strip connectors.

DETAILED DESCRIPTION OF THE DRAWINGS

[0027] Systems and methods for installing floor covering are disclosed for use in a variety of floor covering installations including installations of modular floor covering units (hereinafter referred to as “tiles”). The tiles may be of various colors and textures in a range of sizes and shapes. For example, individual tiles may be in a shape that simulates wood planking or shapes of ceramic and other tiles, including, but not limited to, hexagons, squares, rectangles, triangles and other shapes. In addition, the tiles may be provided in a variety of textures. Tiles may be conventional carpet tile with textile faces (including, but not limited to, tufted, bonded, and printed faces), but could also be other materials, including woven and non-woven textile flooring, solid vinyl, ceramics, leather, or any other suitable material. The tiles are preferably installed on a generally smooth surface, including, but not limited to plywood, laminates, linoleum, vinyl tile, hardwoods, and concrete. However, the tiles may be installed on an intermediate substrate, including pad and carpet, located between the tiles and the underlying floor.
 [0028] Connectors need not connect to the underlying floor surface and thus can be used to create a floor covering that “floats” on that underlying floor surface. Connectors need not be positioned along the entirety of the adjacent edges nor even across all adjacent tiles edges in the installation. Rather, the connectors can be sized so that, when positioned in the installation, they do not extend along the entire length of the adjacent edges. Moreover, while any number of connectors may be used at any number of locations between adjacent tiles, connectors may be strategically placed in locations within the assembly (such as at some of the corners at which four square tiles meet). The releasable nature of the connectors of certain embodiments allows tiles to be easily re-positioned or replaced. Furthermore, in cases where the tiles do not interact with the underlying floor, they are easily removable, without injuring the underlying floor or leaving residue upon such removal.
 [0029] FIG. 1A illustrates one embodiment of a connector 10. The connector 10 includes a base 12 and attaching members 14 on one side. To install flooring tiles, the connector 10 can be positioned so that the attaching members 14 contact the underside of adjacent tiles such that the connector 10 spans the adjacent edges of the tiles and thereby connects the

tiles together to form a floor covering. In this way, the tiles can be assembled on a underlying flooring surface without the need to attach them to the floor surface, so that the tiles create a floor covering that “floats” on the underlying floor surface. In certain embodiments, however, the connector **10** and/or the tiles can be attached (for example via adhesive) to the underlying floor surface and the connector **10** can provide an additional mechanism for securing the tiles within the installation.

[0030] The base **12** may comprise a film of any suitable material, but, to facilitate rapid flooring installations, can be made of a material that is relatively stiff so that a connector positioned partly in contact with the underside of a tile will project beyond the edge of the tile in roughly the same plane as the underside of the tile without significantly curl or droop down from an underside of a tile. The base **12** can be sufficiently flexible to facilitate handling the connectors in a roll and/or to permit the connectors to conform to floor or tile irregularities.

[0031] The base **12** should also resist shrinkage, which can result in buckling of adjacent tiles, and exhibit a relatively high tensile strength to resist stretching under foot traffic and rolling loads. For example, materials that exhibit a tensile strength between 160-270 mega Pascals (“MPa”) in the machine direction and 165-210 MPa in the cross-machine direction have been found particularly suitable for this application. Moreover, the percentage by which the material may be elongated or stretched before breaking can also be relatively high to prevent connector breakage and failure when subjected to tensile stresses. For example, it is preferable, but not required, that the material used be capable of being stretched 120-200% of its machine direction dimension and 150-170% of its cross-machine direction dimension before breaking.

[0032] Polymeric materials, paperboard and other materials including textiles and metals that are suitably stiff, thin, strong, water-resistant and inexpensive may also be used for base **12**. Exemplary base **12** may comprise a synthetic polymer material, such as a polyolefin, a polyamide, or a polyester, and more preferably polyethylene terephthalate (“PET”) polyester. These materials are relatively cheap, can conform to the underlying floor in use, and can resist corrosion. While not necessary, it is preferable that the film material be recyclable.

[0033] The base **12** preferably has a thickness between 0.0005 and 0.015 inches, inclusive, and more preferably between 0.003 and 0.01 inches, inclusive, and even more preferably is 0.005 inches. The base **12** may be any shape, including, but not limited to, a circular shape or any rectilinear shape such as a square or triangular. A square shape is suitable for most installations. Moreover, the size of the base **12** can depend on the size of the tiles being installed. However, as a general rule, the surface area of the base **12** can be as little as 1%, and preferably between 2-5%, of the surface area of the tiles for which the connectors are intended to be installed. For many typical carpet tile sizes, connectors **10** can be, but do not have to be, no larger than about three inches by three inches square to conserve materials and limit expense.

[0034] The connectors **10** are preferably provided to the installation site as individual units already entirely or partially cut into the desired shape and size to be used in the installation. While each connector **10** may be manufactured separately, economies of manufacture may be achieved by first manufacturing an area larger than the intended connector size, and then cutting the connectors **10** from that area. Con-

nectors **10** can be formed in a variety of ways. The base **12** and attachment members **14** of a connector can be formed simultaneously from a single material or different materials. The base **12** and attachment members **14** may be formed separately and later combined, attached, or otherwise used to form the connectors **10**.

[0035] In one method of installing tiles using connectors, a first tile is placed on the floor at a position determined by conventional tile installation methods. A connector **10** is positioned so that the attachment member **14** faces upward away from the underlying floor. The connector **10** is positioned so that only a portion of the attachment member **14** attaches to the underside of the tile, leaving the remainder of the connector **10** extending from the underside of the tile. A tile or tiles are then positioned adjacent the first tile so that a portion of the connector **10** attaches to the adjacent tile(s). In this way, the connector spans the adjacent edge(s) of the adjacent tile(s).

[0036] Any number of connectors **10** may be used to connect adjacent tiles in an installation. However, to create a stable floor covering, the connectors generally need not be positioned along the entirety of the adjacent tile edges nor even across all adjacent tile edges. In many cases, connectors **10** need only extend along a very limited length of some of the adjacent edges. For example, the tiles of a carpet tile installation where only 5%-10% of adjacent tile edges are stabilized with connectors **10** have been found to exhibit planar stability (measured by the cupping and/or curling of the tiles) and dimensional stability (measured by the skewing of the tiles), as well as the ability to retain their relative positions in the installation when subjected to foot traffic, rolling traffic, and stresses applied during cleaning and maintenance.

[0037] FIG. 1B illustrates an indentation **16** on the bottom of a tile **18**. This indentation **16** can interact with an attachment member **14** of the connector **10** to form a secure connection. Such an indentation **16** may be formed during manufacture of the tile, cut out after manufacture, formed during installation of tiles, or formed in any other suitable manner. In the case of carpet tiles, such indentation may be formed in a base layer or backing of a carpet tile. In one example, a tile is positioned in a dye and one or more indentations are cut out.

[0038] FIG. 2A illustrates another exemplary connector **20** with a base **22** and an attachment member **24**. The attachment member **24** forms a continuous projection that can interact with the bottoms of multiple tiles to secure the relative positions of those tiles. FIG. 2B illustrates an indentation **26** on the bottom of a tile **28**. This indentation **26** can interact a portion of the attachment member **24** of the connector **20** to form a secure connection.

[0039] In some embodiments, tiles will not have such indentations. Instead, the attachment member of a connector can interact with the normal undersurface of a tile. In FIG. 3A, a connector **30** includes attachment members **34** each a having relatively sharp edge for interacting with the bottoms of the connected tiles. In the case of a tile having a relatively soft underside, the attachment members **34** may push into the backing to form a secure connection with the tiles. FIG. 3B illustrates an alternative configuration involving parallel groups of attachment members **34** that may further enhance attachment or other interaction with the bottom of the connected tiles.

[0040] Similarly, FIG. 3C illustrates a connector **36** having multiple sharp attachment members **38**. These sharp attachment members can interact with the bottoms of tiles to con-

nect the tiles to one another. In some cases, the sharpness of the attachment members allows the sharp attachment members to impress or point into the backing of a tile. In other cases, the sharpness simply provides friction that prevents lateral movement of a tile with respect to the connector. Other exemplary embodiments provide alternative or additional mechanisms for creating friction with a tile bottom. A connector may be provided with a ridges for indenting a tile backing, a coarse, abrasive, or otherwise irregular surface, such as sandpaper or cilia, and/or a gecko-type adhesives that helps secure the tiles. FIG. 3D illustrates an alternative configuration of attachment members 38.

[0041] FIG. 3E illustrates an attachment member 302 that acts as a raised boundary between tiles. For example, the corner of a first tile corner may be secured at 304, a second tile corner may be secured at 304, a third tile corner may be secured at 306, and a fourth tile corner may be secured at 310. The attachment member 302 in this embodiment need not interact with the back of these tiles and instead can provide stability by providing a boundary between the tiles that prevents relative movement of the tiles. The attachment member 302 can be sized and shaped such that it does not interfere with use of the tiles. For example, an attachment member 302 may project high enough to prevent relative movement without being visible from above the floor covering surface and/or without projected to a height that can interfere with foot or rolling traffic on the floor covering or otherwise. A raised boundary may be configured so that it does not interfere with use of the floor covering tiles when subjected to ordinary foot traffic, rolling traffic, and stresses applied during cleaning and maintenance. In the case of carpet tiles, such a boundary may not project higher than the backing of the carpet tiles, for example. The attachment member width may also be configured narrowly such that tile edges abutting at the attachment member will not be separated from one another more than is necessary to ensure that relative lateral movement of the tiles is prevented. A raised boundary may be sufficiently narrow such that that any separation between adjacent tiles is unnoticeable to a casual observer viewing the installation from above.

[0042] FIG. 4 illustrates an embodiment in which a sharp attachment member 38 also comprises one or more smaller, downward projecting points 39 which can each act as a barb to further secure the connector to a tile, for example, by resisting vertical displacement. This embodiment may utilize a molded or stamped material, such as a plastic, with sharp projections. A connector base could be formed from a recycled plastic or other polymer. A square of such material can be stamped so that numerous triangles or other sharp projections are pressed from the sheet with the bottom of each triangle or projection connected to the base sheet while the top points up. Within each such triangle or projection there is a smaller triangle pointing down to create a barb on the larger triangle or projection.

[0043] Such a barbed connector can be placed under the edges or corners of adjoining tiles. A hand roller or firm hand pressure may be applied to the top of the barbed connector to cause the triangle or projection to pierce the backs of the tiles. The smaller triangle or barb pushes against a tile's backing. If upward pressure is applied to the tile the smaller barb digs into the backing holding the connector firmly to the backing. Strong upward pressure allows the tile to be lifted or removed from the connector. For example, such strong upward pressure may cause the barb to bend backwards so the tile and

connector can separate. A similar embodiment utilizes a metal-based barbed connector.

[0044] A connector can comprise any material or object that is placed under one or more tiles and interacts with those one or more tiles to secure those tiles. A connector may have any shape and size and may interact with the tiles in a variety of ways. An attachment member can interact with tiles in variety of ways. An attachment member can have various shapes and configurations other than the exemplary shapes and configurations illustrated herein. The exemplary embodiments herein suggest just a few of the many potential ways in which an attachment member can interact with a tile to secure the tile relative to other tiles and/or to a flooring surface.

[0045] FIG. 5 shows one embodiment of a conventional installation (i.e., in aligned columns and rows) of tiles. For ease of discussion, the positioning of the connectors is discussed relative to a basic unit 40 of four tiles 41-44, as shown and arranged in FIG. 6. Tiles 41-44 are preferably connected with a central connector 46 at the corners where they intersect. Moreover, the corner of each tile diagonal from the center connector 46 is also connected to adjacent tiles with a connector 20. In this way, only a total of two tile connectors (the center connector 46 plus a quarter of a connector at each of the four diagonal tile corners) need be used to install the basic unit 40 of four tiles 41-44. Breaking this down even further, each of the four tiles 41-44, draws its stability from, on average, only one half of the surface area of a connector.

[0046] Connectors 20 may be positioned at any location between adjacent tiles, and thus any given tile in the installation may contact a portion of as few as one connector and as many as feasible given the size of the tile and of the connectors 20. In addition to placement at the corners of intersecting tiles, connectors 20 may be positioned to span the adjacent edges of only two tiles. Moreover, different shaped or sized connectors 20 may be useful in a single installation.

[0047] Connectors need not be placed directly on an underlying flooring surface, for example, in situations where tiles are not attached to the floor. Rather, the connectors 20 work equally well with tiles positioned on an intermediate substrate positioned between the tiles and the floor. For example, a barrier material, such as a plastic sheet, may be positioned on the floor prior to tile installation. The plastic sheet can serve to protect the floor from damage, such as might be caused by liquids spilled on the tiles that escape through the tile seams, as well as serve as a barrier to moisture present in the existing floor and thereby eliminate the need for sealants and barrier coatings. Moreover, a cushion or foam pad may also be positioned on the floor before tile installation. The cushion provides comfort underfoot and also eliminates the need to use cushion back carpet tiles. Rather, hardback tiles can simply be installed on an underlying cushion pad.

[0048] Connectors can also be used to connect an intermediate substrate. For example, a cushion can be provided as a plurality of cushion modules that underlie a carpet or other floor covering. The individual cushion modules may be connected to one another via a connector. Thus a floor covering installation may involve a plurality of cushion modules, each having an underside, an topside, and edges, that are positioned on a flooring surface. Connectors may be positioned to span adjacent edges of at least some of the adjacent cushion modules to secure the modules to one another. The connectors may be positioned to adhere to or form a mechanical connection with either the undersides of adjacent cushion modules, the topsides of adjacent cushion modules, or both. The con-

nectors may each have a base that is relatively stiff so that a connector positioned partly in contact with a side of a cushion module will project beyond an edge of the cushion module in roughly the same plane as the side of the cushion module without significantly curl or droop down.

[0049] FIG. 7A is a top plan view of an installation of tiles 72 over a connector sheet 70. The connector sheet 70 is an underlayment providing a high coefficient of friction on one or both sides. FIG. 7B is a side cross sectional view of a connector sheet comprising a center layer 74, which may provide a barrier to moisture or other benefit, a top friction layer 76, and a bottom friction layer 78. In an installation of tiles, the top friction layer 76 can interact via friction with the undersides of the tiles such that the friction prevents lateral movement of the tiles, e.g., that might otherwise be caused by the lateral forces of foot traffic, wheelchairs, moving furniture, and otherwise. Similarly, the bottom friction layer 78 can interact with the underlying flooring surface to prevent lateral movement of the connector sheet 70. FIG. 7C is a side cross sectional view of a connector sheet having a frictional layer on top only. FIG. 7D illustrates a connector formed of a single material 100. The single material in this exemplary embodiment has a rough side 102 and a smooth side 104. FIG. 7E illustrates an embodiment involving a friction layer 106, a connecting layer 108, and a base pad of film 110. The connecting layer 108 can provide a variety of mechanisms for connecting the other layers. In one embodiment, the connecting layer 108 comprises an adhesive.

[0050] FIG. 8 is a top plan view of overlapping connector sheets 80 installed over a flooring surface. The connector sheets 80 overlap one another at overlapping area 84 to secure the connector sheets 80 to one another and prevent their relative lateral movement. Such movement may be prevented, for example, if one or both sides of the connector sheets 80 have a high coefficient of friction. Tiles 82 are installed over the connector sheets 80 to form a flooring covering surface.

[0051] FIG. 9 is a top plan view of connectors 90 positioned in strips on a flooring surface to underlie some of the abutting edges of an installation of tiles 92. One or both sides of these strips of connectors may have a high coefficient of friction. In another embodiment, strips are laid to form a grid underlying some or all of the abutting edges of an installation of tiles. The strips of such a grid can intersect and overlap one another at various intersection points at which friction between the strips can secure the strips to one another. Generally, connectors 90 can be laid to underlie some or all of the abutting edges of an installation of tiles 92.

[0052] Other exemplary embodiments use a combination of mechanical connections, friction, and/or adhesive to secure tiles. In some situations, some or all of a connector or underlayer is provided with a coarse, abrasive, or otherwise irregular surface, such as sandpaper or cilia, that helps secure the tiles. Various types of adhesives may be utilized including both traditional and new types of adhesives. Certain embodiments use gecko-type adhesives, including adhesives that are only engaged when force is applied parallel to the surfaces adhered together. Certain embodiments utilize irregular or regular projections that create friction or other engagement with the bottom of a tile to restrict movement of the tile. Such projections can be formed or attached to a connector or underlayer in a variety of ways, including by sewing or adhesive.

[0053] The embodiments described above are illustrative and non-limiting. Many variations of the structures illustrated

in the drawings and the materials described above are possible and within the scope of this invention.

We claim:

1. A connector for joining floor covering tiles, the connector comprising:
 - a base; and
 - an attachment structure on the base, the attachment structure comprising one or more projections,
 wherein, when the connector is positioned on an underlying surface with the attachment structure of the connector facing upwards, the attachment structure forms mechanical connections with undersides of two or more of the floor covering tiles to prevent relative movement of the two or more floor covering tiles when subjected to ordinary foot traffic, rolling traffic, and stresses applied during cleaning and maintenance.
2. The connector of claim 1 wherein the one or more projections each have a relatively sharp point for interacting with the undersides of the two or more floor covering tiles.
3. The connector of claim 2 wherein the one or more projections further comprise smaller, downward projecting points that further secure the two or more floor covering tiles by resisting vertical displacement.
4. The connector of claim 1 wherein the one or more projections of the connector comprise raised ridges that are received in corresponding indentations on the undersides of the two or more floor covering tiles.
5. The connector of claim 1 wherein the connector is configured to span adjacent edges of at least some of the two or more floor covering tiles without abutting other similar connectors.
6. The connector of claim 1 wherein the base is relatively stiff so that a connector positioned partly in contact with an underside of a floor covering tile will project beyond an edge of the floor covering tile in roughly the same plane as the underside of the floor covering tile without significantly curl or droop down from the underside of the tile.
7. The connector of claim 1 wherein a bottom surface of the connector opposite the attachment structure is adapted such that when the connector is positioned on the underlying surface the connectors does not adhere to or form a connection with the underlying surface.
8. A connector for joining floor covering tiles, the connector comprising:
 - a base; and
 - an attachment structure on the base, the attachment structure having a high coefficient of friction,
 wherein, when the connector is positioned on an underlying surface with the attachment structure of the connector facing upwards, friction between the connector and the undersides of the two or more floor covering tiles sufficient to prevent relative movement of the two or more floor covering tiles when subjected to ordinary foot traffic, rolling traffic, and stresses applied during cleaning and maintenance.
9. The connector of claim 8 wherein a bottom surface of the connector opposite the attachment structure also has a high coefficient of friction.
10. The connector of claim 8 wherein the connector is a part of a sheet configured for use underlying floor covering tiles, wherein the sheet comprises a layer that is a barrier to moisture.
11. An installation of floor covering tiles, the installation comprising:

floor covering tiles positioned adjacent to one another above a floor; and
 one or more connectors connecting the floor covering tiles to one another, each connector comprising a base and an attachment structure on the base;
 wherein the one or more connectors are positioned above the floor, wherein an attachment structure of each connector faces upwards and forms a mechanical connection with undersides of two or more of the floor covering tiles, preventing relative movement of the two or more floor covering tiles when subjected to ordinary foot traffic, rolling traffic, and stresses applied during cleaning and maintenance.

12. The installation of floor covering tiles of claim **11** wherein:
 the attachment structure comprises one or more projections;
 the undersides of the two or more floor covering tiles are relatively soft; and
 each of the one or more projections has a sharp edge for impressing into the undersides of the two or more floor covering tiles to form a connection.

13. The installation of floor covering tiles of claim **11** wherein the one or more connectors are one or more sheets providing at least some areas having a high coefficient of friction.

14. The installation of floor coverings of claim **13** wherein undersides of the sheets comprise a high coefficient of friction preventing movement of the sheet with respect to the floor.

15. The installation of floor covering tiles of claim **13** wherein the one or more sheets are positioned to at least partially overlap one another on the floor and provide a moisture barrier or cushion pad over the entire floor.

16. The installation of floor covering tiles of claim **11** wherein:
 each floor covering tile comprises a surface area and each connector comprises a surface area, wherein the surface area of a connector is no more than approximately 5% of the surface area of a floor covering tile; and
 adjacent edges formed by adjacent floor covering tiles in the installation comprise a total length and wherein the connectors in the floor covering installation span up to approximately 10% of the total length of the adjacent floor covering tiles.

17. The installation of floor covering tiles of claim **11** wherein the film has a thickness between approximately 0.0005 and 0.015 inches, inclusive and the film comprises a

material selected from the group consisting of: polyolefin, a polyamide, a polyester, and a polyethylene terephthalate polyester.

18. The installation of floor covering tiles of claim **11** wherein the film has a tensile strength between 165 and 210 MPa in at least one direction and between 160 and 270 MPa in at least one other direction.

19. An installation of floor covering tiles, the installation comprising:

floor covering tiles positioned adjacent to one another above a floor; and

one or more connectors between the floor covering tiles and the floor connecting the floor covering tiles to one another, each connector comprising a base and an attachment structure comprising a raised boundary between two or more of the floor covering tiles and projecting to a height sufficient to prevent relative movement of the two or more floor covering tiles when subjected to ordinary foot traffic, rolling traffic, and stresses applied during cleaning and maintenance.

20. The installation of floor covering tiles of claim **19** wherein the floor covering tiles are carpet tiles each having a backing and tufts tufted into the backing forming a carpet surface above the floor, wherein the raised boundary does not project higher than the backing of the carpet tiles.

21. The installation of floor covering tiles of claim **19** wherein the raised boundary is sufficiently narrow that any separation between adjacent tiles is unnoticeable to a casual observer viewing the installation from above.

22. A floor covering installation comprising:

a plurality of cushion modules, each having an underside, a topside, and edges, that are positioned on a flooring surface; and

connectors positioned to span adjacent edges of at least some of the adjacent cushion modules to secure the modules to one another, wherein the connectors are positioned to adhere to or form a mechanical connection with adjacent cushion modules, wherein each connector comprises a base that is relatively stiff so that a connector positioned partly in contact with a side of a cushion module will project beyond an edge of the cushion module in roughly the same plane as the side of the cushion module without significantly curl or droop down.

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