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(71) Applicant: **Sekisui Alveo AG**
6002 Luzern (CH)

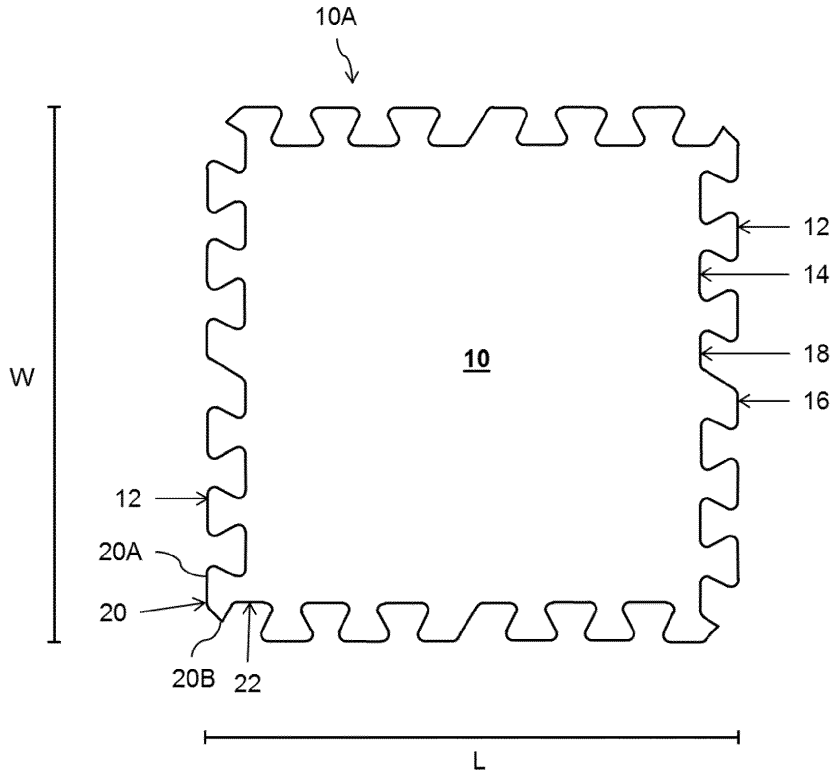
(72) Inventor: **Purcell, David**
Twynyrodyn,
Merthyr Tydfil CF47 0SN (GB)

(74) Representative: **Strehl Schübel-Hopf & Partner**
Maximilianstrasse 54
80538 München (DE)

(54) Interlocking polymer foam floor underlay element

(57) A polymer foam underlay element (10) for flooring applications is provided imparting improved structural stability to the underlayment, each side of the underlay element comprising puzzle locking means (12, 14, 16, 18) engageable with the side of another underlay element having the same design. The puzzle locking means enable each underlay element to directly interlock with both four or six other underlay elements of the same design to form interlocking joints, the interlocking joints being directly observable from a top view.

Fig. 1



EP 2 894 276 A1

Description

[0001] The present disclosure relates in general to floor underlayment, and more particularly, to the assembly of foam underlay material and its properties.

Background

[0002] Floors for commercial and residential buildings generally comprise three layers. The lower is a permanent subfloor with raw, unfinished surface, while the center layer is typically a softer material referred to as underlayment. The third layer is often comprised of decorative thin floor panels, such as hard laminated flooring panels, which are usually laid on top of the underlayment to form a floating floor not directly attached to the supporting subfloor. The underlayment is typically made of floor board, foam, felt or similar material, and offers shock absorbing, acoustic damping, and other advantageous properties to the floor structure, including prevention of wear on the decorative floor surface.

[0003] Underlay materials for floor coverings are mainly offered in the form of rolls, boards or folded sheets. To cover the whole floor surface of a room, strips from a roll or individual boards are laid out next to each other while avoiding gaps so that a floor covering which is installed thereon will be supported stably and consistently. If any gaps exist, performance of the floor coverings will be influenced negatively, for example with regard to acoustics, insulation, moisture barrier, and physical stability. Further, it may lead to unattractive seams, depressions, or bulges in the decorative floor layer, and may null or void any warranties offered by manufacturers of the flooring material.

[0004] During installation of the decorative flooring or prior to, it is common for the installer or others present in the workspace to have to step on the underlay material, thereby causing drifting or sliding of the pieces of underlay material and creation of gaps or damage to the material itself. This is often the case because floor systems are typically installed by first covering the subfloor completely with an underlay and then covering the underlay with the walkable flooring layer. Furthermore, the materials are often lightweight, such as foam, and may easily be shifted around. To prevent the formation of gaps, the pieces of underlay material are often connected or fixed together such as with tape, adhesive, or other added materials.

[0005] However, the use of such means creates inefficiency in installation through additional process steps, as well as added cost of materials, and due to the inability of certain tapes to adhere well to different materials, is often insufficient to securely fasten the underlay material together until the walkable flooring layer can be laid. Further, the adhesive contained in the tape or other added materials may contaminate the underlay and may complicate recycling of the underlay material, and if adjustments need to be made to the underlay during installation, re-separation of the adhered pieces may damage the material itself such as by tearing off with the tape, etc.

[0006] Additionally, particularly for residential applications, the installation of underlay material is often done by inexperienced users, who may not readily understand the best way to arrange the material in a way that imparts maximum structural stability and consistency to the flooring. With rolls, boards, and folded sheets, there is no inherent structure to guide the user as to how to arrange different pieces of different dimensions across a flooring surface in an optimal manner.

[0007] For rigid flooring materials, it is known to use joining mechanisms for connecting modular flooring pieces together, with or without adhesives, as is described for example in the Background of US Pat. No. 8,534,023. However, much less attention has been focused on optimal materials and methods of joining underlay material independently.

[0008] For example, US Pat. No. 7,155,871 describes floor panels that may comprise a hard laminate structure manufactured with a bottom layer of soft polyurethane foam, the floor panels attached via an adhesive. This allows the floor panel to conform to surface irregularities of the floor base, despite the inflexibility of the hard laminate layer. US Pat. No. 7,856,785 describes floor panels with a bonded bottom layer of floor board, foam or felt, and which may be attached via tongue grooves.

[0009] A large disadvantage of such systems is that by bonding the underlay material to the hard laminate flooring, the user has little or no flexibility in choosing optimal underlay materials appropriate for the diverse needs of different flooring applications. The ability to choose the underlay separate from the hard flooring provides maximum flexibility in choosing cost appropriate materials with different physical properties suitable for each user's particular needs and preferences. For example, a second floor housing application may require underlay with better acoustic dampening properties, versus a basement application requiring better thermal insulation and moisture barrier properties, or an application where walking comfort is prioritized over other functionalities. Further, depending on the needs and desires of building owners, the underlayment and decorative flooring overlay may be changed many times over the life of the building, thus it is desirable that the underlayment be readily removable from the decorative flooring layer. Additionally, pre-bonded underlay floor panels are difficult if not impossible to recycle, as the underlay material must be separated from the bonded laminate. Moreover, underlayment material often outlasts the decorative flooring, which is in contact with direct stresses and abuses, and therefore it is often desirable to change out the decorative flooring without having to remove the underlayment material.

[0010] US Pat. No. 5,052,158, is not directed to an underlay material, and describes a temporary cushioning mat floor covering/overlay (such as used in a gym) formed from modular locking square panels comprising foam, the panels horizontally interlocked by a plurality of uniformly spaced fingers and locking apertures around the periphery of each panel. Each finger and aperture comprises vertically angled faces in opposing fashion to reduce vertical displacement in the seams of the mat when subjected to compressive loads. However, in order for such interlocking structure to work, each panel would need to have a minimum thickness of more than about 10mm, for example, which is not suitable for many underlay applications. A similar pattern of uniformly spaced fingers and locking apertures for a flooring overlay is described in WO 2000/017467 A1, minus the angled faces.

[0011] WO 2007/078296 A1 describes polymeric foam floor underlayment assembly, with modular bands of polymeric foam that are coated with adhesive to join surfaces.

[0012] EP 2336452 A2 (US Pub. No. 2011/0146178), is directed to a modular, interlocking floor underlay that comprises a series of protrusions and recesses for locking each underlay panel together.

[0013] Although some of the above disclosures describe puzzle-like modular pieces that may be locked together, there is a need for an improved underlay that is inherently designed to be locked together in a manner ensuring maximum structural stability to the resulting underlayment and overall floor structure, particularly for thin foam underlayment (e.g., less than 5mm), while imparting additional functional features desirable for underlay material.

Summary

[0014] The present disclosure relates to the use of polymer foam underlay elements designed to interlock with abutting underlay elements in a manner imparting maximum structural integrity and stability to a resulting underlayment formed from the elements. Further aspects, preferred embodiments and advantages of the present invention are described in the claims and in the following more detailed description of the present invention.

Brief Description of the Drawings

[0015]

Fig. 1 is a top view of a square polymer foam underlay element.

Fig. 2 is a top view of a rectangular polymer foam underlay element.

Fig. 3 is a top view showing one possibility of assembling polymer foam underlay elements.

Fig. 4 is a top view showing a preferred assembly of the polymer foam underlay elements..

Fig. 5 is an exploded view of one side portion of the polymer foam underlay element as shown in Fig. 1 or Fig. 2.

Detailed Description

[0016] Described herein is an improved interlocking polymer foam element for specific use in underlayment applications. As referred to herein, the term "underlayment" refers to a physical object that is designed to be placed between a subfloor layer and a walkable flooring upper layer.

[0017] As referred to herein, the terms "bottom" and "top" of the polymer foam underlay element refer to the relative vertical position of its surfaces when the underlay element is used. The bottom surface of the underlay element contacts the subfloor lower layer and the top surface supports the decorative flooring upper layer. The measurable dimension between the bottom and top surface is the thickness of the polymer foam underlay element. As used herein, the term "lateral" or "horizontal" refer to a plane existing parallel to the plane of the subfloor.

[0018] In the present invention, the side portions of the polymer foam underlay elements have puzzle locking means comprising protrusions and recesses to allow the formation of puzzle-like interlocking joints with another foam underlay element of the same design. In order to achieve the interlocking connection, the protrusions preferably have the form of a dovetail and/or a trapezoidal form fitting into a mating recess of the respective abutting polymer foam element. At least some, or preferably most, of the protrusions preferably have a wider top than base to achieve a locking effect.

[0019] Fig. 1 is a top view of a polymer foam underlay element 10 according to one embodiment of the invention 10A, with puzzle locking means having dovetailed protrusions 12, dovetailed recesses 14, trapezoidal protrusions 16, trapezoidal recesses 18, and corner protrusions 20 comprising a rounded dovetail portion 20A on one side and an angled portion 20B on the other side. The embodiment 10A depicted in Fig. 1 is square in shape, and thus has the same lateral width (W) and length (L) along its sides.

[0020] Fig. 2 is a top view of a polymer foam underlay element 10 according to another embodiment of the invention 10B. Embodiment 10B is rectangular in shape, and has a lateral width (W) shorter than its length (L). As may be appreciated from the figures, the other structural aspects of embodiments 10A and 10B are the same, including the puzzle locking means.

[0021] The length of the underlay element 10 preferably 30 to 120 cm, more preferably 60 to 80 cm, and the width is preferably 20 to 100 cm, more preferably 40 to 60 cm. A dimension of 80 X 60 cm or 80 X 40 cm is most preferably for accommodating standard European pallet sizes of 120 X 80, as well as typical store shelf sizes. Relatively small dimensions may allow a more versatile installation of the underlay elements and better adaption to non-straight room walls, corners, etc. Also, a small size means a higher number of fixed underlay elements per area so that the fixing effect is enhanced. Further, using underlay elements of smaller dimensions enables installation of each individual element in a stepwise fashion, followed by a stepwise partial installation of the top flooring layer so that the installer does not have to walk on and potentially damage the underlay during the installation process.

[0022] The thickness and density of the polymer foam underlay elements 10 may be adjusted according to the desired properties for the resulting flooring application. Material properties that may be adjusted include, for example, reflected walking sound (can be reduced with damping underlay), impact sound (footstep vibrations transmitted to other rooms), compressive strength (load-bearing capacity at deformation of 0.5 mm), compressive creep (loss of thickness under long-term static loading, e.g. 10yrs), dynamic load resistance (number of loading cycles of a defined alternating load at which maximum allowable deformation of not more than 0.5 mm occurs), comformability (physical compensation of uneven spots in substrate), absorption behaviour (energy absorption to protect laminate surface against impacts), thermal resistance (insulative versus conductive), moisture protection (water vapour diffusion resistance), reaction to fire (flammability and burning behaviour). Generally, thickness may be in the range of from 1 to 100 mm, more preferably from 2 to 20 mm. However, for thermal insulation applications, such as underlayment used in basements, the underlay elements should preferably be at least 5 mm thick, for example.

[0023] Each polymer foam underlay element 10 is designed such that every side of one foam element can be interlocked with any side of another foam element having the same form to form a lateral plane. An advantage of the present invention results from the specific manner in which the underlay elements 10 have been designed to interlock, as shown in Figs. 3 and 4 and described below. Although Figs. 3 and 4 show the square embodiment 10A of polymer foam underlay elements 10 represented in Fig. 1, it may be appreciated that the following discussion applies equally to the rectangular embodiment 10B shown in Fig. 2.

[0024] As displayed in Fig. 1, the polymer foam underlay elements 10 have multiple dovetailed protrusions 12 and recesses 14, and one central trapezoidal protrusion 16 and recess 18 on each side. Referring to Fig. 3, a top view perspective is shown, showing that the underlay elements 10 and underlay elements 1, 2, 3 and 4 of the same design may be locked together such that each side of each underlay element completely touches the full length or width of the side of another element, and with each dovetailed protrusion 12 fitting snugly within each corresponding dovetailed recess 14 to form joint 24, while each trapezoidal protrusion 16 fits snugly within each trapezoidal recess 18 to form joint 26. Further, corner protrusions 20 comprising a rounded dovetail portion 20A on one side and an angled portion 20B on the other side are designed to fit snugly against one another in corresponding corner recesses 22 to form joint 28. In such arrangement, each underlay element 10 may only be in direct contact with four adjacent underlay elements.

[0025] However, as shown in the top perspective of Fig. 4, the design of the trapezoidal protrusions 16 and recesses 18, along with the design of the corner protrusions 20, allows for an improved offset or staggered arrangement for interlocking underlay element 10 and underlay elements 1, 2, 3, 4, 5 and 6 of the same design, such that each side of each underlay element only joins with half of the full length or width of the side of another underlay element. Specifically, two corner protrusions 20 are designed to fit snugly against one trapezoidal protrusion 16 in an interlocking manner utilizing corner recess 22 and trapezoidal recess 18 to form joint 30. This is enabled by the unique design of the corner protrusions 20 having an angled portion such that when two corner protrusions 20 are together, the angled portions 20B of each join to form one contiguous angled face that fits snugly against the angle of the trapezoidal protrusion 16, and such that both corner protrusions 20 fit tightly inside the trapezoidal recess 18. An example of suitable angles and dimensions for the protrusions and recesses is provided in Fig. 5.

[0026] The offset arrangement of joining polymer foam underlay elements 10 made possible by the present invention results in a tangible improvement on the structural stability of the resulting underlayment. As shown in Fig. 4, the offset arrangement allows each underlay element to be directly interlocked with six adjacent underlay elements (Labelled 1, 2, 3, 4, 5, 6 in the Figure), in contrast with the arrangement of Fig. 3 wherein only four adjacent underlay elements are interlocked. Consequently, the risk of the pads being pulled apart during flooring installation is significantly reduced with the offset arrangement. Furthermore, the inherent design of the inventive polymer foam underlay elements 10 ensures that even inexperienced installers can interlock the elements in a manner which ensures maximum structural stability to the resulting underlayment. Nonetheless, to increase flexibility of the interlocking method to compensate for corners or room edges, the arrangement of Fig. 3 is also provided by the design of the inventive underlay elements 10.

[0027] The improved structural stability of the offset arrangement shown in Fig. 4 can also be quantitatively measured

in terms of compressive strength, as shown in Table 1 below.

Table 1: Results of compressive strength measurements at 0.5 mm according to CEN/TS 16354, tested on polypropylene foam samples with 3mm thickness and 55 kg/m^3 in density.

Sample	Compressive strength (kPa)	% of Sample 1 Reference
1	155	100
2	145	94
3	140	90
4	135	87

[0028] Sample 1 (reference) represents a single, uncut piece of polymer foam underlayment with no interlocking means. Sample 2 represents two dovetail protrusions 12 of the foam underlay elements interlocked together (joint 24, present in both an offset and non-offset arrangement). Sample 3 represents the offset arrangement wherein two corner protrusions 20 are interlocked with one trapezoidal protrusion 16 (joint 30 such as shown in Fig. 4). Sample 4 represents a non-offset arrangement wherein four corner protrusions 20 are interlocked together (joint 28, such as shown in Fig. 3). For underlay material, compressive strength can be interpreted as an indicator of internal structural stability. Upon application of an external pressure force against the touching sides/edges of the interlocking underlay elements, the foam will tend to drift away from the force at its weakest point. In the case of uncut polymer foam elements (= no interlocking) the undestroyed polymer structure of the foam prevents lateral yielding at a certain point, and will naturally show the highest compressive strength. In the interlocking case, the dove tail protrusions and the corner interlocking means will create weakness in the foam structure. The more stable the interlocking connection is, the higher the remaining compressive strength.

[0029] The results of Table 1 show that Sample 4 representing a non-offset arrangement shows the lowest compressive strength, achieving 87% of the reference Sample 1, whereas Sample 3 having an offset arrangement shows a higher compressive strength, achieving 90% of reference Sample 1. Sample 2 shows an even higher compressive strength for dovetail protrusion 12 joints, achieving 94% of Sample 1. Accordingly, these results show that the offset arrangement represented by a combination Samples 2 and 3, rather than the non-offset arrangement represented by Samples 2 and 4, shows the highest overall compressive strength, and will also result in the highest structural stability across the resulting foam underlayment, even for thin foams of 3mm thickness. This is particularly true when considering the accumulative effect of each joint across the entire surface of the fully assembled underlayment.

[0030] Additional advantages of the present invention may also be appreciated. For example, since each underlay element 10 may be locked together mechanically through use of the dovetailed protrusions 12, trapezoidal protrusions 16, and corner protrusions 20 along with paired mating recesses, the application of tape or additional materials is no longer needed to fix the underlay elements together. As described above, the underlay elements 10 will form an underlayment with tight, structurally stable junctions across the entire lateral surface once locked together, even for thin and lightweight foams.

[0031] Furthermore, the underlay elements 10 of the present invention have interlocking joints 24, 26, 28, 30 which are clearly observable from a top view. Compared to a tongue and groove joint system, such as is often used for wooden or laminate top layer flooring, ease of installation is increased as the junctions of the elements are easily identifiable and the elements do not have to be titled when inserting one into another. Additionally, if top layer flooring is laid onto the underlayment such that the seams or junctions of the top layer align with the seams/junctions of the underlayment, the resulting structural integrity of the floor can be compromised due to the compounding of weak points. By using the underlay of the present invention, the seams are easily identifiable from the top, enabling the installer to more easily offset the seams of the top flooring layer with the seams of the underlay to achieve greater structural stability in the overall flooring system. Further, since the underlay elements 10 of the present invention may be assembled in both an offset and non-offset interlocking relationship, flexibility is increased for creating a seam/junction pattern across the underlayment that will suit different dimensions and joining characteristics of diverse decorative flooring systems.

[0032] Generally, the polymer foam underlay elements 10 are one-piece elements cut out from a foam plate. In other words, the protrusions and recessions are not separate elements mounted on the sides of the polymer foam elements but are formed as a result of the cutting process to produce the polymer foam elements.

[0033] In a preferred embodiment, the polymer foam elements 10 may be provided with through-holes which are preferably located in the central region of each element. These holes may be die cut simultaneously in the cutting step to produce the underlay elements. The through-holes can have an arbitrary form, but circular, elliptical and slit forms are preferred. The through holes may function to improve heat and humidity exchange between the subfloor and the top layer of the floor system. They may also have the function of allowing the top layer to be fixed to the subfloor if

necessary, such as by using an adhesive without the adhesive contacting a substantial portion of the polymer foam element material itself.

[0034] In addition, the through-holes may be provided to compensate for possible deformations of the polymer foam elements due to temperature changes and extremes. Such temperature changes or localized temperature differences may result in a relative expansion or contraction of the foam material which could result in a warping of the underlayment, and a decrease in the physical performance properties of the underlayment and/or the overall flooring system. The foam elements may also be micro perforated in order to enable improved sound absorption, water vapour permeability, and/or improved thermal conductivity.

[0035] The polymer foam underlay elements 10 may also be laminated on the top and/or bottom with functional layers such as, but not limited to, a damp-proof membrane, an anti-skid layer, an adhesive, etc.

[0036] The polymer foam underlay elements 10 may be made of polymer foams which may be crosslinked or uncrosslinked. The kind of polymer in the present invention is not particularly limited and can be, for example, polystyrene, polyvinyl chloride, polyurethane, polyamide, melamin, rubber, or any other homopolymer of a monomer, and/or a copolymer. Preferred are polymer foam elements made of a polyolefin or polystyrene. As an example, the following polyolefins may be preferably used: a polyethylene-based polymer; a polypropylene-based polymer; an olefin copolymer such as an ethylene-vinyl acetate copolymer (EVA), an ethylene-methyl acrylate copolymer (EMA), and an ethylene-butyl acrylate copolymer (EBA), EPDM, and a polyethylene/polypropylene rubber. A polymer-based polymer having, as a main component, a polyethylene-based polymer, a polypropylene-based polymer, or a mixture of a polyethylene-based polymer and a polypropylene-based polymer is preferable. A main component means that one of the polyethylene-based polymer and the polypropylene-based polymer, or both of them are contained in the polymer-based polymer at a total amount 50 % by weight or more.

[0037] The polyethylene-based polymer is not particularly limited, and examples include very low density polyethylene (VLDPE), low density polyethylene (LDPE), medium density polyethylene, high density polyethylene (HDPE), linear low density polyethylene (LLDPE), linear medium density polyethylene, and linear high density polyethylene, and these may be used alone, or may be used together.

[0038] In addition, the polypropylene-based polymer is not particularly limited, but examples include a propylene homopolymer, and a copolymer of propylene and other olefin, and these may be used alone, or two or more kinds of them may be used together. In addition, a copolymer of propylene and other olefin may be any of a block copolymer, a random copolymer, and a random block copolymer.

[0039] In addition, examples of olefin to be copolymerized with propylene include α-olefins such as ethylene, 1-butene, 1-pentene, 4-methyl-1-pentene, 1-hexene, 1-octene, 1-nonene, and 1-decene.

[0040] The polymer foam underlay element 10 of the present invention is not limited to the application of any particular top layer flooring, and may be used in conjunction with, for example, a parquet floor, a laminate floor, or floors made of plastics, such as polyvinyl, polystyrene, or a carpet.

[0041] The present invention also relates to a method of installing a floor system comprising joining or assembling the above describe polymer foam elements to form an underlay and covering the underlay with a top layer. The underlay is installed on a subfloor which is not particularly limited.

[0042] Preferably, the installation of a floor system is performed sequentially, i.e. a first part of the underlay is assembled, for example a first row or first rows of underlay elements 10 laid from one end of the room to another end of the room. Then this first part of the assembled underlayment is covered with a portion of the top layer flooring to such an extent that the side interlocking portion of the underlay elements can still be accessed for assembling the next section of the underlayment. Once the next section is assembled, the subsequent top layer flooring section is laid, and these corresponding sequences of steps are repeated until the entire floor with all layers have been laid. Such a sequential establishment of a floor system is advantageous in that a person installing the floor system does not have to step on the underlay elements during installation. Thus, a damaging of underlay material and a formation of gaps due to stepping on the underlay during installation of the floor system can be avoided.

[0043] Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

Claims

1. A polymer foam underlay element for flooring applications, each side of the underlay element comprising puzzle locking means engageable with the side of another underlay element having the same design, the puzzle locking means enabling the underlay element to directly interlock with both four or six other underlay elements of the same design to form interlocking joints, the interlocking joints directly observable from a top view.

2. The polymer foam underlay element of claim 1, wherein the puzzle locking means comprises a dovetailed protrusion, a dovetailed recess, a trapezoidal protrusion, and a trapezoidal recess, and wherein the trapezoidal protrusion and the trapezoidal recess are located in the center of each side of the underlay element.

3. The polymer foam underlay element of claim 2, wherein the puzzle locking means further comprises a corner protrusion having both a dovetailed portion and an angled portion of the protrusion.

4. The polymer foam underlay element of claim 3, configured such that when two corner protrusions are joined, the angled portion of each corner protrusion meet to form a contiguous angled face that fits snugly against the trapezoidal protrusion, and both corner protrusions fit inside the trapezoidal recess to form an interlocked joint with the trapezoidal protrusion.

5. The polymer foam underlay element of claim 4, wherein 90% or more compressive strength remains at all the interlocked joints when compared to an uncut foam underlay element of the same dimensions.

6. The polymer foam underlay element of claim 5 having a thickness of 2 to 5 mm.

7. The polymer foam underlay element according to any one of claims 1 to 5, wherein the underlay element has a thickness of 1 to 100 mm.

8. The polymer foam underlay element according to any one of claims 1 to 5, wherein the underlay element has a lateral dimension of 30 to 120 cm in length and 20 to 100 cm in width.

9. The polymer foam underlay element according to any one of claims 1 to 5, wherein the underlay element further comprises a through-hole having a circular, elliptical and/or slit form.

10. The polymer foam underlay element according to any one of claims 1 to 5, wherein the underlay element is perforated.

11. The polymer foam underlay element according to any one of claims 1 to 5, wherein the underlay element is laminated on a top side, bottom side, or both top and bottom sides, with one or more functional layers selected from the group consisting of a damp-proof membrane, an anti-skid layer and an adhesive layer.

12. The polymer foam underlay element according to any one of claims 1 to 5, wherein the underlay element further comprises polyolefin, polystyrene, polyurethane, polyvinyl chloride or rubber.

13. The polymer foam underlay element according to any one of claims 1 to 5, wherein the underlay element further comprises a polyolefin homopolymer or copolymer.

14. The use of the polymer foam underlay element as described in any one of claims 1 to 13 for forming an underlayment layer for a flooring system.

15. A method of installing a floor system, comprising joining polymer foam underlay elements as described in any one of claims 1 to 13 to form an underlayment layer, and covering the underlayment layer with a top layer of flooring material.

16. A method according to claim 15, further comprising joining a first portion of the polymer foam underlay elements onto a subfloor, covering the first portion of underlay elements with a first portion of a flooring layer, joining a second portion of the polymer foam underlay elements to the first portion of underlay elements, and covering the second portion of the polymer underlay elements with a second portion of a flooring layer.

Fig. 1

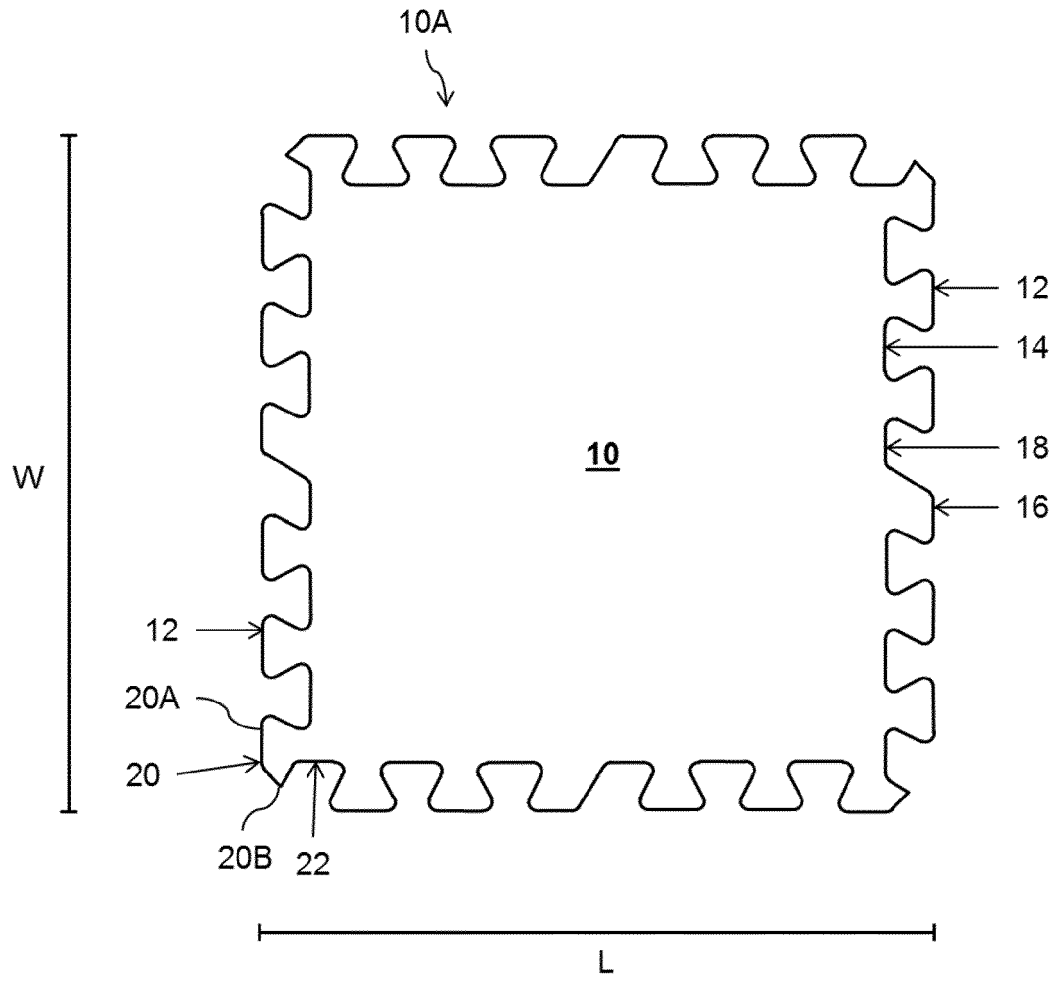


Fig. 2

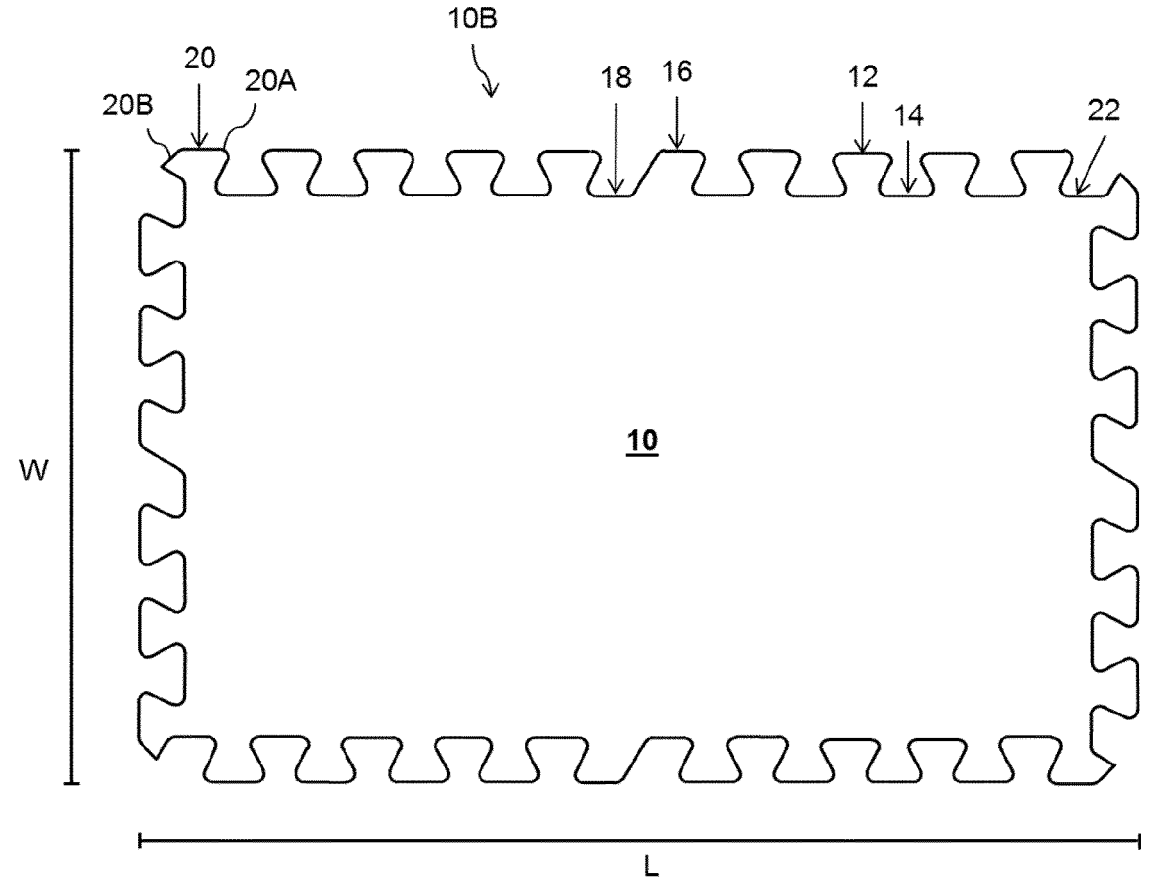


Fig. 3

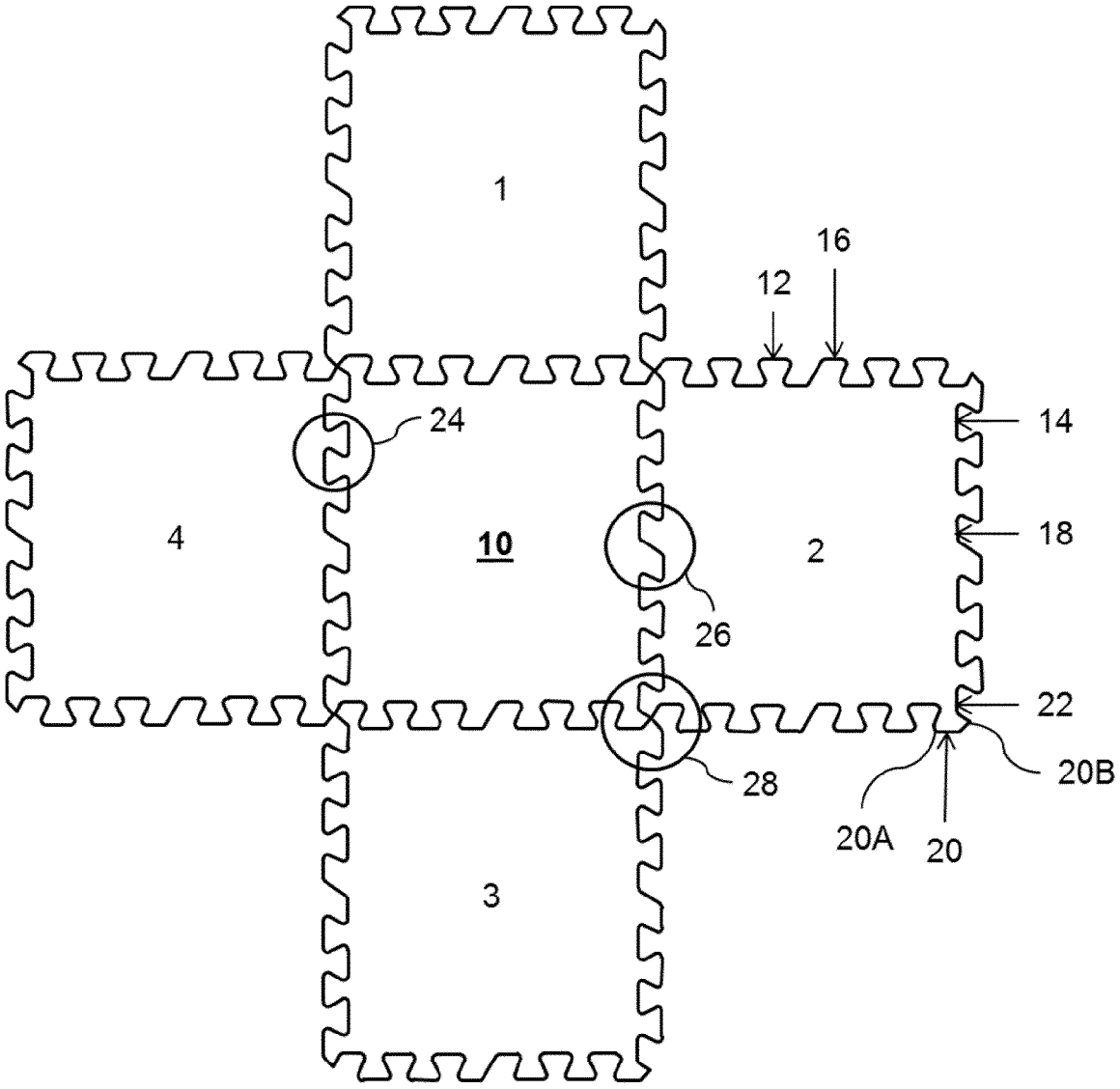


Fig. 4

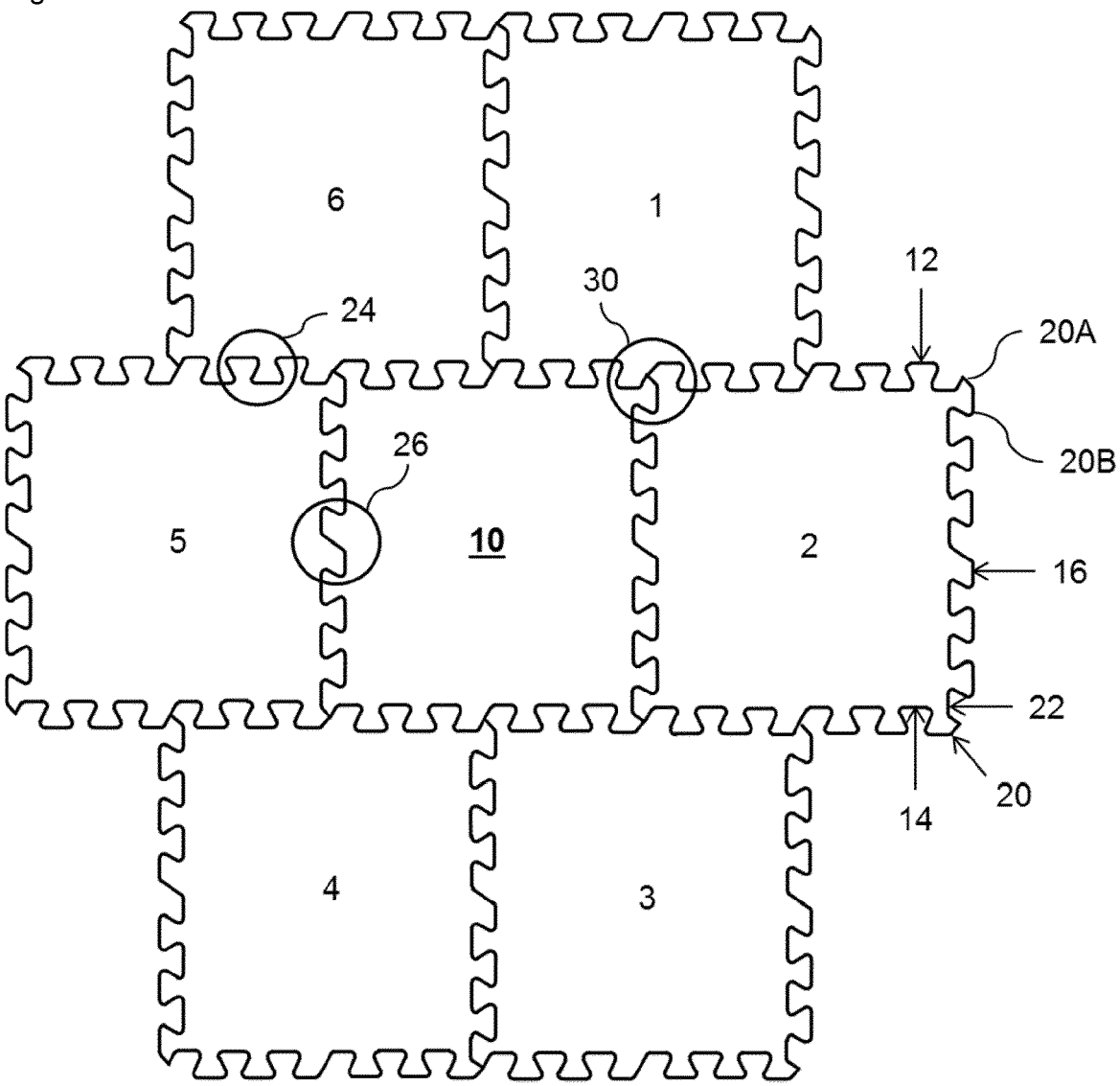
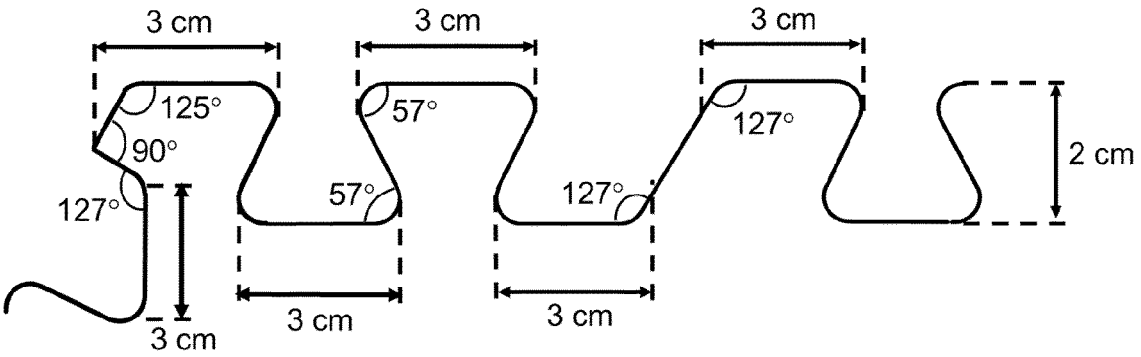


Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 14 15 0704

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	DE 10 2008 003281 A1 (LEHMANN GABRIELE [DE]) 9 July 2009 (2009-07-09) * paragraphs [0003], [0007] - [0009], [0012] - [0014], [0017]; claim 6; figures 1-3 *	1-16	INV. E04F15/18
Y	DE 20 2005 017640 U1 (SELIT DAEMMTECHNIK GMBH [DE]) 12 January 2006 (2006-01-12) * paragraphs [0001], [0007], [0011], [0012]; figures 1-2 *	1-16	
A	US 2003/093964 A1 (BUSHEY RICHARD D [US] ET AL) 22 May 2003 (2003-05-22) * figure 4 *	1,15	
A,D	WO 00/17467 A1 (KO DUKKI [KR]) 30 March 2000 (2000-03-30) * the whole document *	1,15	

TECHNICAL FIELDS SEARCHED (IPC)
E04F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 May 2014	Warthmüller, Almut

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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