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(54) **FLOOR COVERING APPARATUS**

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(57) **ABSTRACT**

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A floor covering apparatus is provided to enable the easy laying, relaying and rearranging of a protective floor covering while providing for improved customization. The apparatus comprises a rigid, substantially planar base having an upper face, a lower face, and a perimeter defining a two-dimensional shape; a rigid edge portion extending from the upper face of the base and defining a depth, wherein the depth is a distance between the upper face of the base and an uppermost surface of the edge portion; wherein the floor covering apparatus is arranged to tessellate with at least one other such floor covering apparatus. The apparatus aims to provide a modular floor covering apparatus with improved structural and functional properties compared with currently available solutions.

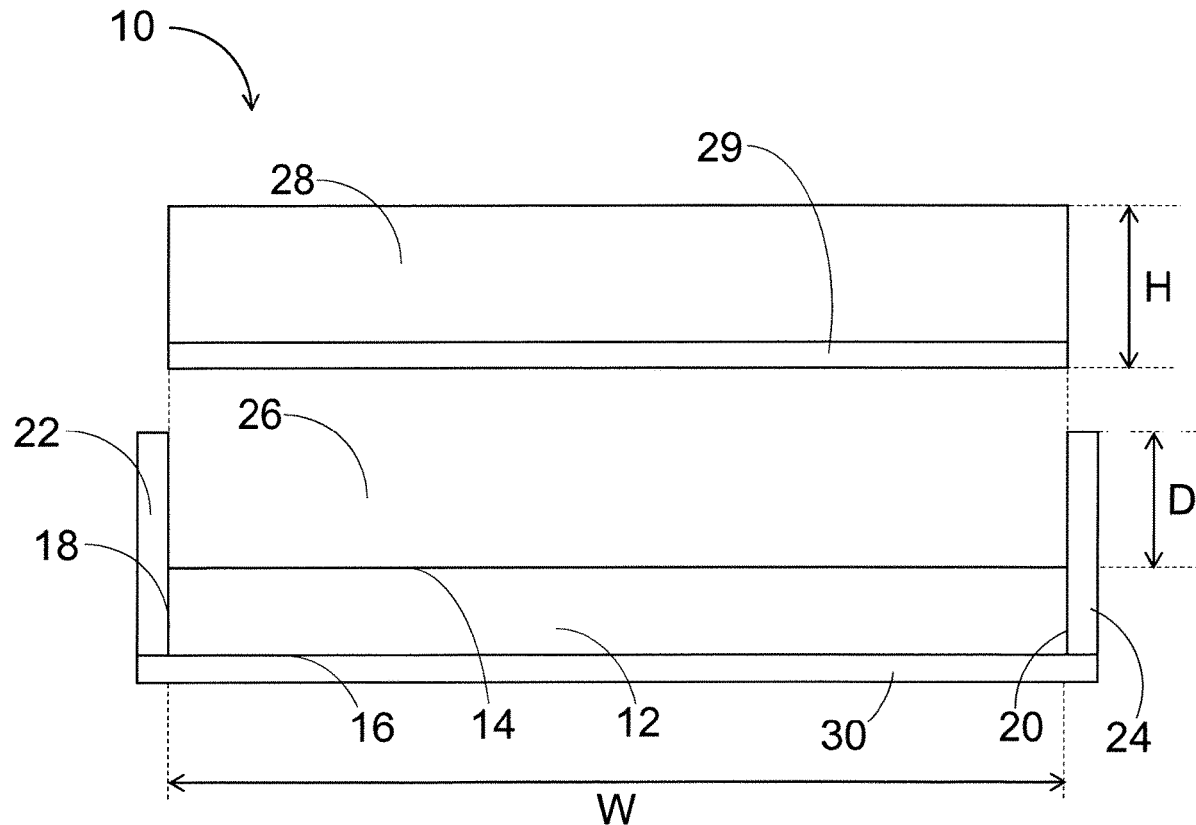
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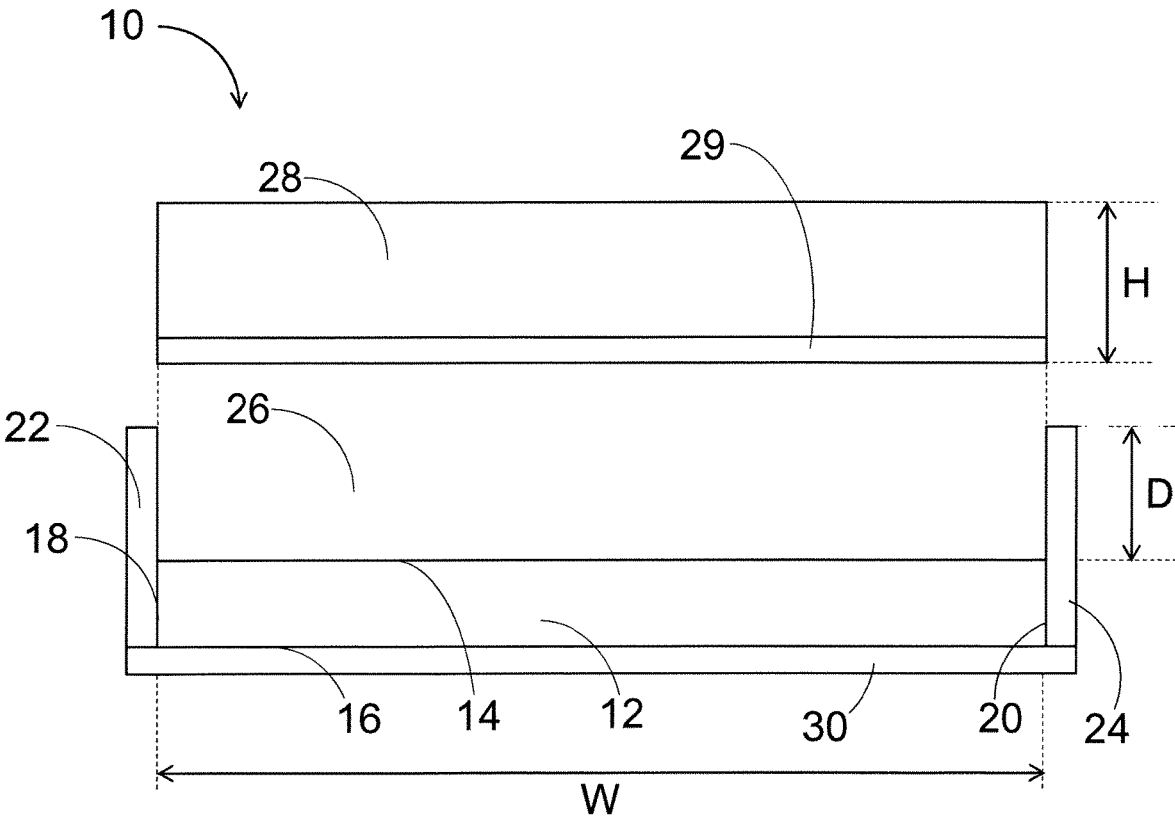


FIG. 1

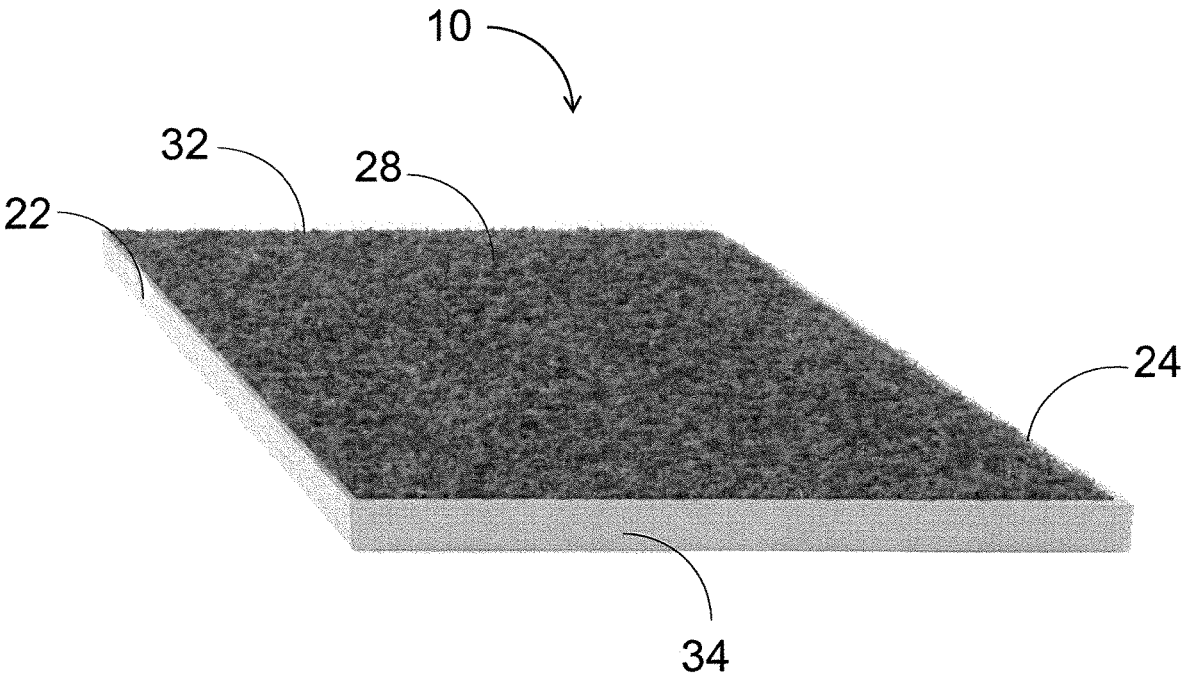


FIG. 2

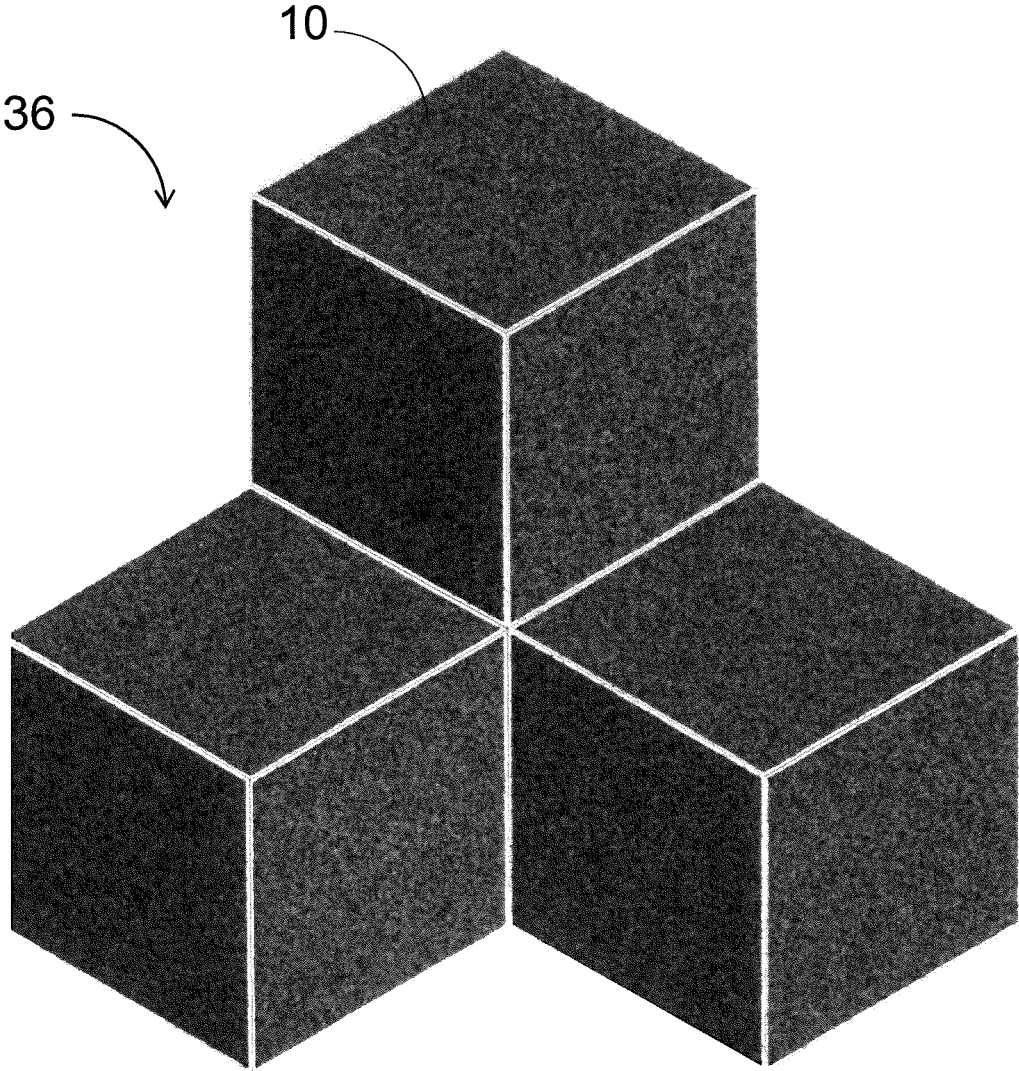


FIG. 3

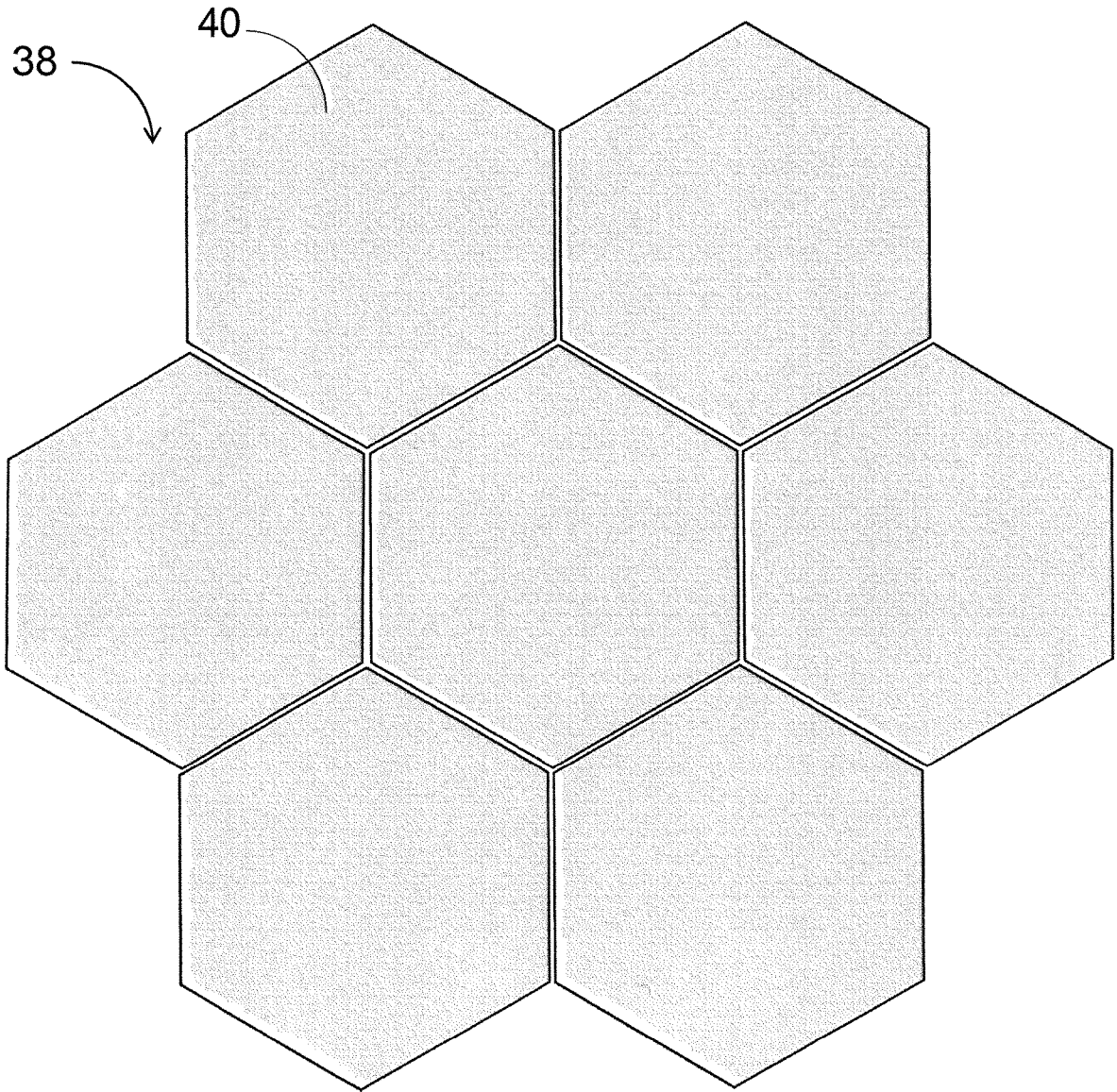


FIG. 4

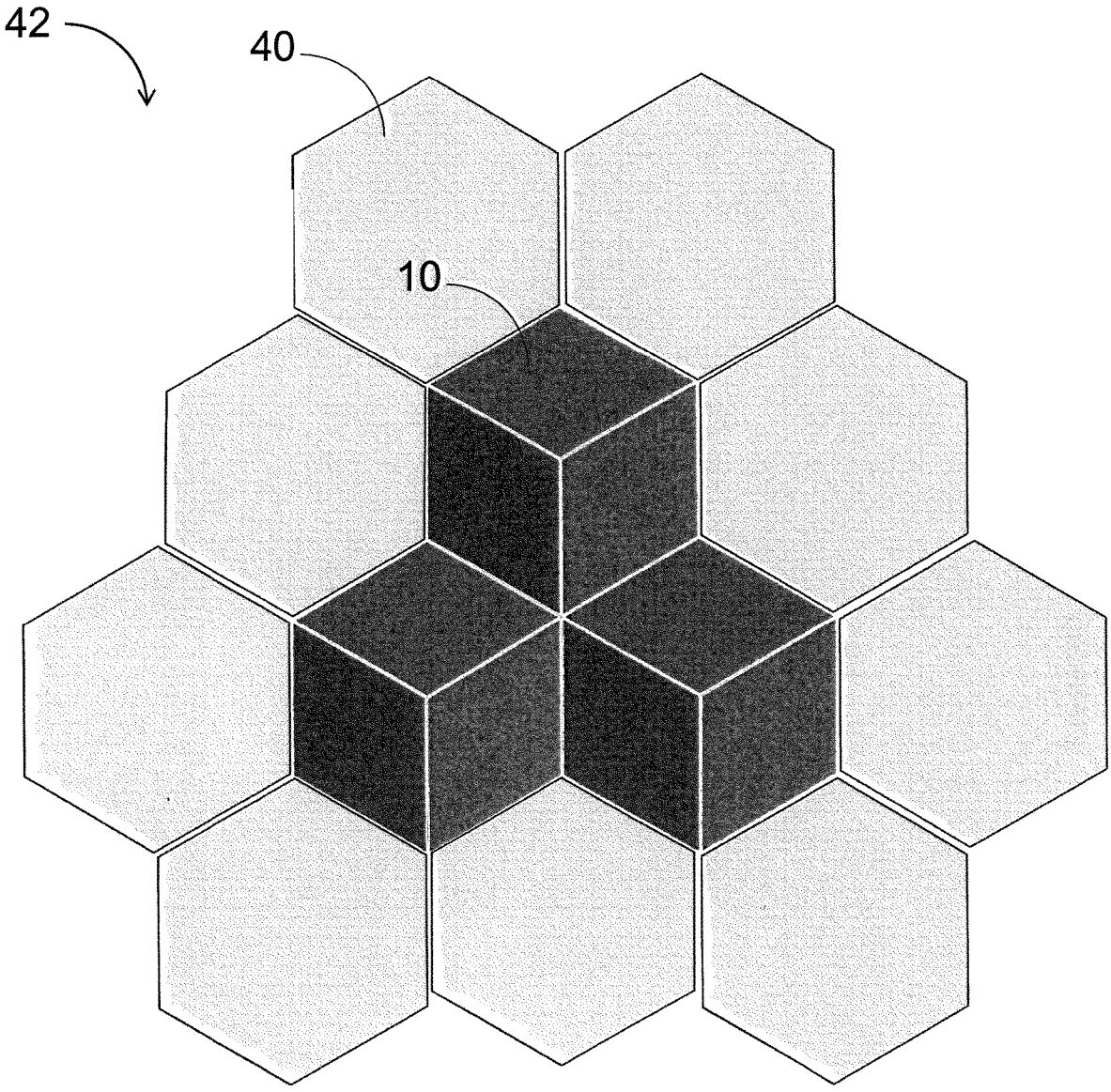


FIG. 5

## FLOOR COVERING APPARATUS

### CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of prior-filed Great Britain Application No. GB 1815624.0, filed on Sep. 25, 2018 and incorporated herein in its entirety by reference.

### STATEMENT REGARDING FEDERALLY-SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable

### BACKGROUND OF THE INVENTION

#### 1. Field of Invention

[0003] The present invention relates to modular solutions for covering floors, and in particular to modular entrance matting.

#### 2. Description of the Related Art

[0004] Entrance matting is known and has been used for a number of years. Such entrance matting is commonly made from a woven, wear-resistant, coarse plant fibre material, such as for example, coconut fibre.

[0005] A woven structure typically provides a base upon which an array of bristles pointing upwards may be located. Such bristles typically can perform the task of removing dirt and excess moisture from the underside of shoe soles. Dirt and moisture removed in this way typically falls between the bristles, where it remains until it is beaten out of the entrance matting.

[0006] There are a number of disadvantages to this type of entrance matting, particularly in those covering a large surface area of a floor. Entrance matting of this large size presents a difficulty when the time comes for cleaning said matting. Specialised equipment and/or a great deal of time and effort are often required for cleaning large entrance matting, which is exacerbated for frequently-used matting requiring more regular cleaning.

[0007] Large matting invariably also contains one or more locations which see more frequent use than other areas of said matting. In such circumstances, the effect of age and said additional use can become apparent on these areas much more quickly than other, less frequently used areas. This non-uniform rate of use across the whole matting can therefore greatly impact the visual appeal of said matting, requiring a complete replacement of the matting including areas which have not been affected by frequent use.

[0008] Some currently available solutions have been provided which use a plurality of smaller matting sections as part of a larger, modular matting product. Some example solutions include sections of a mat, forming individual matting tiles which clip together to form a continuous larger mat. The tiles often clip together using a connecting or interlocking means. The means for connecting or interlocking the tiles are often separate from the tiles themselves, and wear at a different rate to the tiles. As such, these connecting or interlocking means are often a point of weakness for said tiles. Said means can also make it difficult to remove, replace and rearrange individual tiles and as such additional effort is required for maintaining and/or repairing the matting.

[0009] One function of entrance matting is to direct traffic to a required location. Present solutions provide linear arrays of rectangular, or square, matting tiles in straight lines and are therefore ineffective at/incapable of handling multidirectional traffic.

[0010] It is therefore desirable that an entrance matting solution be provided which overcomes the disadvantages of currently available solutions, and preferably provides a simpler, more creative and elegant solution which is easier to maintain and more robust to wear and tear.

### BRIEF SUMMARY OF THE INVENTION

[0011] In accordance with a first aspect of the present invention, there is provided a floor covering apparatus, the apparatus comprising, a rigid, substantially planar base having an upper face, a lower face, and a perimeter defining a two-dimensional shape; a rigid edge portion extending from the upper face of the base and defining a depth, wherein the depth is a distance between the upper face of the base and an uppermost surface of the edge portion; wherein the floor covering apparatus is arranged to tessellate with at least one other such floor covering apparatus.

[0012] The present invention preferably provides a rigid floor covering apparatus that can be used alongside other such apparatuses in a modular fashion, such that the floor covering apparatuses tessellate, preferably give multiple possible design permutations, and are preferably robust to suit multi-directional traffic, rather than being restricted to a simple linear pattern of currently available solutions. The present invention preferably opens up a huge potential for creativity in design for entrances, while critically comprising a rigid raised edging around each base for durability and quality.

[0013] Most current rigid entrance matting is linear in construction and is not provided in multiple shapes and tessellating patterns, and therefore cannot effectively handle or direct multidirectional traffic while remaining robust to wear and tear. Some current manufacturers cut their existing linear product into a standard tile size that can be clipped together and arranged by 90 degrees only, suiting unidirectional or bidirectional traffic only.

[0014] Preferably the edge portion is located about the perimeter, defining a well having a well depth equal to said depth. In preferable embodiments the edge portion is continuous about the perimeter of the base. The edge portion preferably extends perpendicular to the base. More preferably, the edge portion cooperates with the base to form a well. Preferably the well is arranged to accommodate a mat.

[0015] Preferably the floor covering apparatus further comprises a mat adjacent the upper face of the base and the edge portion, the mat comprising a cleaning material. The mat is preferably arranged to clean the underside of shoe soles as said soles interact with the mat during the course of normal walking. Preferably the cleaning material comprises one selected from the group: a fibrous material; a woven material; bristled material; rubber; nylon. In embodiments comprising rubber, the rubber preferably comprises a textured surface. Preferably the mat comprises an absorptive material. Preferably the mat comprises a compressive material. Preferably, the apparatus of the present invention comprises a mat arranged to provide a compressive feel underfoot.

[0016] In the context of the present invention, the term "cleaning material" will be understood by the skilled

addressee in the context of matting used for cleaning the underside of soles of shoes and/or for absorbing moisture from the underside of soles of shoes.

**[0017]** Preferably the mat is affixed to the base and/or the edge portion. In preferable embodiments, the mat is fixed in place. The mat may be fixed in place using a temporary fixing means, such as a hook and loop mechanism, or optionally a permanent fixing means, such as, for example, a glue. In embodiments comprising a hook and loop system, preferably the mat material provides a loop to be hooked. Other examples of suitable temporary and permanent fixing means will be apparent to the skilled reader.

**[0018]** Preferably the mat is detachable from the base. In some embodiments, the mat may be detachable from the base and as such may be replaceable. Replacement of the mat may, for example, be desirable for redecoration or for replacement due to wear and tear.

**[0019]** Preferably the mat comprises a height, and preferably wherein the height is substantially the same as the depth. In accordance with most preferable embodiments, the height is greater than the depth. In such embodiments, the height is greater than the depth by a distance selected from the range: 1 mm to 10 mm. Most preferably the height is greater than the depth by a distance selected from the range: 1 mm to 2.5 mm. Preferably the height of the mat slightly exceeds the distance between the upper face of the base and the uppermost surface of the edge portion. As such, the mat is preferably proud of the uppermost surface of the edge portion, which preferably accounts for any compression of said mat, and therefore preferably provides a smooth surface suitable for walking upon.

**[0020]** In embodiments wherein the edge portion is located about the perimeter of the base and therefore cooperates with the base to form a well, the mat is preferably located within said well.

**[0021]** Preferably the mat comprises a plurality of layers. In some embodiments, the mat may comprise layers, each arranged to perform a specific function. In preferable embodiments, the uppermost of said layers is arranged to perform the function of cleaning the underside of soles of shoes during normal walking. In some embodiments, the lowermost of said layers is arranged to be affixed to the base.

**[0022]** Preferably the floor covering apparatus further comprises a support member, the support member positioned adjacent the lower face of the base. In preferable embodiments, the apparatus comprises a support member on the underside of the base, which is preferably arranged to minimize the impact of said apparatus on a floor.

**[0023]** The support member is preferably therefore arranged to minimize any resulting sound of the apparatus underfoot. The support member preferably comprises a sound-absorbing material; and or a shock-absorbing material. Some embodiments of the present invention are preferably arranged to minimize impact of a floor covering apparatus on a setting and may be part of a temporary floor covering solution. As such, damage to any existing floor is preferably minimized through the inclusion of a compressive support member located on the underside of the base.

**[0024]** Preferably the support member comprises a compressive material. In embodiments comprising both a support member and a mat, the support member preferably comprises a different compressive material to that comprised within the mat. Preferably the compressive material comprises one selected from the group: foam; rubber; a fibrous

material. Preferably the foam is EPDM neofam. In some embodiments, the support member may comprise one or more feet positioned about the underside of the base to distribute weight imparted upon said base evenly across an underlying floor.

**[0025]** Preferably the support member comprises a single layer of compressive material extending continuously across the base, such that the underside of the base is covered with said support member.

**[0026]** Preferably the base and the edge portion each comprise a metal. Preferably the base comprises a metal composite. Preferably the metal is aluminium. Embodiments will be appreciated wherein any suitable metal is used for the base and/or the edge portion. Aluminium may be used in preferable embodiments since it is lightweight and durable, thereby preferably requiring minimal effort in removing, replacing or rearranging said apparatus, while also minimizing the effect of wear and tear on said apparatus.

**[0027]** In accordance with preferable embodiments, the base is an aluminium composite, and the edge portion is pure aluminium. The edge portion comprises a rigid material, which preferably maximizes durability against repeated use. "Use" in the context of the present invention will be understood by the skilled addressee to mean fitting, removing, replacing and rearranging said floor covering apparatus, and will also be understood to include walking on said apparatus. As such, "repeated use" includes repeated interaction with said apparatus, which might otherwise, in currently available solutions, be subject to accelerated wear and tear when compared with the present invention.

**[0028]** Preferably the edge portion is affixed to the base. In some embodiments, the edge portion is continuous with the base, and both may be formed from a single sheet of material. In other embodiments, the base and the edge portion are manufactured from separate items, and affixed to one another during manufacturing. In such embodiments, the base and the edge portion are each comprised of different materials.

**[0029]** Preferably the two-dimensional shape is a regular polygon selected from the group: rectangle; triangle; hexagon; rhombus; kite; diamond; parallelogram; trapezoid. Preferably the two-dimensional shape is an irregular polygon. Embodiments will be appreciated wherein the two-dimensional shape is any shape desired or required for a particular application. Said application may, for example, involve fitting said apparatus into an irregular floor space.

**[0030]** In some preferable embodiments, the shape is not a rectangle. "Rectangle", in the context of the present invention will be understood by the skilled reader to include a quadrilateral shape comprising four right-angles (90°), and includes a square. "Rectangle", in the context of the present invention will be understood to exclude any quadrilateral not comprising four right-angles, such as, but not limited to, a kite; a parallelogram; a trapezoid; a rhombus; a diamond.

**[0031]** One function of entrance matting is to guide traffic to a required location. Present solutions primarily comprise linear arrays composed exclusively of rectangular, including square, tiles which are incapable of effectively directing multi-directional traffic (as opposed to unidirectional or bidirectional traffic). The present invention preferably provides an alternate solution to those currently provided by offering any suitable shape arranged to create arrays of floor covering apparatuses according to the first aspect, said arrays being more equipped to direct multi-directional traf-

fic. The present invention therefore preferably provides architects and engineers with the creative freedom to produce entrance matting arrangements capable of handling multi-directional traffic—something that present linear array solutions are preferably incapable of doing. Such embodiments of the present invention will be conceivable which are arranged to tessellate with rectangular tiles.

**[0032]** The present invention preferably provides for floor covering apparatuses of any number of possible tessellating shapes, and said apparatuses can preferably be fitted together in an almost infinite number of design permutations. The present invention therefore preferably provides a heavy-duty, robust entrance mat solution, which may comprise aluminium and fibre, and preferably allows real creativity of design and easily replaceable component parts.

**[0033]** Preferably the at least one other such floor covering apparatus comprises a base having a perimeter defining a different two-dimensional shape. In some embodiments, the floor covering apparatus may be used in combination with other of such floor covering apparatuses which may comprise a different two-dimensional shape. Such differences in the two-dimensional shape of the apparatuses used may, for example be according to a desired effect or desired, or due to a limitation imposed by a particular application, which may be, for example, an irregular floor space. In embodiments comprising a well, preferably the well defines a two-dimensional shape. In preferable embodiments, the two-dimensional shape of the well is equivalent to the two-dimensional shape defined by the perimeter of the base. In some embodiments, the shape of the well may be different to the shape defined by the perimeter of the base.

**[0034]** In accordance with a second aspect of the present invention there is provided a modular floor covering kit, the kit comprising a plurality of floor covering apparatuses according to the first aspect of the present invention.

**[0035]** Preferably the modular floor covering kit may comprise a floor covering apparatus having any one or a combination of the features described herein. Preferably the modular floor covering kit comprises a floor covering apparatus with a base having a perimeter defining a two-dimensional shape, wherein the two-dimensional shape is not a rectangle. In such embodiments, the modular floor covering kit may also comprise a floor covering apparatus with a base having a perimeter defining a two-dimensional shape, wherein the two-dimensional shape is a rectangle. Preferably the modular floor covering kit does not exclusively comprise floor covering apparatuses each with a base having a perimeter defining a two-dimensional shape, wherein the two-dimensional shape is a rectangle.

**[0036]** Preferably the kit is arranged to form a two-dimensional array of floor covering apparatuses.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

**[0037]** Specific embodiments will now be described by way of example only, and with reference to the accompanying drawings, in which:

**[0038]** FIG. 1 shows a sectional view of an example embodiment of a floor covering apparatus according to the first aspect of the present invention;

**[0039]** FIG. 2 shows an isometric view of the example embodiment of FIG. 1;

**[0040]** FIG. 3 shows an example embodiment of a floor covering kit according to the second aspect of the present invention comprising the floor covering apparatus of FIG. 1;

**[0041]** FIG. 4 shows a second example embodiment of a floor covering kit according to the second aspect of the present invention; and

**[0042]** FIG. 5 shows a third example embodiment of a floor covering kit according to the second aspect of the present invention comprising floor covering apparatuses from the example embodiment of FIG. 1 in combination with floor covering apparatuses from the example embodiment of FIG. 4.

#### DETAILED DESCRIPTION OF THE INVENTION

**[0043]** While the present invention has been illustrated by description of several embodiments and while the illustrative embodiments have been described in detail, it is not the intention of the applicant to restrict or in any way limit the scope of the appended claims to such detail. Additional modifications will readily appear to those skilled in the art. The invention in its broader aspects is therefore not limited to the specific details, representative apparatus and methods, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of applicant's general inventive concept.

**[0044]** Referring to FIG. 1, an example embodiment 10 of a floor covering apparatus is shown according to the first aspect of the present invention. The floor covering apparatus 10 comprises a planar aluminium-composite base 12 having an upper face 14, a lower face 16, and a first edge 18 and a second edge 20. The floor covering apparatus 10 further comprises a planar, first aluminium edge portion 22 affixed to the first edge 18 of the base 12, and a second aluminium edge portion 24 affixed to the second edge 20 of the base 12. Each of the first edge portion 22 and the second edge portion 24 extends perpendicular to the base 12, and defines a well 26 having a depth D. Shown elevated above the well 26, but arranged to be positioned in the well 26, and adjacent to the upper face 14 of the base 12, and the first and second edge portions 22, 24 is a fibrous mat 28, comprising a woven fibrous material 28 affixed to a fabric mat bed 29, the mat 28, 29 having a height H which is 2 mm greater than the depth D. Affixed to the lower face 16 of the base 12, and extending across the width W of the base 12, is a EPDM neofam support member 30.

**[0045]** The embodiment 10 of FIG. 1 is shown in the isometric view of FIG. 2, wherein a third aluminium edge portion 32 and a fourth aluminium edge portion 34 are shown, conjoining the first and second edge portions 22, 24. As shown in FIG. 2, the base 12 is diamond-shaped.

**[0046]** In use, the first, second, third and fourth edge portions 22, 24, 32, 34 are each arranged to abut an edge portion of an additional such floor covering apparatus such that said floor covering apparatuses tessellate to form a tessellating array of floor covering apparatuses.

**[0047]** The floor covering apparatus 10 of the first aspect of the present invention does not require any considerable preparation of an underlying floor prior to laying the apparatus onto said floor, and can also be removed from said floor, replaced and rearranged on said floor without considerable effort.

[0048] In use, the rigid raised edge portions provide a durable, continuous, and gap-free interface between individual floor covering apparatuses when arranged in a modular fashion. Some current solutions require connective elements permanently affixed to the floor covering apparatus. Other solutions provide a separate connecting piece, arranged to connect two modular apparatuses together. These solutions invariably suffer from wear and tear following extended use. The rigid edge portions of the present invention provide a relatively frictionless interface which does not suffer from wear and tear from repeated detachment and reattachment, and also allows for minimal effort in removing, replacing and rearranging individual apparatuses. The rigid nature of the edge portions also allows the edge portions to withstand continued use without causing the material of the mat, which in the embodiments shown is a woven material, to fray at the edges.

[0049] In the embodiment shown, the bed 29 of the mat 28 is permanently affixed to the base 12 of the apparatus 10 using an adhesive, but embodiments will be appreciated wherein the mat 28, 29 is temporarily affixed to the base, and may instead be detached and replaced. In such embodiments, a suitable temporary or detachable fixing means would be required to affix the mat to the base. An example of such a fixing means would include a hook and loop system. A hook and loop system would be particularly useful in embodiments wherein the mat is a fibrous material. Embodiments will be appreciated wherein any suitable fixing means is provided and is tailored to the material used for the mat. The mat for use with the present invention preferably comprises a compressive cleaning material. Certain such compressive cleaning materials may have a finite lifespan due to prolonged cyclic compression and therefore it may be advantageous for the mat to be temporarily fixable to the base. A temporary fixing means is preferably also useful for quick and easy redecoration, if for instance a different coloured mat material is required.

[0050] Referring to FIG. 3, a modular floor covering kit 36 is shown according to the second aspect of the present invention, comprising a plurality of floor covering apparatuses 10 according to the first aspect of the present invention, and as shown in FIG. 1 and FIG. 2. As can be seen, the plurality of floor covering apparatuses 10 of the kit 36 have been arranged to form a larger floor covering apparatus arranged in a pattern. The edge portions of the floor covering apparatuses 10 are arranged to abut an edge portion of one other floor covering apparatus 10 such that a continuous, robust interface is created between the floor covering apparatuses. This robust interface permits robustness against continued use.

[0051] In the embodiment shown, the aluminium edge portions 22, 24, 32, 34 are bonded to the aluminium composite base 12, and the fibre matting insert 28 and EPDM neofam backing 30 are adhered to the base 12 to form the completed apparatus. When installed as shown in FIG. 3, the apparatuses tessellate together, and in the embodiment shown, are fitted to a floor using a tackifier adhesive.

[0052] Alternative methods of manufacturing the present invention could include the step of folding an aluminium plate, or cast aluminium tiles, into the various tessellating shapes, including the required edge portions. Alternative methods may include a step of cutting a single piece of a rigid material to a desired shape, and preceded or followed by a step of routing said well out of said single piece of

desired rigid material. Such routing of the well would therefore leave the required base and the required edge portions in-tact. Said single piece of desired rigid material may for example comprise metal; stone; porcelain; ceramic; wood; rubber; linoleum; any combination thereof, or any other suitable rigid material. Said apparatuses could further be affixed together using jointing strips, clips, and/or adhesive.

[0053] Referring to FIG. 4, an alternate floor covering kit 38 is shown according to the second aspect of the present invention, comprising a plurality of floor covering apparatuses 40 according to the first aspect of the present invention. As can be seen from the embodiment of FIG. 4, the plurality of floor covering apparatuses 40 comprise a base having a perimeter defining a hexagonal shape.

[0054] Referring to FIG. 5, a further alternate floor covering kit 42 is shown according to the second aspect of the present invention, comprising a plurality of floor covering apparatuses 10 as shown in FIG. 2 and floor covering apparatuses 40 as shown in FIG. 4, tessellating to form a larger, continuous floor covering apparatus.

[0055] In the embodiments shown, the base is a regular polygon. Embodiments will be appreciated wherein the base takes the form of any suitable regular polygon capable of tessellating with another regular polygon, or an irregular polygon. Embodiments will also be appreciated wherein the shape is an irregular polygon arranged to tessellate with another irregular polygon or a regular polygon. In the embodiment shown, aluminium is used for the edge portions, and an aluminium composite is used for the base, each for rigidity and strength. Embodiments will be appreciated wherein any suitable rigid material is used, for example metal; stone; porcelain; ceramic; wood; rubber; linoleum; any combination thereof, or any other suitable rigid material.

[0056] In the embodiment shown in FIG. 1, the apparatus forms a diamond-shape having dimensions 115 mm×690 mm (2×45° angle; and 2×135° angle). Other examples of possible shapes/dimensions suitable for the present invention (but not limited to) are:

[0057] small square—230 mm×230 mm;

[0058] large square—460 mm×460 mm;

[0059] small triangle—230 mm×230 mm;

[0060] large triangle—460 mm×460 mm;

[0061] extra-small rectangle—115 mm×345 mm;

[0062] small rectangle—230 mm×460 mm;

[0063] medium rectangle—230 mm×690 mm;

[0064] medium, slim rectangle—115 mm×690 mm;

[0065] large rectangle—460 mm×690 mm;

[0066] small diamond—230 mm×230 mm;

[0067] medium, slim diamond×115 mm×690 mm (2×45° angle; and 2×135° angle);

[0068] large diamond—460 mm×460 mm (2×60° angle; and 2×120° angle); and

[0069] small hexagon—230 mm×230 mm.

[0070] It will be appreciated that the above described embodiments are given by way of example only and that various modifications thereto may be made without departing from the scope of the invention as defined in the appended claims.

Having thus described the aforementioned invention, what is claimed is:

1. A floor covering apparatus, the apparatus comprising, a rigid, substantially planar base having an upper face, a lower face, and a perimeter defining a two-dimensional shape; a rigid edge portion extending from the upper face of the base and defining a depth, wherein the depth is a distance between the upper face of the base and an uppermost surface of the edge portion; wherein the floor covering apparatus is arranged to tessellate with at least one other such floor covering apparatus.
2. The floor covering apparatus of claim 1, wherein the edge portion is located about the perimeter, defining a well having a well depth equal to said depth.
3. The floor covering apparatus of claim 2, wherein the floor covering apparatus further comprises a mat adjacent the upper face of the base and the edge portion, the mat comprising a cleaning material.
4. The floor covering apparatus of claim 3, wherein the cleaning material comprises one selected from the group: a fibrous material; a woven material.
5. The floor covering apparatus of claim 4, wherein the mat is affixed to the base and/or the edge portion.
6. The floor covering apparatus of claim 5, wherein the mat is detachable from the base.
7. The floor covering apparatus of claim 6, wherein the mat comprises a height, wherein the height is substantially the same as the depth.
8. The floor covering apparatus of claim 7, wherein the mat is located within said well.
9. The floor covering apparatus of claim 8, wherein the mat comprises a plurality of layers.
10. The floor covering apparatus of claim 9, wherein the floor covering apparatus further comprises a support member, the support member positioned adjacent the lower face of the base.
11. The floor covering apparatus of claim 10, wherein the support member comprises a compressive material.

12. The floor covering apparatus of claim 11, wherein the compressive material comprises one selected from the group: foam; rubber; a fibrous material.

13. The floor covering apparatus of claim 12, wherein the base and the edge portion each comprise a metal.

14. The floor covering apparatus of claim 13, wherein the base comprises a metal composite.

15. The floor covering apparatus of claim 14, wherein the metal is aluminium.

16. The floor covering apparatus of claim 15, wherein the edge portion is affixed to the base.

17. The floor covering apparatus of claim 16, wherein the two-dimensional shape is a regular polygon selected from the group: rectangle; triangle; hexagon; rhombus; kite; diamond; parallelogram; trapezoid.

18. The floor covering apparatus of claim 16, wherein the two-dimensional shape is an irregular polygon.

19. The floor covering apparatus of claim 18, wherein the at least one other such floor covering apparatus comprises a base having a perimeter defining a different two-dimensional shape.

20. A modular floor covering kit, the kit comprising a plurality of floor covering apparatuses, each apparatus comprising,

a rigid, substantially planar base having an upper face, a lower face, and a perimeter defining a two-dimensional shape;

a rigid edge portion extending from the upper face of the base and defining a depth, wherein the depth is a distance between the upper face of the base and an uppermost surface of the edge portion;

wherein each floor covering apparatus is arranged to tessellate with at least one other such floor covering apparatus.

21. The modular floor covering kit of claim 20, the kit arranged to form a two-dimensional array of floor covering apparatuses.

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