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(71) Applicant: **Flooring Industries Limited, SARL**
8070 Bertrange (LU)

(72) Inventors:
- **NAEYAERT, Christophe**
  B-8490 Jabbeke (BE)
- **DE BAERE, Manuel**
  B-9800 Vinkt (BE)

(74) Representative: **Unilin Technologies**
Patent Department
Ooigemstraat 3
8710 Wielsbeke (BE)

(54) FLOOR COVERING

(57) A floor covering (10) is disclosed having a decorative surface (14) lying in a plane of the floor covering. The floor covering comprises rectangular floor panels (12), each floor panel having:
- a core (38) and preferably a decorative layer (40) on the core, the decorative layer forming a portion of the decorative surface (14),
- a first edge (16) and a second edge (18) forming a first pair of opposite edges,
- a third edge (20) and a fourth edge (22) forming a second pair of opposite edges, and
- four corners (23) at intersections of the edges.

At least the first pair of opposite edges (16, 18) is provided with mechanical coupling means (24) so that a plurality of similar panels can be coupled to one another. The coupling means (24) provide for an interlocking in a direction perpendicular to the plane of the floor covering, as well as in a direction perpendicular to the coupled edges and parallel to the plane of the floor covering. The floor covering further comprises a plurality of alignment elements (46). Each edge of the floor panel at least partially defines a hollow receiving cavity (42) below the decorative layer (40). The hollow receiving cavity (42) has a shape such that, when a first edge (16) of a second floor panel (12; B) is coupled to a second edge (18) of a first floor panel (12; A), the hollow receiving cavities (42) are aligned to form a receiving pocket (48) within which one of the plurality of alignment elements (46) is at least partially received.

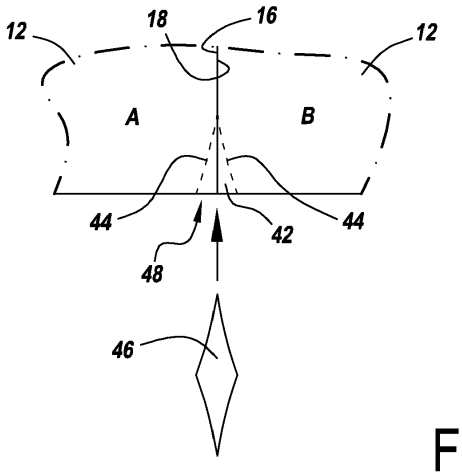

Fig. 7

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Description

[0001] The present invention relates to a floor covering comprising rectangular floor panels having a core and, preferably a decorative layer. More particularly, the invention pertains to floor coverings of the floating type, i.e. the floor covering rests on, but is not affixed to, a subfloor.

[0002] Contemporary floor coverings are normally installed by coupling a plurality of rectangular floor panels together at their short edges to form a first row, and then laying a second row of floor panels such that the short edges of the floor panels of the second row are offset in relation to the short edges of the floor panels in the first row. Subsequent rows of floor panels are then laid such that their short edges are offset in relation to those of the preceding row.

[0003] Nowadays, floor panels are predominantly provided with mechanical coupling means along their edges which allow two panels to be joined together without the need for adhesive. As is described in WO 97/47834, mechanical coupling means can be made by milling profiles along the edges of a panel to form coupling parts. Adjacent edges of each panel have a male coupling part in the form of a tongue and the other adjacent edges have a female coupling part in the form of a groove. When two panels are to be joined, the tongue is inserted into the groove and the panels are joined together, either by way of an angling down motion of the tongue panel with respect to the groove panel or by means of a relative horizontal motion. Preferably, the coupling parts are elastically deformed during joining such that a click or snap connection is attained. Another type of connection is described in WO 2010/082171 in which a so-called fold-down system is disclosed. In this respect, reference is also made to WO 2103/102803 and WO2013/118030. Coupling parts which permit floor panels to be coupled by means of a pushdown movement are known from WO 2021/111210.

[0004] With only a few exceptions, floor panels are rectangular in shape and may be oblong or square. Normally, oblong floor panels are laid in rows in which short edges of adjacent panels are connected together. A subsequent row is then laid with its short edges offset from the short edges of the preceding row. Sometimes, however, it is desirable to lay floor panels in a so-called chessboard pattern in which the short edges of adjacent rows are aligned with each other. This is particularly the case for square floor panels. Although the provision of mechanical coupling parts on the face of it facilitates the laying of floor panels in a chess board pattern, it has been found that the coupling motions described above that are needed to assemble the floor panels tend to pull already-installed panels out of alignment. This problem is less of an issue when panels are laid in an offset manner since one edge of a panel from a previous row keeps the edges of two panels being installed in the new row in alignment.

[0005] A further problem which may arise when laying floor panels in a chessboard pattern is that any geometric variations of the panels due to tolerances in the machining, especially imperfect squareness of edges, tend to accumulate during the installation. This is particularly relevant for square panels.

[0006] There is therefore a need to facilitate accurate laying of floor panels having mechanical coupling means.

[0007] Accordingly, it is an object of the present invention to provide a floor covering made up of rectangular floor panels in which alignment of the edges of the panels can be facilitated, at the same time that a sufficient locking force can be maintained between the laid panels.

[0008] This object is achieved by means of a floor covering as claimed in claim 1 having a decorative surface lying in a plane of the floor covering. The floor covering comprises rectangular floor panels, each floor panel having:

- a core and, preferably a decorative layer on the core, the decorative layer forming a portion of the decorative surface,
- a first edge and a second edge forming a first pair of opposite edges,
- a third edge and a fourth edge forming a second pair of opposite edges, and
- four corners at intersections of the edges.

[0009] At least the first pair of opposite edges is provided with mechanical coupling means so that a plurality of similar panels can be coupled to one another. The coupling means provide for an interlocking in a direction perpendicular to the plane of the floor covering, as well as in a direction perpendicular to the coupled edges and parallel to the plane of the floor covering. The floor covering further comprises a plurality of alignment elements. Each edge of the floor panel at least partially defines a hollow receiving cavity below the decorative layer. The hollow receiving cavity has a shape such that when a first edge of a second floor panel is coupled to a second edge of a first floor panel, the hollow receiving cavities are aligned to form a receiving pocket within which one of the plurality of alignment elements is at least partially received.

[0010] Preferably, said coupling means are formed as a male part, that is for example basically formed as a tongue, and a cooperating therewith female part, that is for example basically formed as a groove bordered by a lower lip and an upper lip into which said tongue can be placed. The male and female part are provided with locking means preventing the drifting apart of the male and female part. For example said lower lip may be provided with a recess into which a protrusion on a lower surface of the tongue fits when two panels are coupled together. The basic shape of the male and female part, for example the tongue and groove shape, may herein provide for said interlocking in a direction perpendicular to the plane of the floor covering, while said locking means, for example said recess and protrusion, may provide for said

interlocking in a direction perpendicular to the coupled edges and parallel to the plane of the floor covering.

[0011] Preferably, coupling means are provided at both pairs of opposite edges, i.e. as well at the first and second edges, as at the third and fourth edges. The coupling means at both pairs of edges are preferably compatible and/or have an identical, or largely identical geometry. With "compatible" it is meant that said first edge can cooperate with said second edge as well as with said fourth edge, and that said second edge can cooperate with said first edge as well as with said third edge, wherein in each case an interlocking is obtained in a direction perpendicular to the plane of the floor covering, and/or in a direction perpendicular to the coupled edges and parallel to the plane of the floor covering. The compatibility allows, in the case of square panels, that they may alternatingly be installed in a row with changing orientation. This is sometimes desirable. For example, in the case of decorative surfaces showing a directional pattern, the panels may be installed with the directions alternating between parallel and transverse to the direction of the pattern of a first panel in a row. The alternation may then also be continued in following rows, being it, preferably, in the exact opposite order, such that a chessboard pattern is obtained of parallel and transverse directed patterns.

[0012] The provision of an alignment element at least partially received in the receiving pocket means that edges of adjacent floor panels can be brought into, and held in, alignment both during laying of the floor covering and once the floor covering has been laid. As a result, the risk that panels are pulled out of alignment due to interaction between the mechanical coupling parts as panels are coupled together is mitigated.

[0013] In one embodiment, a hollow receiving cavity is provided at each corner of the floor panels, with the hollow receiving cavity extending from the intersection of the two edges forming the corner and part way along each of the two edges. In this manner, a receiving pocket is formed at adjacent corners of the floor panels and an alignment element can be inserted into the receiving pocket. The alignment element serves to aid in the assessment of the alignment of the joined panels, as well as to facilitate alignment of subsequent panels as they are being laid.

[0014] The receiving cavity may further have one or a combination of two or more of the following properties:

- a first property that said receiving cavity is at least present at a central location of the thickness of the floor panel;
- a second property that said receiving cavity is provided at such location in the thickness of the floor panel that it interferes with a protruding portion of the coupling means provided at at least one edge, and preferably at two edges that intersect to form a corner;
- a third property, wherein the receiving cavity shows the above second property and wherein said protruding part is the portion of a tongue shaped coupling part that protrudes beyond the edge of the decorative surface and/or wherein said protruding part is a portion of a lower lip bordering a groove and that protrudes beyond said decorative surface;
- a fourth property, wherein the receiving cavity shows the above third property, inclusive said second property, and wherein said portion of a tongue shaped coupling part protruding beyond the edge of the decorative surface is completely absent at the location of said receiving cavity.

[0015] The preferred properties regarding the location of the receiving cavity in the thickness of the floor panel each separately or in combination may lead to an optimisation of the remaining strength of the corners with a maintained ease of installation, wherein the coupling means do not or only minimally interfere with the alignment elements during coupling. In the cases where the protruding portion of the tongue is completely absent at the location of said receiving cavity, it is obtained that no weak, easily damaged portions remain at the edge or corner.

[0016] The invention is particularly useful when floor panels are laid to form a chessboard pattern, i.e. a pattern in which there are no offset edges. With such a pattern, there will be a meeting point of four floor panels. A substantially closed receiving compartment will be formed by the hollow receiving cavities of the corners of the meeting point. The substantially closed receiving compartment accommodates one of the alignment elements. Since the hollow receiving cavities making up the substantially closed receiving compartment are formed below the decorative layer of each panel, the alignment element will not be visible to a person standing on, or next to, the floor covering. Furthermore, because the receiving compartment is substantially closed, the thickness of the core of the floor panel can be maintained over as large an area of the floor panel as possible, thereby contributing to the stability and robustness of the floor covering.

[0017] Depending primarily on how the floor panels are made, each hollow receiving cavity is essentially right-triangular shaped such that the substantially closed receiving compartment is essentially square-shaped. Such a shape means that no account need be taken of the orientation of the alignment element when it is inserted into the receiving pocket during laying of the floor covering.

[0018] In another embodiment, each hollow receiving cavity is essentially right-triangular shaped such that the closed receiving compartment is essentially lozenge-shaped. In this regard, a lozenge is a figure with four equal sides and two acute and two obtuse angles, and the lozenge shape has a major diagonal and a minor diagonal. Preferably, the major diagonal has a length which is at least 20 % greater than the length of the minor

diagonal, optionally at least 50 % greater, optionally at least 100 % greater, optionally at least 200 % greater. Advantageously, when two adjacent floor panels in a row of floor panels are coupled together, the respective hollow receiving cavities form a receiving pocket such that the major diagonal will lie along the joined edges. In this manner, when an alignment element is inserted into the receiving pocket, the alignment element is more securely held in the receiving pocket than if the minor diagonal were to lie along the joined edges. Furthermore, the part of the alignment element that protrudes from the receiving pocket will be longer and thinner than if the minor diagonal were to lie along the joined edges. The protruding part thereby assists in guiding panels of the subsequent row to the correct aligned position during laying and the sides of the lozenge-shape act as stop surfaces to maintain the panels in correct alignment. Advantageously, therefore, the length of the major diagonal is between three and four times greater than the length of the minor diagonal. Purely by way of example, the major diagonal may be between 30 mm and 50 mm, preferably about 40 mm, and the minor diagonal between 7,5 mm and 12,5 mm, preferably about 10 mm.

[0019] Primarily as a result of how the floor panels are manufactured, each essentially right-triangular shaped hollow receiving cavity has a hypotenuse which is curved. The hypotenuse is constituted by an internal wall of the hollow receiving cavity that extends between adjacent edges of the floor panel.

[0020] In one embodiment, a hollow receiving cavity is located along each edge of the floor panel, preferably midway along each edge.

[0021] To more readily ensure accurate alignment of panels, it is useful if each of the plurality of alignment elements has a shape corresponding substantially to that of the receiving pocket or substantially closed receiving compartment.

[0022] Each of the plurality of alignment elements has a substantially planar profile having a thickness. The thickness will depend to some extent on the thickness of the floor panels and may be between 0.5 mm and 3 mm. A suitable material for the alignment elements is a plastics material, for example PVC (PolyVinyl chloride), ABS (Acrylonitrile Butadiene Styrene), PP (Poly Propylene), PE (Poly Ethylene), PET (PolyEthylene Terephthalate) and/or PLA (Poly Lactic Acid). The plastics material may comprise additives, for example fillers and/or plasticizers. In the case of PVC, preferably no plasticizer and no filler are used, alternatively less than 5phr plasticizer is used and/or a filler content of less than 50 wt%, or less than 10wt%.

[0023] Preferably the largest dimension of the alignment element in the plane of the panels, for example the major diagonal, is larger than 5 times the thickness of the alignment element as measured perpendicular to said plane. In such case some flexibility can be expected from the alignment element. Such flexibility may be handy during installation. It may for example allow for a slight angling of the joint between two panels while the alignment element is already received in the receiving cavities of at least said two panels. Such slight angling may be used at the end of a sliding coupling motion to achieve the final stage of connection. According to another example, such flexibility may enhance a joining of two panels by means of a downward motion, for example wherein a portion of the coupling means of the downwardly moving panel is snapped over and underneath a portion of the alignment element, such that this portion becomes automatically placed in the receiving cavity of the downwardly moving panel.

[0024] According to the most preferred embodiment, said alignment element is somewhat flexible, and/or shows, for example, a thickness smaller than 2 mm, a main dimension, for example major diagonal, in the plane of the panels larger than 10 mm and/or is mainly realized in a plastic material selected from the list consisting of PVC, ABS, PE, PP and PET.

[0025] Irrespective of the shape and dimensions of the alignment element, it is to be understood that the alignment element is preferably an extraneous element, i.e. it is not an integral part of a floor panel. Since the alignment elements do not hold adjacent floor panels together, the floor panels can still be mechanically coupled together to form a floor covering even without the presence of alignment elements.

[0026] The invention may be applied to any type of flooring which employs mechanical coupling means. Thus, the floor panels may be laminate floor panels having a core of MDF/HDF material and a thickness of, for example, 6 mm to 15 mm. Alternatively, the panels may be plastic floor panels having a thickness of e.g. 3.2 mm to 6 mm. Examples of such plastic floor panels include:

- so-called SPC (stone plastic composite) in which the substrate is made of rigid PVC with less than 5 phr plasticizer, and including filler materials such as chalk at a fill ratio of up to 4:1 (filler:PVC);
- WPC (waterproof plastic composite) in which the substrate is a closed cell foamed PVC including filler materials such as chalk at a fill ratio of up to 2:1, and
- LVT (luxury vinyl tile) in which the substrate is a soft PVC with more than 5 phr plasticizer, preferably more than 15 phr, and filler materials such as chalk at a fill ratio of up to 2:1.

[0027] SPC has been shown to be extremely suitable since it is less susceptible to splitting and telegraphy.

[0028] Telegraphy is the transmission of imperfections and/or unevenness in the subfloor upon which the floor covering is laid. It manifests itself on the decorative surface of the floor covering in the form of ripples or raised areas and hollows. To mitigate the risk of the alignment elements causing telegraphy, each receiving pocket and/or substantially closed receiving compartment may have a depth in a direction perpendicular to the plane of the floor covering, the depth being greater than, or sub-

stantially equal to, the thickness of the alignment elements. Nevertheless, in some cases, for example if the material of the core of the floor panels is not particularly susceptible to telegraphy or splitting, it may be advantageous to make the alignment elements slightly thicker than the depth of the receiving pocket so that a small press fit is obtained. The press fit will assist in retaining the alignment elements in the receiving pockets during installation of the floor covering. Thus, the thickness of the alignment elements may be up to 15 % greater than the depth of the receiving pockets.

[0029] Preferred mechanical coupling means are those which allow the floor panels to be coupled to one another via a snap action. A snap action can be incorporated in coupling means which permit joining of floor panels by way of horizontal shifting, vertical displacement, angling-in and/or in fold-down systems. Thus, the snap action may occur as two panels are shifted towards each other in a direction substantially parallel to the plane of the floor covering and/or as two panels are shifted towards each other in a direction substantially perpendicular to the plane of the floor covering.

[0030] The floor covering of the present invention may be made up of rectangular floor panels of any length and width, depending essentially on the visual impression that is wished to be created. Typically, though, for a chessboard type of pattern, the floor panels are square and can have a decorative layer with an edge length of between 300 mm and 750 mm, preferably about 600 mm. The decorative surface may be provided with lowered edges at one or more sides, for example bevels or grout imitations, or even a space for introducing grout. In the case of bevels, the decorative surface is preferably continuous over the surface of the lowered edge. Herein the decoration may be flat, while the bevel is limited in depth to a wear layer situated above said decoration, or the decoration may be bevelled in itself for example due to a deformation of an underlaying portion of the core. It is however not excluded that a separate decoration, such as a paint, a print and/or a lacquer, is provided on the bevelled surface. As an alternative the lowered edge may be free from decoration and extend into a portion of the core, to thereby expose the color of the core. All these decoration options are also available in the case of a lowered edge forming a grout imitation. Such lowered edge preferably has an L-shaped geometry. The bottom of such lowered edge forming a grout imitation may be horizontal or practically horizontal. The proximal wall of the grout imitation may be vertical or practically vertical, whether or not chamfered toward the global upper surface of the panel. As an alternative the proximal wall may be convex or concave, preferably tangent to said bottom. In general, the decorative surface of the panel may convey any desired pattern, such as a woodgrain pattern, a stone pattern or a fanciful pattern.

[0031] It is clear that the decorative surface is preferably at least formed by means of a decorative layer attached to the core. It is however also possible that the core itself has a decorative aspect basically forming said decorative surface. The latter may for example be the case when the core is a solid wood, or is a compact vinyl. It is of course not excluded, that in such case the decorative aspect of the core is protected from wear, scratches and other damages by means of a protective lacquer or similar. Where certain aspects or preferred embodiments of the invention are described in relation to a decorative layer, it is clear that similar preferred embodiments are available where the core basically forms the decorative surface.

[0032] According to the most preferred embodiment, said alignment element is freely and gluelessly introduced in a respective receiving cavity, pocket or compartment. Preferably said receiving cavity, pocket or compartment is free from ridges that would hinder the introduction of said alignment element. Within the scope of the present invention, it is however not excluded that means would be provided to maintain said alignment element at least to some extent at its position within said receiving cavity, pocket or compartment. Such means may take various forms of which here below two possibilities are described, without desiring to be exhaustive.

[0033] According to a first possibility, said means comprise snapping hooks at the receiving cavity, pocket or compartment and cooperating undercuts at the alignment element, or vice-versa. Preferably said means provide for a hindrance in at least one direction in the plane of the panels, such that said alignment element is, at least to some extent, maintained in said cavity, pocket, or compartment. In said first possibility, preferably said alignment element is somewhat flexible, for example made with a thickness smaller than 2 mm, a main dimension, for example major diagonal, in the plane larger than 10 mm and/or from a plastic material selected from the list consisting of PVC, ABS, PE, PP and PET.

[0034] According to a second possibility, said means comprise adhesive. Said adhesive may be provided by the installer or at the factory in said pocket or compartment, and/or on said alignment element. A factory-applied adhesive may be protected with a removable film. In order to reach a fully adequate adhesive connection between the alignment element and the walls of the receiving cavity, pocket or compartment a structure, for example with one or more ridges and/or with a surface roughness larger than 5μm Ra, may be provided at one or both of the alignment element and the walls of the receiving cavity, pocket or compartment.

[0035] Said first and second possibility may be combined in a single embodiment.

[0036] Further, it is remarked that the adhesive applied in accordance with said second possibility may wholly or partially fill remaining spaces between the alignment element and the walls of the receiving cavity, pocket or compartment. This is especially interesting in the cases where the depth in a direction perpendicular to the plane of the floor covering, is greater than the thickness of the alignment element. In such case the glue may at least

partially, or wholly, fill the space created by the dimensional difference between said thickness of the alignment element and said depth. In such embodiment an optimal support of the edges of the panels at the location of the receiving cavities, pockets or compartments may be achieved, for example at the corners.

[0037] Preferably one or more of said hollow receiving cavities are machined using one or more continuous milling machines, such as end-tenoners, wherein the panel is continuously fed past rotating milling tools. One or more of said milling machines preferably comprises a so-called jumper tool, i.e. a rotating milling tool having an axis that is displaceable in a direction transverse to the feeding direction of the panel. Such jumper tool may then be used to machine a receiving cavity, for example as further clarified in the detailed description. According to a variant one or more of said hollow receiving cavities are machined using one or more CNC (Computer Numerically Controlled) milling machines, wherein one or more milling tools or sawblades are following a programmed path in order to machine the one or more hollow receiving cavities while the panel is at standstill or is made to follow a programmed path itself. Using CNC milling machines, a large variety of geometries of receiving cavities may be obtained, including e.g. L-shaped cavities that may have equal length at both edges intersecting the respective corner where the cavity is provided. According to still another variant a rotating milling tool or sawblade with an axis at standstill is used to provide said hollow receiving cavity into a panel that is brought into engagement with said milling tool through a translational movement, for example of the corner wherein said cavity needs to be provided towards said milling tool into engagement, and withdrawing out of engagement, or with a rotational movement, for example of the corner wherein said cavity needs to be provided into and out of engagement with said milling tool. The movement out of engagement may be obtained through reversing or further following the rotational movement.

[0038] It is clear that the invention also concerns a floor panel suitable for assembling a floor covering having the features of the invention and/or its preferred embodiments, an alignment element for use in a floor covering having the features of the invention and/or its preferred embodiments, a kit of one or more such floor panels and alignment elements, possibly commonly packaged, a method of assembly of such floor covering wherein alignment elements are introduced into hollow receiving cavities, and a method of manufacturing such floor panel, all as disclosed herein.

[0039] The invention will be described below in greater detail, by way of example only and with reference to the accompanying drawings, in which:

Figs. 1A and 1B schematically and in perspective each represent a portion of a floorcovering in accordance with the present invention;

Fig. 2 is a schematic plan view of one of the floor panels making up the floor covering of Fig. 1A;

Fig. 3 is an elevational view in the direction of arrow F3 in Fig. 2;

Fig. 4 is an elevational view in the direction of arrow F4 in Fig. 2;

Fig. 5 is a schematic perspective view of a floor panel making up a portion of the floor covering according to Fig. 1A;

Fig. 6 is a schematic perspective view on a larger scale of a portion of the floor panel of Fig. 5 marked as F6;

Fig. 7 illustrates a receiving pocket for an alignment element;

Figs. 8 to 11 illustrate how four floor panels can be laid to form a floor covering according to the present invention;

Fig. 12 is a plan view of a lozenge-shaped alignment element according to one embodiment of the present invention;

Fig. 13 is a schematic plan view of four floor panels of the floor covering having a common meeting point;

Fig. 14 is a plane view of another embodiment of an alignment element for use in the floor covering of the present invention;

Figs. 15 to 19 schematically illustrate how floor panels for use in the floor covering of the present invention may be made;

Fig. 20 is a plan view of a floor panel having an alternative arrangement of hollow receiving cavities; and

Fig. 21 schematically illustrates a receiving pocket which is created when two floor panels of Fig. 20 are coupled together.

[0040] In the drawings, reference number 10 denotes a floor covering in accordance with the present invention. As may be gleaned from Figs. 1A and 1B, the floor covering 10 comprises rectangular floor panels 12. In Fig. 1A, the floor panels 12 are square, whereas in Fig. 1B the floor panels are oblong. The floor covering has a decorative surface 14 lying in a plane of the floor covering.

[0041] With reference to Fig. 2, each floor panel 12 has a first edge 16 and a second edge 18 forming a first pair of opposite edges, and a third edge 20 and a fourth edge 22 forming a second pair of opposite edges. Thus, the floor panel 12 has four corners 23 at intersections of the edges. In Fig. 2 the floor panel is square, though it is to be understood that, for an oblong floor panel having a pair of short edges and a pair of long edges, the first pair of opposite edges is preferably constituted by the pair of short edges. In this manner, and as is illustrated in Fig. 1B, a row of oblong floor panels is formed by coupling the floor panels together at their short edges 16, 18. In a corresponding manner, a row of square floor panels 12, as illustrated in Fig. 1A, is formed by coupling the floor panels together at their first pair of opposite edges 16, 18.

[0042] To allow floor panels 12 to be coupled together,

at least the first pair of opposite edges 16, 18, though preferably both pairs of opposite edges, are provided with mechanical coupling means 24. The mechanical coupling means 24 can have various forms as long as they provide for an interlocking in a vertical direction V perpendicular to the plane of the floor covering, as well as in a horizontal direction H perpendicular to the coupled edges and parallel to the plane of the floor covering. The directions V and H are shown in Figs. 1A and 1B. One form of coupling parts which may be employed on the first pair of edges 16, 18 is shown in Fig. 3. Fig. 3 is an elevational view shown in the direction of arrow F3 in Fig. 2, i.e. a view of the fourth edge 22. The mechanical coupling means 24 are constituted by a tongue 26 at the first edge 16 and a cooperating groove 28 at the second edge 18. In a manner described in more detail in WO 97/47834, the groove 28 is delimited by an upper lip 30 and a lower lip 32. To aid in the guiding of the tongue 26 into the groove 28 of an adjacent floor panel, the lower lip 32 of the groove may be made longer than the upper lip 30. The lower lip 32 is provided with a recess 34 into which a protrusion 36 on a lower surface of the tongue 26 fits when two panels are coupled together. Floor panels with such mechanical coupling means can be joined together by way of an angling down motion in which the tongue 26 on the first edge 16 of one floor panel, after having been inserted at an inclined angle into the groove 28 on the second edge 18 of an already laid floor panel, is angled downwards until the protrusion 36 on the tongue 26 fits into the recess 34 in the lower lip of the groove 28. During the angling down motion, the coupling means 24 may undergo an elastic deformation so that the protrusion 36 snaps into the recess 34. Preferably, the same mechanical coupling means also allow for two panels to be joined by means of a relative horizontal motion.

[0043] In one embodiment, and as is illustrated in Fig. 4, mechanical locking means 24 may also be provided at the second pair of opposite sides 20, 22. Thus, Fig. 4 is an elevational view in the direction of arrow F4 in Fig. 2, i.e. a view of the second edge 18. The mechanical coupling means 24 are constituted by a tongue 26 at the third edge 20 and a cooperating groove 28 at the fourth edge 22. The tongue 26 and the groove 28 at the second pair of opposite sides may have similar profiles to the coupling means on the first pair of opposite sides, meaning that two adjacent floor panels may be joined together by an angling down motion and/or a horizontal motion.

[0044] It is to be understood that the mechanical coupling means 24 may be of any type that will permit a plurality of floor panels 12 to be coupled to one another in the horizontal and vertical directions without the need for adhesive. Purely by way of example, useful such mechanical coupling means are described in WO 2021/111210 and WO 2010/082171. Preferably, the mechanical coupling means extend over a majority of the length of the edges on which they are located.

[0045] Referring to Figs. 5 and 6, each floor panel 12 has a core 38 and a decorative layer 40 on the core. The decorative layer may be constituted by a separate sheet or foil laminated to the core, or it may be a decoration that is printed and/or embossed directly onto the core. As indicated by reference number 42, at each corner 23 of the floor panel there is a hollow receiving cavity below the decorative layer 40. The hollow receiving cavity 42 has an internal wall 44 which extends between adjacent edges of the floor panel such that each edge at least partially defines the hollow receiving cavity 42. Consequently, the hollow receiving cavity extends from the intersection of the two edges forming the respective corner 23 and part way along each of the two edges. The hollow receiving cavity 42 is adapted to partially receive an alignment element 46. As is apparent from Fig. 6, the hollow receiving cavity accommodates approximately a quarter of the alignment element 46. The alignment element 46 has a thickness t_e which is, in the example, about equal to the depth d of the hollow receiving cavity 42.

[0046] Fig. 7 illustrates a first floor panel A and a second floor panel B of a row of floor panels. The second edge 18 of the first floor panel A is coupled to the first edge 16 of the second floor panel B. The hollow receiving cavity 42 of each floor panel has a shape such that, when the two panels are coupled together, the hollow receiving cavities are aligned to form a receiving pocket 48. The receiving pocket 48 partially receives the alignment element 46. When inserted in the receiving pocket 48, the alignment element 46 provides a visual indication as to whether the two floor panels are properly aligned with each other.

[0047] As will be described in the following with reference to Figs. 8 to 11, the alignment element 46 can aid in the alignment of floor panels during laying and may aid in the maintenance of the panels in an aligned condition.

[0048] Thus, Figs. 8 to 11 schematically illustrate how a floor covering according to the present invention may be laid using alignment elements 46. In common with Fig. 7, Fig. 8 illustrates a first floor panel A and a second floor panel B of a first row of floor panels, with the second edge 18 of the first floor panel A being coupled to the first edge 16 of the second floor panel B. Fig. 8 also illustrates a third floor panel C and a fourth floor panel D which are to form floor panels of an adjacent row. Once the first floor panel A and the second floor panel B are coupled together, a receiving pocket 48 is formed having an insertion opening along a common edge of the row of floor panels to which the third floor panel C and the fourth floor panel D are to be coupled. For ease of laying, this common edge is preferably made up of the respective fourth edges 22 of the first and second floor panels. The first row of floor panels may be extended by coupling further (not illustrated) floor panels to the second edge 18 of the second floor panel B.

[0049] When it is desired to lay an adjacent row of floor panels, and as is illustrated in Fig. 9, an alignment element 46 is inserted into the receiving pocket 48 between the first and second floor panels. Since the receiving

pocket 48 only partially receives the alignment element 46, a protruding portion 50 of the alignment element extends beyond the common fourth edge 22 of the first row of floor panels. The protruding portion 50 is then used to ensure correct alignment of the third and fourth floor panels C, D. Accordingly, and as is apparent from Fig. 10, the third edge 20 of the third floor panel C is coupled to the fourth edge 22 of the first floor panel A so that approximately half of the protruding portion 50 of the alignment element 46 is received in the hollow receiving cavity 42 at the intersection between the second edge 18 and the third edge 20 of the third floor panel C. The coupling of the third edge 20 of the third floor panel C to the fourth edge 22 of the first floor panel A is preferably attained by displacing the third floor panel horizontally towards the first floor panel so that the mechanical coupling means along the adjacent edges snap into each other.

[0050] Finally, and as is shown in Fig. 11, a fourth floor panel D is coupled to the third floor panel C and the second floor panel B. Depending on the type of mechanical coupling means at the first and second pair of opposite edges, it may be advantageous to couple the first edge 16 of the fourth floor panel D to the second edge 18 of the third floor panel C such that the third edge 20 of the fourth floor panel D is initially spaced from the fourth edge 22 of the second floor panel B. Thereafter, the fourth floor panel D may be displaced in a horizontal direction towards the second floor panel B by sliding the fourth floor panel D along the made-up joint between it and the third floor panel C until the protruding portion 50 of the alignment element 46 enters the hollow receiving cavity 42 in the fourth floor panel D. The sliding motion of the fourth floor panel D may be followed by an angling up and down to ease the coupling of the fourth floor panel D with the second floor panel B. Preferably, in such case, the alignment element 46 is somewhat flexible and/or, for example, has a major diagonal 56 that is at least 5 times its thickness t_e. Once the fourth floor panel D has been coupled to the second floor panel B, a meeting point 52 of the first to fourth floor panels is created. At the meeting point, a substantially closed receiving compartment 54 is formed by the hollow receiving cavities 42 of the corners 23 of the meeting point 52. The substantially closed receiving compartment 54 thereby accommodates the alignment element 46.

[0051] The substantially closed receiving compartment 54 will have a shape which is dictated by the shape of the hollow receiving cavities 42. In the Figs. 2 to 11 embodiments, each hollow receiving cavity 42 is essentially right-triangular shaped, with the hollow receiving cavity having a greater extension along the first pair of edges 16, 18 than the second pair of edges 20, 22. The difference in extension of the hollow receiving cavities 42 along the edges can be clearly seen when comparing Fig. 3 with Fig. 4. The substantially closed receiving compartment 54 which is formed at the meeting point 52 of four of the floor panels will then be essentially lozenge-shaped. Advantageously, each of the alignment elements 42 has a shape corresponding substantially to that of the substantially closed receiving compartment 54. Thus, Fig. 12 illustrates an alignment element 46 having substantially the same lozenge shape as that of the closed receiving compartment. The lozenge shape has a major diagonal 56 and a minor diagonal 58, with the major diagonal having a length which is at least 20 % greater than the length of the minor diagonal. In order to more securely retain the alignment element 46 in the receiving pocket 48 between the first floor panel A and the second floor panel B as the floor covering is being laid (see Fig. 9), the length of the major diagonal 56 may be considerably greater than that of the minor diagonal 58. For example, the major diagonal 56 may have a length which is at least 50 % greater, optionally at least 100 % greater or at least 200 % greater, than the length of the minor diagonal 58. In a particular embodiment, the length of the major diagonal 56 may be between three and four times greater than the length of the minor diagonal.

[0052] In the embodiment illustrated in Fig. 13, each hollow receiving cavity 42 is essentially right-triangular shaped, with the internal wall 44 of the hollow receiving cavity subtending an angle of about 45° to the adjacent edges of the floor panel 12. This results in the substantially closed receiving compartment 54 being essentially square-shaped. Consequently, and as shown in Fig. 14, each of the alignment elements 46 will, preferably, also be essentially square-shaped. An embodiment having a receiving compartment 54 with four equal quadrants, as is the case in Fig. 13, allows to match any corner of one panel 12 with any corner of another panel while always obtaining a receiving compartment 54 having a same geometry. Such an embodiment may allow installing panels 12 with alternating orientation, i.e. alternatingly coupling first and second edges, with coupling first and fourth edges. This of course requires the coupling means at first and second edges to be compatible with the coupling means at third and fourth edges. Preferably, the coupling means at both pairs of edges have an identical, or largely identical geometry.

[0053] The shape of the hollow receiving cavities 42 is influenced by how the floor panels 12 are produced. Figs. 15 to 19 illustrate part of a continuous process for milling the edges 16, 18, 20, 22 of a floor panel 12 and forming a hollow receiving cavity 42 at each of the corners. In Fig. 15, reference number 60 generally denotes a first end-tenoner which is set up to mill a second pair of opposite edges 20, 22 of a floor panel 12. Although the drawings illustrate a square floor panel, it is to be understood that if the floor panel is oblong, the first end-tenoner will preferably mill the long sides of the floor panel. As the floor panel 12 is moved in a first direction 62, the first end-tenoner 60 mills the second pair of opposite edges 20, 22 to provide them with complementary mechanical coupling means 24, for example as shown in Fig. 4. Thus, the third edge 20 may be provided with a tongue 26, whereas the fourth edge 22 may be provided with a groove 28. Upon exiting the first end-tenoner 60, the floor

panel 12 is, in the example, temporarily held in a buffer stock, and then caused to move in a second direction 64 perpendicular to the first direction 62 towards a second end-tenoner 66. The floor panel is driven in the second direction 64 by means of cams 68 acting on the already machined fourth edge 22 of the floor panel. Since the fourth edge has been machined, accurate alignment of the floor panel when passing through the second end-tenoner 66 is assured.

[0054] Turning to Fig. 16, as the floor panel 12 is moved in the second direction 64, the second end-tenoner 66 mills the first pair of opposite edges 16, 18 to provide them with complementary mechanical coupling means 24, for example as shown in Fig. 3. Thus, the first edge 16 may be provided with a tongue 26, whereas the second edge 18 may be provided with a groove 28. When milling oblong floor panels, the second end-tenoner 66 will preferably mill the short sides. Since the production process is continuous, the short sides may be milled in the same time that it takes to mill the long sides of an upstream panel. Accordingly, the short sides can be milled at a lower speed, thereby enhancing accuracy.

[0055] In the second end-tenoner 66, preferably at the downstream end of the second end-tenoner 66, a pair of jumper tools 70 is provided. The jumper tools 70 can be moved towards and away from each other in a direction perpendicular to the second direction 64 of movement of the floor panel 12. As the floor panel approaches the pair of jumper tools 70, the jumper tools are positioned towards each other in an engagement position. When the floor panel 12 reaches the pair of jumper tools 70, and as is shown in Fig. 17, the jumper tools 70 initially contact the leading edge of the floor panel, namely the third edge 20. As the floor panel proceeds past the pair of jumper tools, the jumper tools are retracted (Fig. 18) and exit the floor panel along the first pair of opposite edges 16, 18 to thereby form a hollow receiving cavity 42 at each corner between the third edge 20 and the first and second edges 16, 18, respectively. By controlling the speed of retraction of the jumper tools with respect to the speed of movement of the floor panel past the pair of jumper tools, the size and shape of the hollow receiving cavities 42 can be determined.

[0056] To form hollow receiving cavities 42 at the corners of the trailing edge, i.e. the fourth edge 22, and as is shown in Fig. 19, the pair of jumper tools 70 is controlled such that the jumper tools 70 are brought into contact with the first pair of edges 16, 18 and moved towards their engagement position. The jumper tools 70 then exit the floor panel 12 along the fourth edge 22. The pair of jumper tools is then kept in its engagement position until an immediately upstream floor panel reaches the pair of jumper tools to, preferably perform a same or similar sequence of movements as described above for machining the edges of the upstream panel.

[0057] The above-described movement of the pair of jumper tools 70 can provide hollow receiving cavities 42 with an internal wall 44 that is curved, as shown for example in Fig. 6. Since each hollow receiving cavity is essentially right-angular shaped, the curved internal wall 44 forms the hypotenuse of the right-angular shape. Accordingly, each edge of the alignment element 46 may have a correspondingly curved shape.

[0058] Each jumper tool 70 has a circular saw blade 72 having a blade thickness tb, as indicated on Fig. 3. The saw blade 72 cuts a slot into the core 38 of the floor panel, which slot forms a hollow receiving cavity 42. The blade thickness t_b will determine the depth d of the hollow receiving cavities 42 in a direction perpendicular to the plane of the floor covering. The depth d is shown in Figs. 3 and 4. When several floor panels are coupled together, aligned hollow receiving cavities will form receiving pockets 48 and substantially closed receiving compartments 54 having the same depth d.

[0059] With respect to Figs. 15 to 19 it is remarked that the jumper tool 70 is shown as a separate device positioned after the exit of the respective end-tenoner 66. This is not necessarily the case. The jumper tool 70 may be integrated in the end-tenoner 66 in place of a regular milling tool position. In any case, it is preferred that the panel is being transported past the jumper tool 70 by the same transporting mechanism as used to transport the panel through the end-tenoner 66, for example by means of being clamped between a lower chain transporting device having cams 68, and an upper belt. In case of Figs. 15 to 19 the transporting mechanism of the end-tenoner 66 thus preferably also exits the end-tenoner 66 and extends past said jumper tools 70, without interruptions.

[0060] To fit in the receiving pockets 48 and receiving compartments 54, the alignment elements 46 are generally planar and have a thickness t_e which, depending on how snug a fit is desired, is preferably no greater than the depth d of the hollow receiving cavities. In some embodiments, particularly when coupling of adjacent edges of two floor panels is performed with a vertical component of movement, it may be advantageous if the thickness t_e of the alignment elements 46 is less than the depth d of the hollow receiving cavities to thereby allow for some vertical displacement of the alignment elements during joining. Thus, the thickness t_e of the alignment element may be at least 50 %, or at least 60 %, or at least 70 %, or at least 80 % of at least 90 % of the depth d of the hollow receiving cavities.

[0061] Providing hollow receiving cavities at the corners 23 of each floor panel 12 is particularly useful for aligning edges at the meeting point 52 of four floor panels. Nevertheless, improved alignment of panels can be attained even when the hollow receiving cavities 42 are at one or more locations along one or both pairs of opposite edges. Thus, in one embodiment, and as is depicted in Fig. 20, a hollow receiving cavity 42 is provided midway along each edge 16, 18, 20 22. As schematically shown in Fig. 21, when two panels A, B are connected together at adjacent edges such that two hollow receiving cavities are aligned with each other, a receiving pocket 48 will be formed. The receiving pocket 48 is adapted to accom-

modate an alignment element 46 of corresponding shape. The hollow receiving cavities 42 are suitably formed using the same equipment described above in relation to Figs. 15 to 19, it being understood that both the first and the second end-tenoners 60, 66 will each require a dedicated pair of jumper tools should hollow receiving cavities be desired at all edges. Thus, the jumper tools 70 will be deployed first when the floor panel is approaching half-way through its passage of each of the end-tenoners 60, 66. Because the floor panel 12 is moving when the jumper tools are deployed, the hollow receiving cavities 42 will have a greater dimension along the respective edge than into the core 38 of the floor panel, approximating an essentially flattened bell-curve shape.

[0062] With reference to the examples in the drawings, it is remarked that the hollow receiving cavities 42 are at least present at a central location of the thickness of the floor panel 12, wherein said receiving cavities 42, in the examples, are provided at such location in the thickness of the floor panel 12 that they interfere with a portion of the tongue 26 that protrudes beyond the edge of the decorative surface 14. In these cases, said protruding portion of the tongue 26 is completely absent at the location of said hollow receiving cavity 42. The receiving cavities 42 further interfere with a portion of the lower lip 32 that protrudes beyond said decorative surface 14, more particularly with the upwardly protruding part at the distal end of the lower lip 32 that borders said recess 34.

[0063] According to a special embodiment, not represented in the figures, the panels are square, wherein the first edge and the second edge that form said first pair of opposite edges may both be provided with an identical or similar coupling means, for example both with a male coupling part, for example a tongue 26 as described in connection with the drawings, while the third edge and the fourth edge that form the second pair of opposite edges, are also both provided with an identical or similar coupling means, that is complimentary to the coupling means at said first pair of opposite edges, for example both with a female coupling part, for example a groove 28 as described in connection with the drawings. Such embodiment still allows an installation in a chessboard pattern. Preferably such panels are used with receiving compartments and alignment elements that are formed from four equal quadrants, for example such as illustrated in Figs. 13 and 14. According to a deviating embodiment of the present invention, a floor covering assembled from such square panels does not necessarily show the feature that they comprise a plurality of alignment elements wherein at least one edge of said floor panel at least partially defines a hollow receiving cavity forming a receiving pocket within which an alignment element can at least partially be received. Indeed, in such case, the alternating use of tongues and grooves in the floor covering may provide for a certain maintenance of the alignment in the chessboard pattern.

[0064] The invention has been described above with reference to various embodiments. It is to be understood, however, that the embodiments are presented by way of example only and that the skilled person will appreciate that the floor covering of the present invention may be varied in many ways. For example, although the hollow receiving cavities have been described as forming a closed or substantially closed receiving compartment, the invention may still be practiced if the hollow receiving cavities are open in a direction towards the subfloor onto which the floor covering is to be laid. In this manner, the alignment elements will be supported from beneath by the subfloor. The invention may also be practised when the hollow receiving cavities are open in a direction towards the decorative surface. Preferably, however, such open cavities are then subsequently hidden from sight, for example by means of a grout applied in a space available between the upper edges of the joint panels, wherein said grout at least closes the opening of the hollow receiving cavity towards said decorative surface.

Claims

1. Floor covering having a decorative surface (14) lying in a plane of the floor covering, said floor covering comprising rectangular floor panels (12), each floor panel having:

- a core (38) and, preferably a decorative layer (40) on said core, said decorative layer forming a portion of said decorative surface (14),
- a first edge (16) and a second edge (18) forming a first pair of opposite edges,
- a third edge (20) and a fourth edge (22) forming a second pair of opposite edges, and
- four corners (23) at intersections of said edges, at least said first pair of opposite edges (16, 18) being provided with mechanical coupling means (24) so that a plurality of said floor panels (12) can be coupled to one another, said coupling means providing for an interlocking in a direction perpendicular to the plane of the floor covering, as well as in a direction perpendicular to the coupled edges and parallel to the plane of the floor covering,

said floor covering (10) further comprising a plurality of alignment elements (46), wherein each edge of said floor panel at least partially defines a hollow receiving cavity (42) below said decorative layer (40), the hollow receiving cavity having a shape such that when a first edge (16) of a second floor panel (12; B) is coupled to a second edge (18) of a first floor panel (12; A), said hollow receiving cavities (42) are aligned to form a receiving pocket (48) within which one of said plurality of alignment elements (46)is at least partially received.

2. Floor covering according to claim 1, wherein said hollow receiving cavity (42) is provided at each corner (23) of said floor panels, said hollow receiving cavity extending from the intersection of the two edges forming the corner and part way along each of the two edges.

3. Floor covering according to claim 1 or 2, wherein said floor panels (12) are laid to form a chessboard pattern, i.e. with no offset edges.

4. Floor covering according to claim 3 when dependent on claim 2, wherein at a meeting point (52) of four floor panels (12; A, B, C, D), a substantially closed receiving compartment (54) is formed by the hollow receiving cavities (42) of the corners of the meeting point, said substantially closed receiving compartment (54) accommodating one of said plurality of alignment elements (46).

5. Floor covering according to claim 4, wherein each hollow receiving cavity (42) is essentially right-triangular shaped such that said substantially closed receiving compartment (54) is essentially square-shaped.

6. Floor covering according to claim 4, wherein each hollow receiving cavity (42) is essentially right-triangular shaped such that said closed receiving compartment (54) is essentially lozenge-shaped, said lozenge shape having a major diagonal (56) and a minor diagonal (58), the major diagonal having a length which is at least 20 % greater than the length of the minor diagonal, optionally at least 50 % greater, optionally at least 100 % greater, optionally at least 200 % greater.

7. Floor covering according to claim 6, wherein the length of the major diagonal (56) is between three and four times greater than the length of the minor diagonal (58).

8. Floor covering according to any one of claims 5 to 7, wherein each essentially right-triangular shaped hollow receiving cavity (42) has a hypotenuse which is curved.

9. Floor covering according to claim 1, wherein each said hollow receiving cavity (42) is located along each edge (16, 18, 20, 22), preferably midway along each edge.

10. Floor covering according to any of the preceding claims, wherein each of said plurality of alignment elements (46) has a shape corresponding substantially to that of the receiving pocket (48) or substantially closed receiving compartment (54).

11. Floor covering according to any of the preceding claims, wherein each of said plurality of alignment elements (46) has a substantially planar profile having a thickness (te).

12. Floor covering according to any of the preceding claims, wherein each of said plurality of alignment elements (46) is made of a plastics material, preferably of PVC.

13. Floor covering according to any of the preceding claims, wherein said receiving pocket (48) and/or said substantially closed receiving compartment (54) has a depth (d) in a direction perpendicular to the plane of the floor covering, said depth being greater than, or substantially equal to, the thickness (te) of said plurality of alignment elements (46).

14. Floor covering according to any of the preceding claims, wherein said mechanical coupling means (24) allow said floor panels (12) to be coupled to one another via a snap action.

15. Floor covering according to claim 14, wherein said snap action occurs as two floor panels (12) are shifted towards each other in a direction substantially parallel to the plane of the floor covering and/or said snap action occurs as two floor panels (12) are shifted towards each other in a direction substantially perpendicular to the plane of the floor covering.

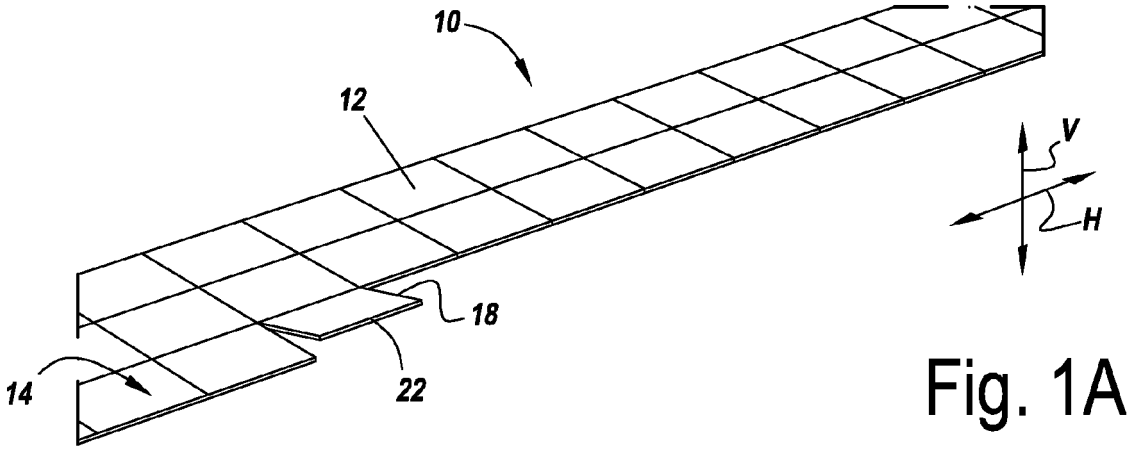

Fig. 1A

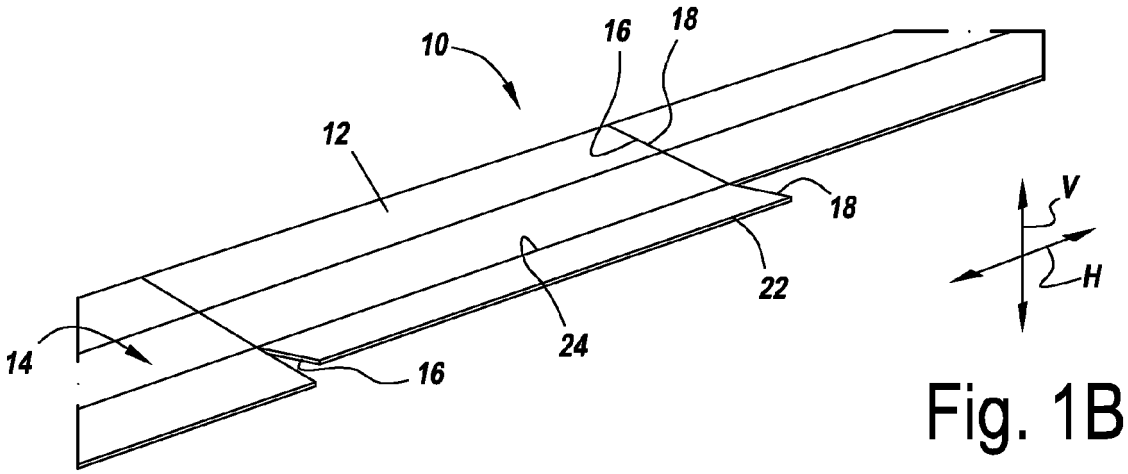

Fig. 1B

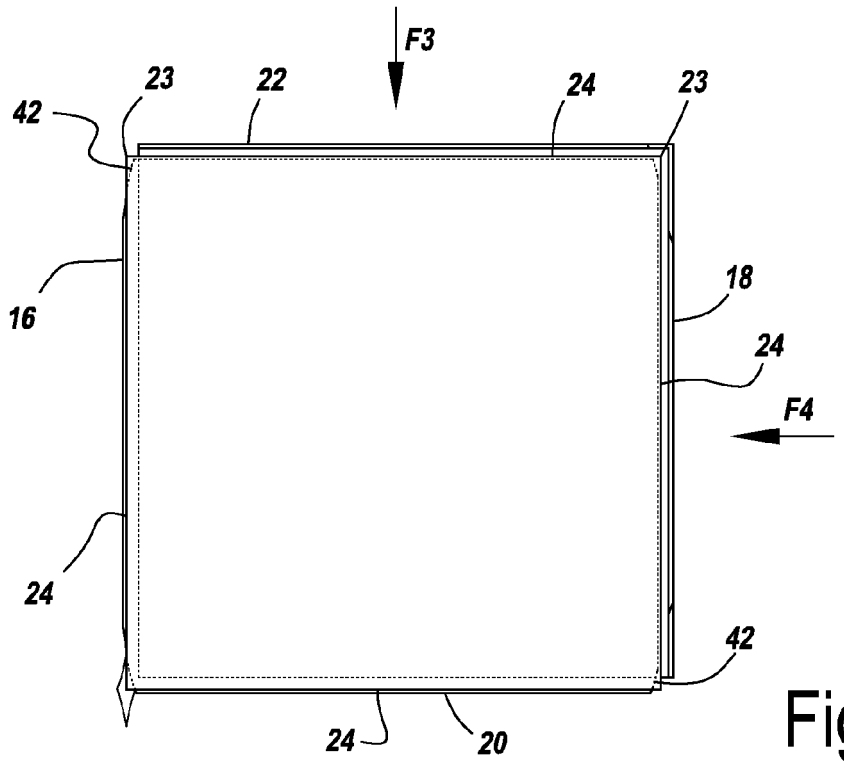

Fig. 2

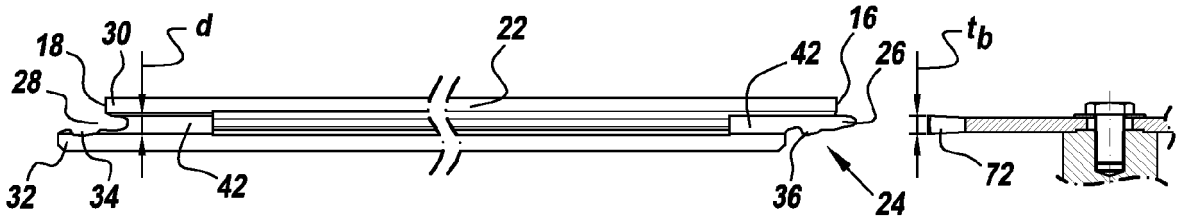

Fig. 3

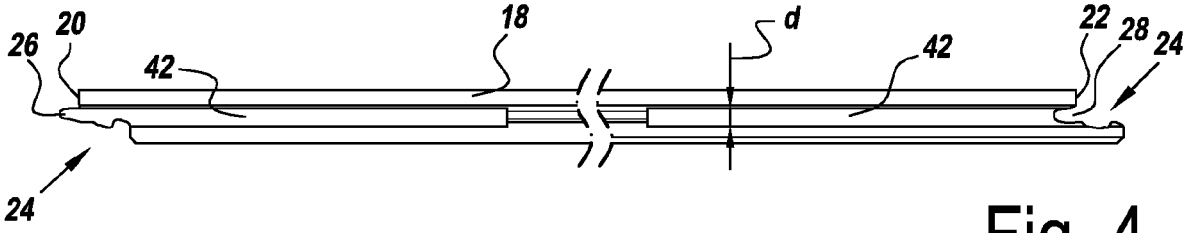

Fig. 4

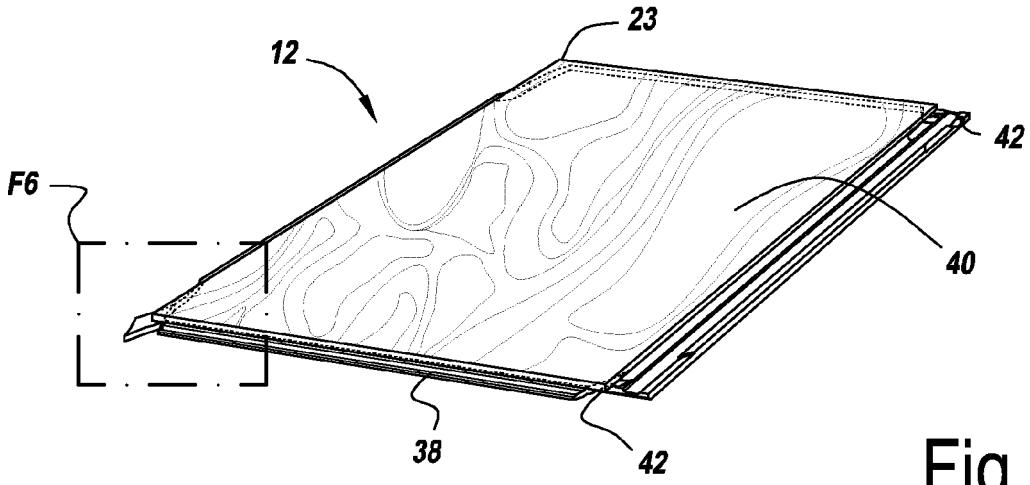

Fig. 5

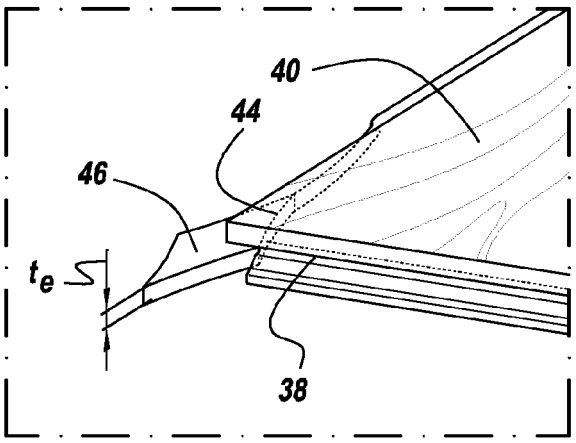

Fig. 6

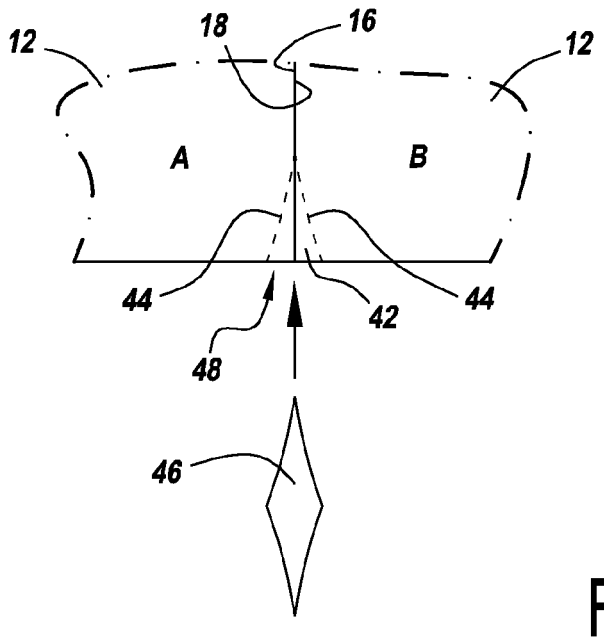

Fig. 7

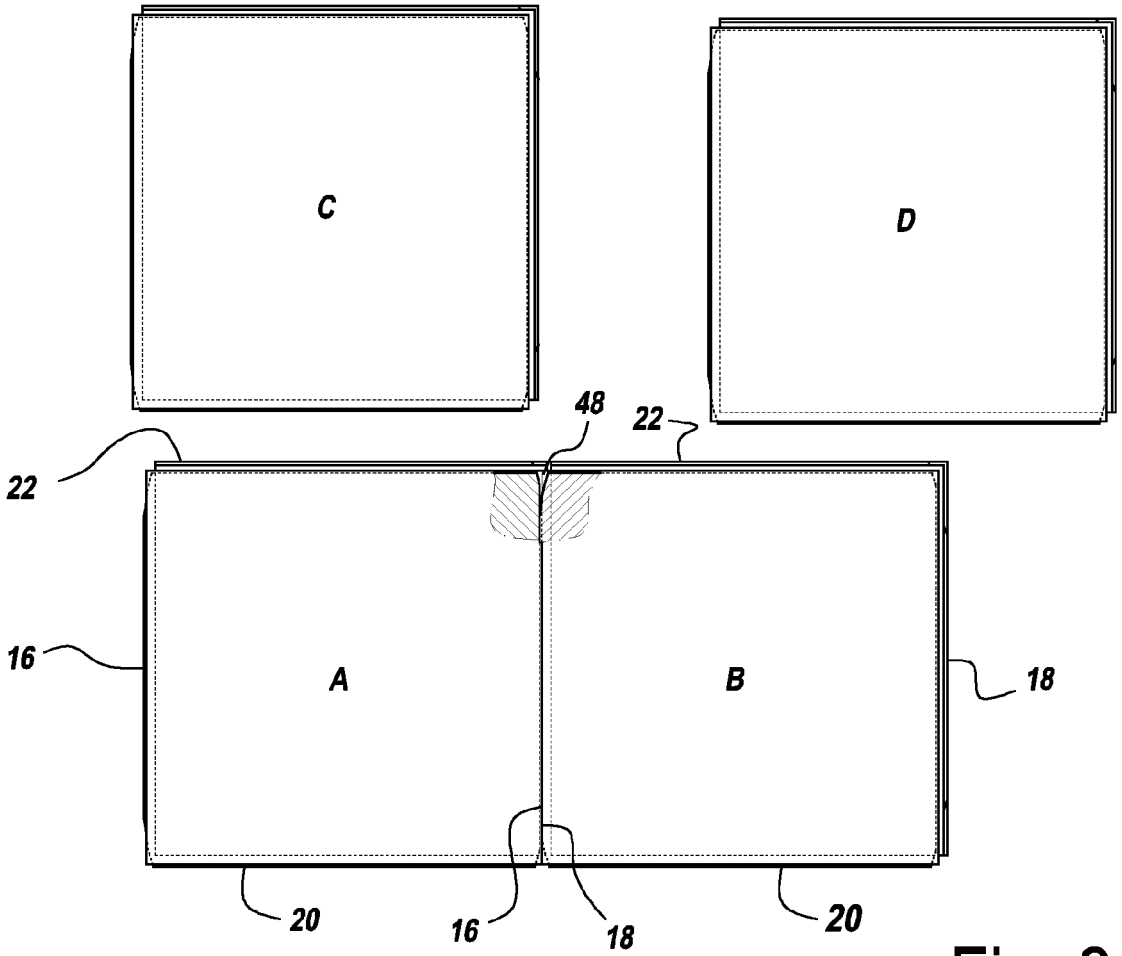

Fig. 8

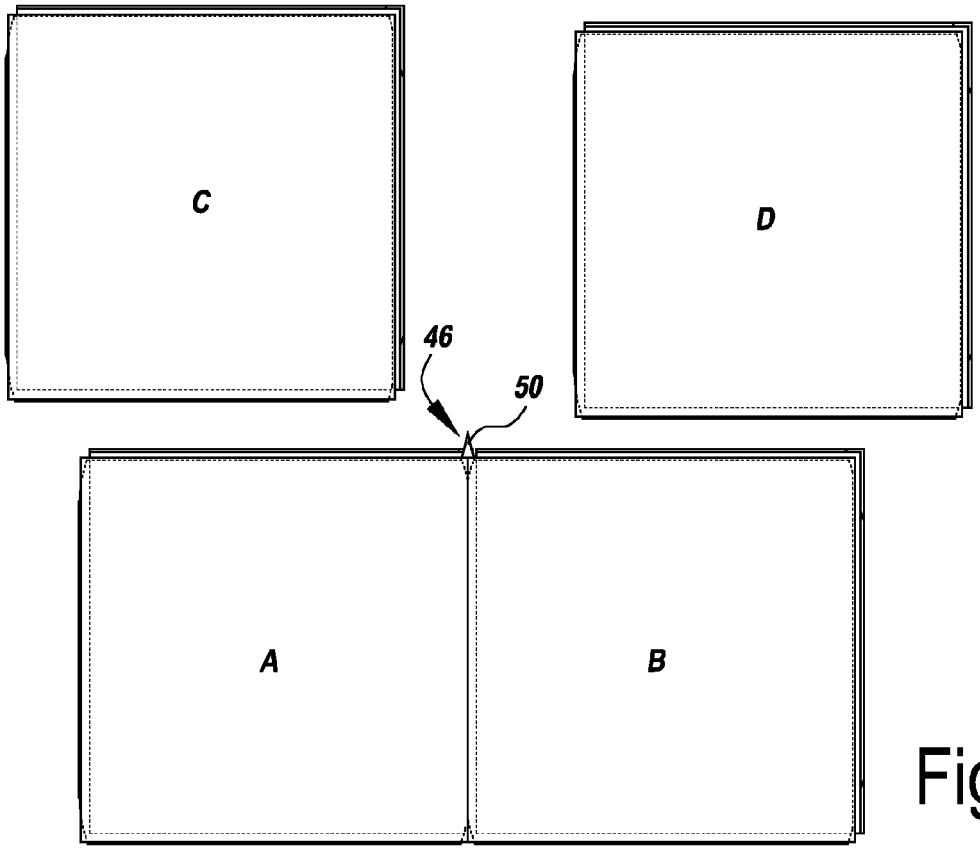

Fig. 9

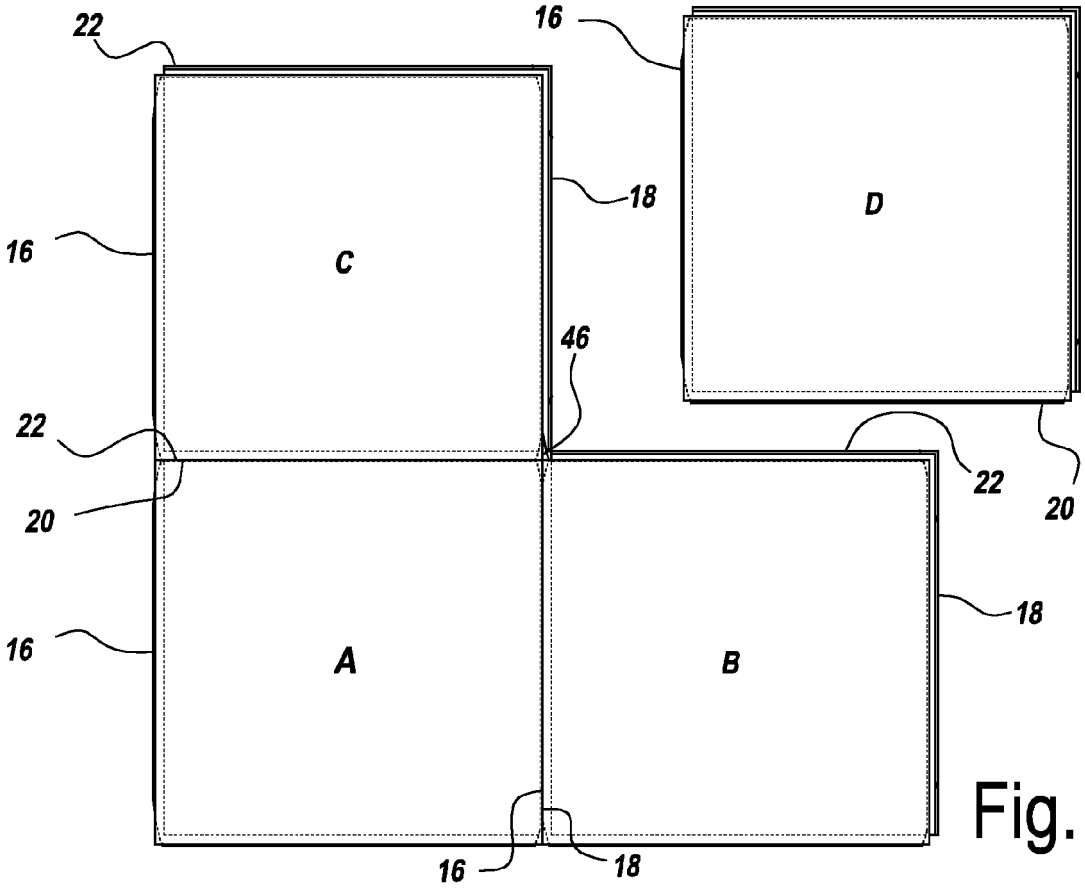

Fig. 10

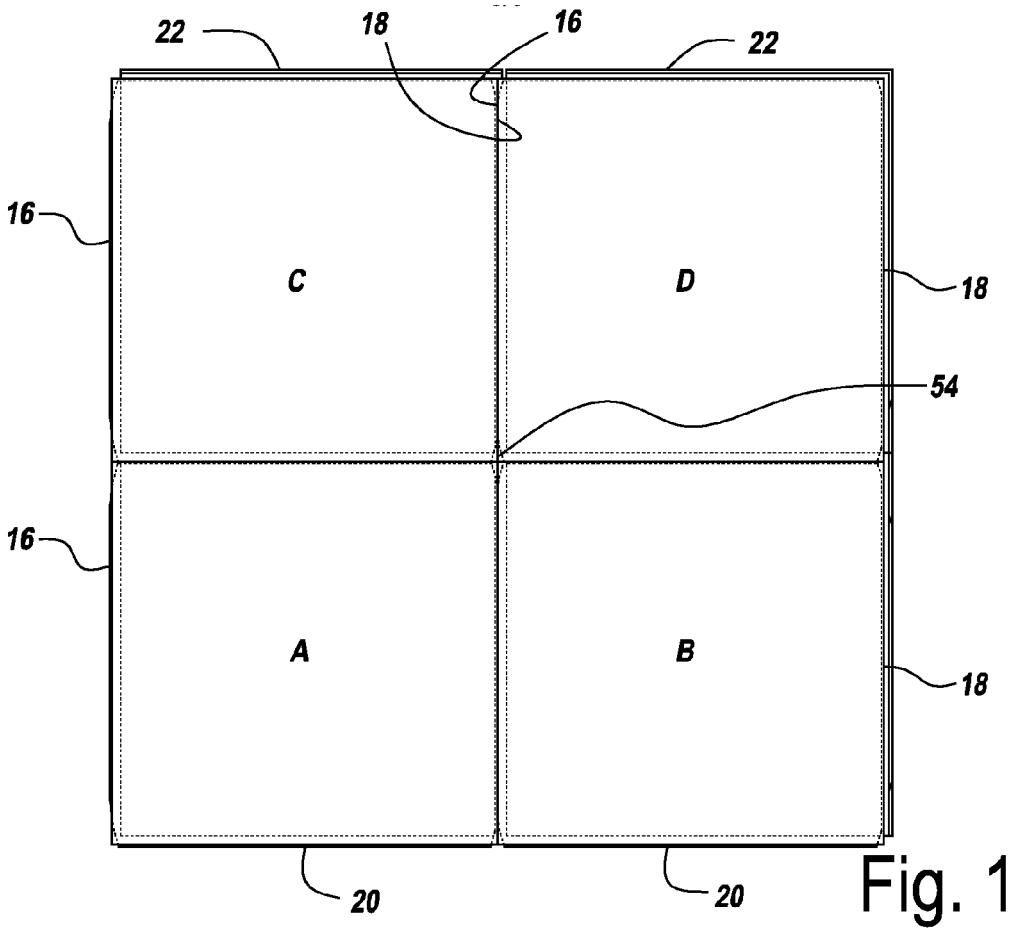

Fig. 11

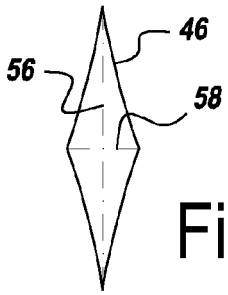

Fig. 12

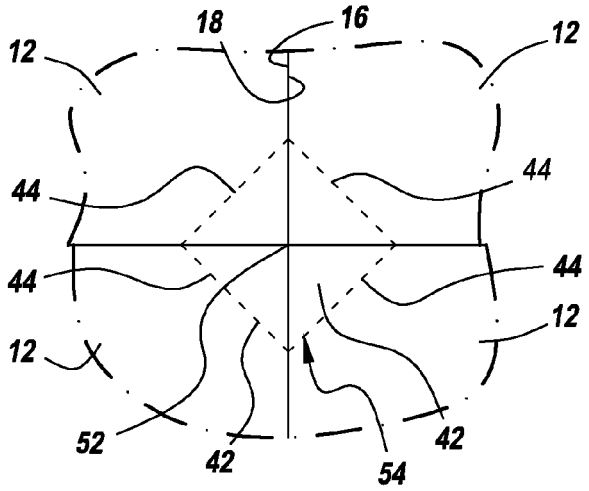

Fig. 13

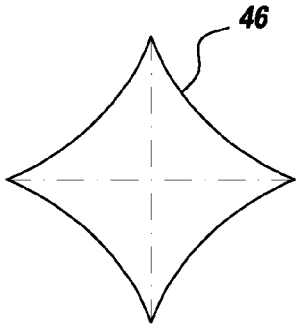

Fig. 14

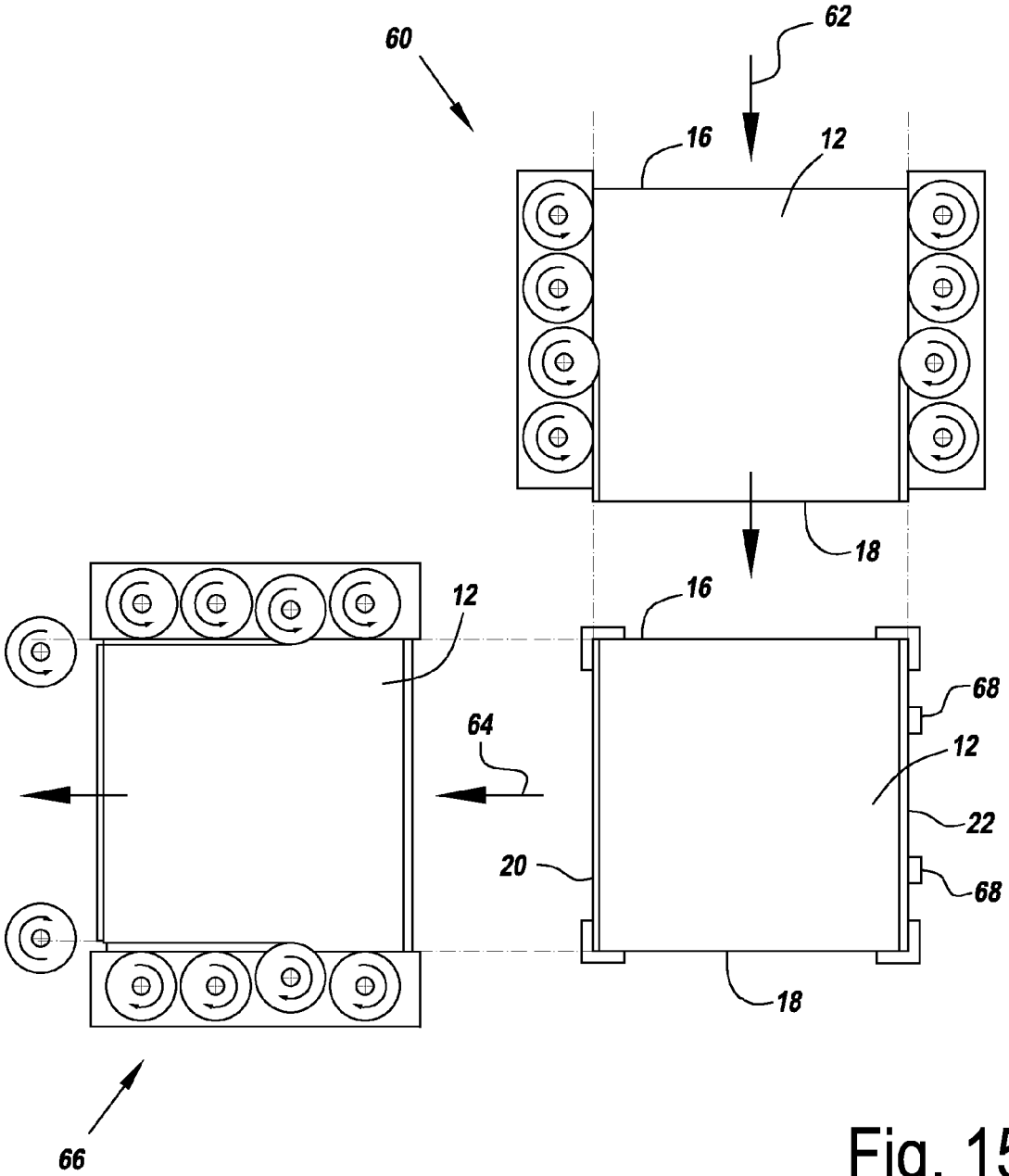

Fig. 15

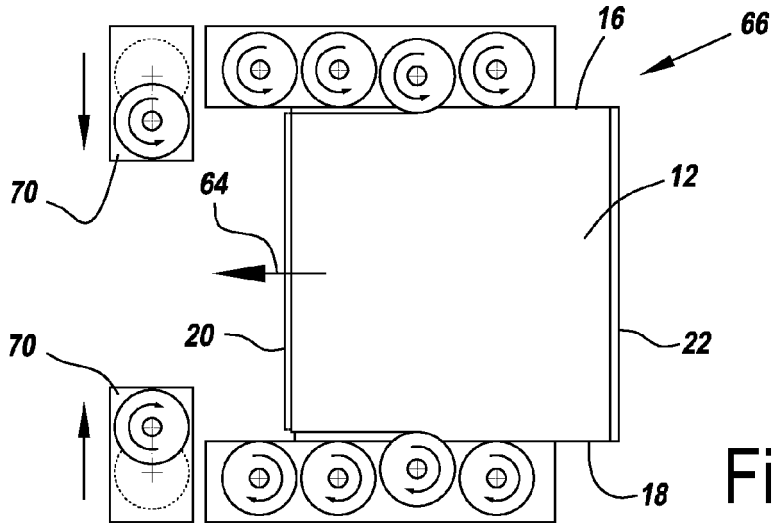

Fig. 16

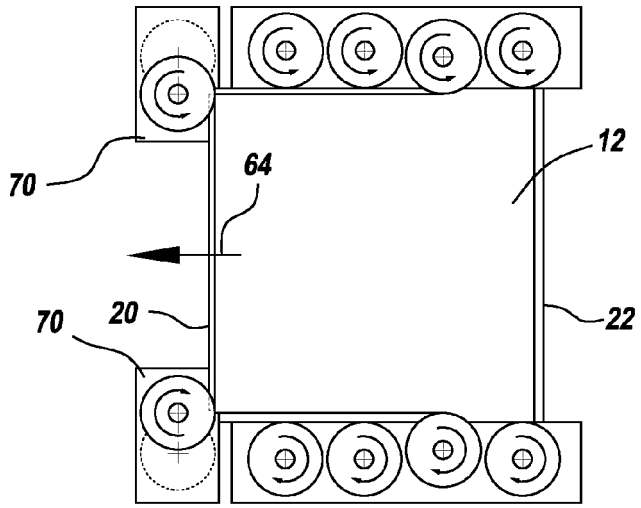

Fig. 17

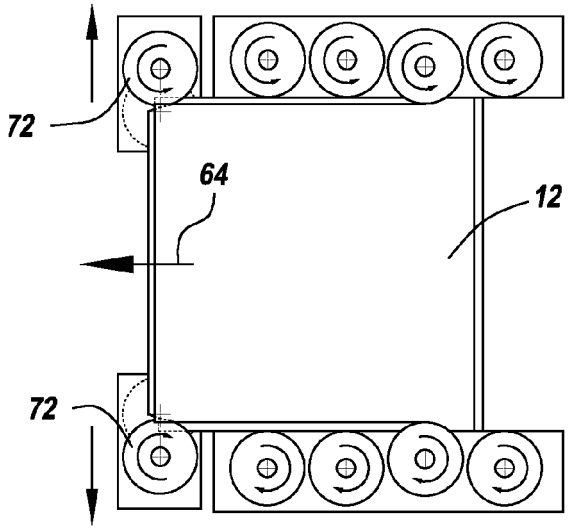

Fig. 18

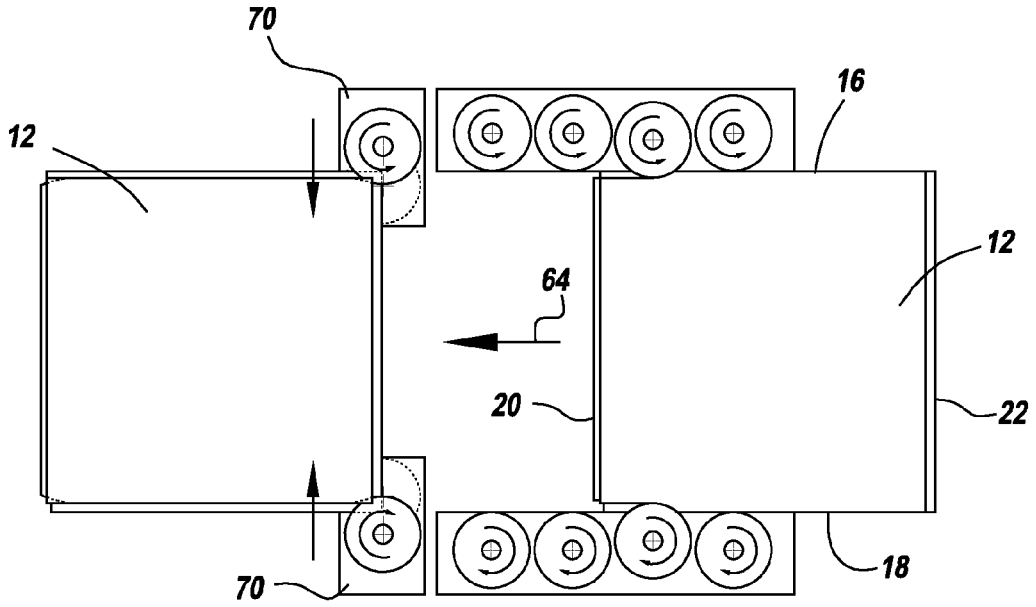

Fig. 19

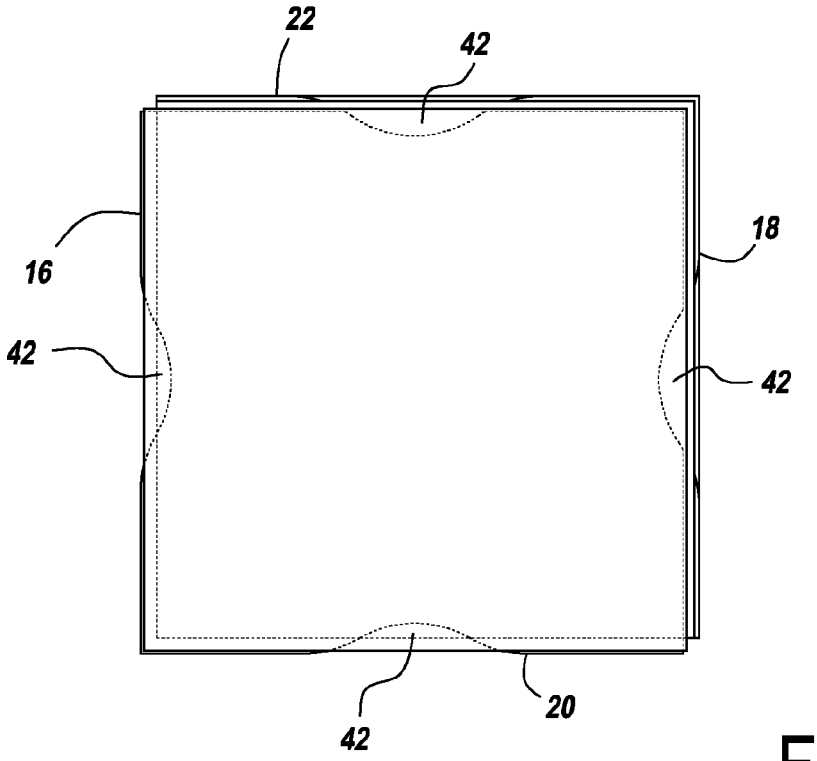

Fig. 20

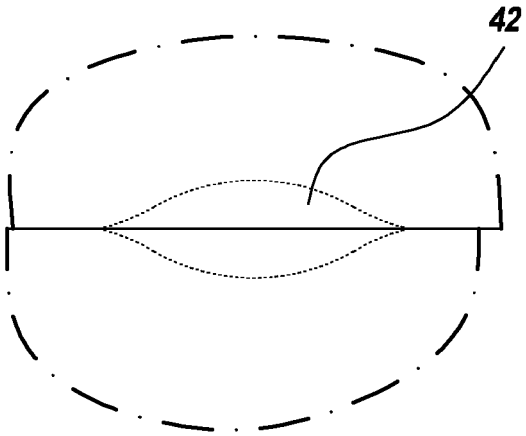

Fig. 21

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 22 15 0296

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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