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## DESCRIPTION

**[0001]** The invention relates to a floor panel, to a method of construction a floor using such floor panels and to a method of producing such floor panels.

**[0002]** Constructing floors using floor panels is very common way of decorating supporting floors of houses, buildings, factories and the like. An increasing trend in constructing floors, especially in case of private houses, is to do-it-yourself. Prior art floor panels comprise a tongue and a slot, wherein, for assembling the floor panels, at least one of the floor panels needs to be lifted

**[0003]** Prior art floor panels comprise a tongue and a groove, wherein, for assembling the floor panels, at least one of the floor panels needs to be lifted. US6769218 describes a floor panel constructing a floor, comprising:

- a tongue extending along a first edge and comprising an upper and lower surface;
- a groove extending along a second edge, opposite the first edge and comprising an upper and lower surface;
- wherein the tongue comprises a protrusion at its upper surface,
- wherein the groove comprises a cavity in its upper surface,
- wherein the groove of a first panel is adapted to receive the tongue of a second panel. The protrusion of the tongue of the second panel and the cavity of the groove in the first panel counteract and prevent horizontal separation in a direction transversal to a joint plane parallel to the first edge of the second panel and the second edge of the first panel. The tongue with its protrusion can be inserted in groove and its cavity by horizontally snapping-in, the lower lip being bent so that the protrusion of the tongue can be inserted into the cavity in the groove. The bending of the lower lip requires a certain flexibility of the material of the floor panel or at least its lower lip.

**[0004]** WO2006131130 relates to a panel having means for the detachable connection of adjacent panels by means of pivoting. DE3041781 A1 relates to connecting means for plates, consisting of a groove at one edge and a tongue at another edge that fits into the groove.

WO201018 discloses a veneer floor element, comprising an edge profile on at least two opposite edges in the form of a modified groove and tongue joint for the purpose of connecting adjacent tiles, with a coincident arrangement consisting of one groove and one tongue on each of at least two edges, of which the tongue on one edge of a first tile and the groove in an associated edge of a second tile rise obliquely upwards from the bottom of the tile.

JP07180333 describes flooring material that is equipped with cavities, a tongue and a groove and that is formed by extrusion moldings. The tongue is equipped with a protrusion at its distal end and the groove comprises a cavity in its upper surface. The groove of a first panel is adapted to receive the tongue of a second panel. WO145915 describes a tongue and groove arrangement provided for joining adjacent strips of a composite material made according to an extrusion process.

US 2007/044416 A1 relates to a cover profile system for forming a wall surface, which is formed from a plurality of flat, elongated hollow profile bodies, each comprising a first wall, a second wall, a first longitudinal edge and a second longitudinal edge, wherein the first longitudinal edge is provided with a first longitudinal strip having holes for attachment, wherein one of either longitudinal edges is provided with a second longitudinal strip, which at the side of the first strip that faces the first wall, extends over the first strip to at least the opposite longitudinal edge.

WO2007012137 A describes a flooring board configured to interlock with similar boards. The board comprises a first locking portion with a tongue presenting a convex face, and a second locking portion with a groove for receiving the tongue of a similar board disposed adjacent thereto.

**[0005]** Another floor panel described in US6769218 has a joint system where the tongue, while a first panel is held in an upwardly angled position can be snapped into the groove of a second panel and then be angled down by a pivoting motion about the upper joint edge.

**[0006]** Although this pivoting motion does not requires a flexible material, a pivoting motion about the upper joint edge requires a high level of precision, is therefore a time consuming activity, which especially for long floor panels can hardly be done by a single person without damage to the floor panels.

The aim of the invention is to provide a floor panel avoiding these problems.

**[0007]** This aim is reached in that the upper and the lower surface of the groove extend at least partially in a downward direction from the second side wall to its distal end and the surfaces of the first and second side wall parts above and below the groove (8) and the tongue (6) extend in substantially the same vertical plane and the floor panel is made from a composite of wood fibers

and polyvinylchloride, said composite having a Young modulus of more than 4 GPa.

**[0008]** The provision of a tilted groove facilitates in assembling floor panels, in that the space opposite to the protrusion allows for less accurate positioning of floor panels in advance of assembling floor panels, while the assembled floor panels still result in a high quality constructed floor. This further facilitates assembly that can be carried out by just lifting and shifting the second panel in the first panel. The downward direction of at least part of the groove makes it possible to assemble two panels even with a foot. This leads to easier and quicker constructing of floors, whereas also less damage to the floor panels will occur as no snapping is required for the assembling of two panels. This is of special interest in case of constructing floors by a single person. Using a floor panel according to the invention by a single person doesn't require contact of the edges of their top main faces to insert a first floor panel into a second floor panel, which decreases the change of damaging the top layer and which makes inserting floor panels easier. In addition, the space makes assembling floor panels less sensitive for little undesired fragments, especially fragments within the groove, such as fragments from the supporting floor. It may be clear, that also other edges can be provided with one or more protrusions or cavities, for example the short opposing edges at the tips of the floor panel.

**[0009]** According to a first embodiment the part of the lower surface of the groove adjacent to the edge extends at least partially in the horizontal direction. This feature allows an easier insertion of the tongue into the groove and hence assembly of the panel.

**[0010]** In yet another embodiment the lower surface of the tongue extends substantially horizontally. The upper surface of the tongue necessarily extends in a downward sloping direction to its distal end, required to offer space for the part of the upper surface after which the protrusion engages. The feature of this embodiment provides the tongue with sufficient strength, in particular at its connection to the panel.

**[0011]** According to yet another embodiment the lower surface of the tongue has preferably a rounded surface at its distal end. This allows easier insertion of the tongue in the groove and prevents sticking during assemblage.

**[0012]** According to yet another embodiment, the ratio between the depth of the groove and the greatest height of the groove is greater than two. This feature results in a longer thinner tongue so that only a relative minor tilt angle of the panel to be inserted relative to the panel already on the ground is required so that the insertion is further simplified.

**[0013]** Preferably the edge surfaces of the panel part above and below the groove and the tongue extend in substantially the same vertical plane. This feature implies that the length of the tongue is substantially equal to the depth of the groove, leading to large contact faces between both the under surfaces of the tongue and groove and upper surfaces of the tongue and groove, leading to a low local pressure between these parts.

**[0014]** In another embodiment at least one of the edge surfaces of the panel part above the tongue and above the groove extends substantially extends outward from the tongue in the upward direction. Although this feature may still be within the scope of the preceding claim. It will lead to a closer fit between the upper edges of joined panels that lead to a better appearance of the floor as a whole.

**[0015]** Preferably at least one of the lower edges of the edge surfaces of the panel part is chamfered. This leads to a space between the lower edges of the joined panels, so that the dust that may have been collected between the panels does not hamper a close joint of the panels. During assembling of floor panels there is even a lower risk of damaging the floor panels, as the top layers are away from each other. In a preferred embodiment both upper edges are chamfered and the chamfered edges extend over the full length of the sides of the floor panel. For the persons known in the field other methods of modelling edges of floor panels will be known, such as rounding edges or any other shape. A second advantage of chamfered edges is that it provides the constructed floor with a more natural exposure, as if the floor is made from natural wood. Although the invention provides a close joint of the panels and hence a nearly invisible separation line between the joined panels, some styles of flooring may be enhanced by a V-shaped groove between the panels. Therefore a preferred embodiment provides that at least one of the lower edges of the edge surfaces of the panel part is chamfered. Preferably both edges are chamfered to obtain the V-shaped groove.

**[0016]** Most prior art panels of the kind described in US2002/0112433 are composed of wood or wood containing products. Such panels are assembled from their constituent parts and are further machined, in particular to form the groove and the tongue. This machining process leads to a lot of waste, and to wear of the machining tools, making this process costly. A preferred embodiment avoids these disadvantages by providing a floor panel of the kind referred to above wherein the floor panel has been produced by extrusion. Of course the extrusion process can only be used for a limited choice materials, but it appears that there are sufficient materials available, which are adapted to be extruded, and which have properties allowing them to be used for floor panels.

**[0017]** An example of such a material, which can be extruded and which is nevertheless sufficiently strong hard and durable, is a composite from wood fibres or wood flour and pvc. Hence a preferred embodiment provides a floor panel, which is composed of a composite from wood fibres and pvc. It is noted that such a material has, after some post processing, like brushing, a pleasant appearance not unlike the appearance of weathered wooden panels, so that there is no need to provide a upper layer on the panel as is common in laminated floor panels.

**[0018]** Preferably the floor panel comprises cavities extending between the longitudinal edges extending parallel to the longitudinal edges. These cavities lead not only to a reduction of use of raw material and hence to a reduction of costs, but also to an improved thermal and acoustic insulation between the upper and lower surface of the panel.

**[0019]** According to another embodiment provides a floor panel wherein the upper surface of the tongue is adapted to touch the upper surface of the groove, when the tongue is horizontally inserted in the groove, whereas space remains between the protrusion and the lower surface of the groove when the tongue is inserted in the groove while the first floor panel is tilted with a tilt angle of between 3 and 20 degrees. The advantage of this measure is that assembled floor panels are blocked in a direction transversal to a plane parallel to the first edge of the second panel and the second edge of the first panel. Thus a more rigid floor is provided, which has a better appearance and which will last longer, as less wear will occur due to the absence of relative movements between floor panels. It also provides the user with more comfort, as positioning objects on the assembled floor panels, according to the invention, will lead to increased support, as all main faces of floor panels extend in a similar plane. Also, the chance of knocking against floor panels, which protrude from a main plane of the constructed floor, during walking, will decrease, as floor panels all extend in the main plane of the constructed floor.

**[0020]** In yet another embodiment, the floor panel is characterized in that during insertion of said tongue into said groove, the lower surface of said tongue and lower surface of said groove of the other floor panel touch, whereas space remains between edges of both floor panels above the upper surface of said tongue.

With this remaining space a cumbersome pivoting motion about the upper joint edge is avoided. This further leads to a tolerance in vertical positioning a first floor panel relative to a second floor panel, as this measure leads to easier insertion with a smaller chance of damaging floor panels.

**[0021]** In another embodiment the floor panel comprises a tongue of which the cross section perpendicular to the longitudinal direction of the edge is tapered. In more detail, the tongue has its largest thickness where it transfers into the floor panel and gets thinner away from the floor panel. In other words, the tongue is thinner where it first enters the groove of another floor panel. Due to the tapered tongue, insertion of the tongue into the groove during assembling. A smaller thickness of the tongue away from the floor panel than the opening of the groove also facilitates assembly and avoids the risk of jamming during assembly. It also provides a tolerance in a direction perpendicular to the main surfaces of the panels when positioning the floor panels relative to each other.

The thickness of the base of the tongue at the edge provides a resistance against fracture of the tongue caused by a possible vertical movement of the first and the second panel relative to each other.

**[0022]** According to yet another embodiment, the cross section of the tongue groove perpendicular to the longitudinal direction of the edge is tapered. This leads to a more rigid fixation of floor panels, especially in a direction perpendicular to their main faces, if the shape of the tapered groove corresponds with the tapered tongue of another floor panel.

**[0023]** According to yet another embodiment, the tip of the tongue has a rounded surface at its distal end. This allows easier insertion of the tongue in the groove and prevents sticking during assemblage.

In a more advantageous embodiment, the protrusion and cavity, respectively of the tongue and the groove, extend over the full length of the corresponding sides of the floor panel. Making use of a cavity and protrusion over the full length of their corresponding sides of the floor panels, leads to a stronger fixation of floor panels, and thus a stronger constructed floor. In addition, the floor panels can be made cheaper and assembling shortened floor panels, having various lengths, common practice when constructing a floor, is independent of the position of the cavity within the groove and the protrusion on the tongue, as they extend over the full length of the sides of the floor panel. Cheaper production is a result of the possibility of making the cavity or protrusion in a single process step, which doesn't hold in case of several protrusions and cavities in each floor panel, which should have corresponding positions during assembling of floor panels.

**[0024]** The floor panel according to the invention is made from a composite comprising wood fibers and polyvinylchloride (PVC). The floor panels of the present invention generally are a replacement for wooden floor panels. Composites comprising wood fibers and a polymer strongly resemble wood, but are durable and have a much higher resistance against indentation by stiletto

heels in particular when the composite is a composite of wood fibers and PVC. The Young modulus of the wood fiber/PVC composite is more than 4 GPa. This high modulus prevents any snapping during the insertion of the tongue into the groove thus avoiding any risk of breaking out the lower lip of the cavity.

**[0025]** Another advantage of a wood fiber reinforced polymer over wood is its high dimensional stability with changes in the relative humidity.

**[0026]** The floor panels of the invention are preferably be made via extrusion, e.g. of a wood fiber/PVC mixture. The advantage of making the floor panels via extrusion is that the groove can comprise a relatively deep laying cavity. Cavities that are deep laying i.e. far from the edges of the lips of the groove are difficult if at all to make via milling. The advantage of a deep laying cavity, e.g. in a groove with a distance between its edges and its bottom end which is more than twice the size of its vertical opening, is that this requires only a tilting angle between about 3 and 5 degrees to insert the tongue into the groove.

**[0027]** A preferred embodiment provides a method for producing a floor panel comprising a panel part adapted to cover a floor with its main plane substantially parallel to the floor to be covered, a tongue extending along a first edge of the panel part and comprising an upper and lower surface and a groove extending along a second edge of the panel part, opposite the first edge and comprising an upper and lower surface, the method comprising the steps of mixing wood fibres or flour and pick, extruding the mixture thus obtained to produce the floor panel and cutting the extrusion product into lengths.

**[0028]** Preferably the method also comprises the feature that the floor panels are brushed, to obtain an appearance similar to that of wood.

**[0029]** The invention will now be explained in greater detail by means of the enclosed drawings, wherein the drawings depict:

Figure 1: a perspective broken away view of two joined floor panels according a first embodiment of the invention;

Figure 2: a crosssectional view of a floor panel according to the invention during the process of joining two panels.

Figure 3: view similar to that of figure 2 during a further step in the process of joining two panels.

Figure 4: view similar to that of figure 3 in an alternative way of mounting.

**[0030]** Figure 1 depicts two floor panels 1a, 1b respectively, which have been joined together on a support floor 2.

**[0031]** Both floor panels 1a, 1b respectively comprise a panel part 3 with an upper face 4. The panel part 3 of the first floor panel 1a comprises a first side wall 5. A tongue 6 is provided at said first side wall 5. The tongue extends over the full length of the floor panel 1a. The panel part 3 of the second floor panel 1b comprises a second side wall 7 with a groove 8 provide therein. The groove 8 extends over the full length of the wall panel 1b. It will be clear that the first floor panel 1a comprises also a second side wall 7 with a groove provided therein, although it is not depicted in the drawing. Similarly it will also be clear that the second floor panel 1b also comprises a first side wall 5 with a tongue 6.

**[0032]** From the figure it appears clearly that the groove 8 extends substantially in a downward direction from the side wall 7 to its distal end. This counts for the upper surface 9 of the groove 8 and for the lower surface 8a and 8b of the groove 8. At its distal end the groove 8 comprises a cavity 11 extending also over the full length of the panel 1b located above the groove 8. The upper surface 9 of the groove extends until the cavity 11. The lower surface of the groove 8 comprises a first part 8a extending substantially horizontally adjacent to the side wall 7 and a second part 8b , extending in a downward direction.

**[0033]** The tongue 6 comprises a lower surface 12 extending substantially horizontally and an upper surface 13 extending in a downward direction from the side wall 5 to the distal end of the tongue. Adjacent to the upper surface, a protrusion 14 is connected to the tongue 6. The surface of the protrusion 14 at its side away from the side wall 5 and at its lower side is curved.

**[0034]** In the position depicted in figure 1, the protrusion 14 hooks into the cavity 11, thus forming a form engaging connection between the tongue 6 and the groove 7, so that both panels 1a, 1b are firmly connected.

**[0035]** Further it appears from figures 1 through 4 that the panels 1a, 1b comprise cavities 16 extending in the longitudinal direction of the panels 1a, 1b.

[0036] The features of the invention allow the panels 1a, 1b to be joined from a substantial horizontal direction. Put it otherwise the panel 1a can be joined to panel 1b by simply shifting towards panel 1b already located in its correct position. Only a minor tilt of less than 3 degrees of the panel 1a is required to obtain locking. Figure 3 shows clearly how this is achieved.

[0037] Panel 1a is located on the same support floor 2 as onto which the panel 1b is already present. Initially the panel 1a is located on the same floor and it is shifted substantially perpendicular to its longitudinal direction to the panel 1a, until both panels contact each other. As depicted in figure 2, the tongue of the panel 6 of the panel 1a will then already been inserted into the groove 8 of the panel 1b and the upper surface of the protrusion 14 will contact the upper surface 9 of the groove 8. Further linear movement is precluded. However a further insertion can be obtained by a small tilt of the panel 1a, as is depicted in figure 3. A single person, even if the panels have a substantial length, can easily achieve such a small tilt. The small tilt, makes the protrusion 14 free from the upper surface 9 of the groove 8 so that it can be inserted further. The tilt requires further space at the lower part of the groove but this is provided by the downward direction of the rear part 8b of lower surface of the groove. When the tongue has been inserted further, and the distal part of the tongue reached the inner part of the groove, the panel can be rotated back to its horizontal position after which the position depicted in figure 1 is obtained and the panels 1a, 1b are firmly locked.

[0038] Figure 4 illustrates that the way of joining two panels can also be executed the other way around; joining the panel 1a to panel 1b already present on the supporting floor.

[0039] As stated before this floor can be produced by extrusion of a mixture of pvc ore another suitable plastic and wood flour, ore another suitable filler. Extrusion makes the provision of the through going cavities 16 particularly easy just as the tongue 6 and groove 8.

[0040] Although the preceding description and claims refers to the application of this panel as the floor panel; it is by no way excluded that the panel can be used for other purposes, such as the cladding of walls. In particular its composition makes it very durable, so that these panels may be used for cladding of outside walls. Also then the attractive appearance similar to weathered panels is advantageous, as it looks like the weather board cladding common in the south of the UK.

## **REFERENCES CITED IN THE DESCRIPTION**

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## PATENTKRAV

1. Gulvpanel (1a, 1b) til fremstilling af et gulv, hvilket gulvpanel omfatter:
  - en fer (6), der strækker sig fra en første sidevæg (5) og omfatter en øvre overflade (13) og en nedre overflade (12);
  - 5 - en not (8) tilvejebragt i en anden sidevæg (7), modsat den første sidevæg (5) og som omfatter en øvre overflade (9) og nedre overflade (8a, 8b);
  - hvor feren (6) omfatter et fremspring (14) ved dens øvre overflade (9),
  - hvor noten (8) omfatter et hulrum (11) i dens øvre overflade (9),
  - hvor noten (8) i et første panel (1b) er tilpasset til at modtage feren (6) på et andet panel (1a),
  - 10 - hvor fremspringet (14) af feren (6) på det andet panel (1a) og notens (8) hulrum (11) i det første panel (1b) modvirker og forhindrer horisontal adskillelse i en retning på tværs af et plan, der er parallelt med den første sidevæg (5) af det andet panel og den anden sidevæg (7) af det første panel (1b), **kendetegnet ved, at** den øvre overflade (9) og den nedre overflade (8b) af noten
  - 15 mindst delvis strækker sig i en nedadgående retning fra den anden sidevæg (7) til dens distale ende og overfladerne af første og anden sidevægsdele over og under noten (8) og feren (6) i alt væsentligt strækker sig i det samme vertikale plan og gulvpanelet er fremstillet af et kompositmateriale af træfibre og polyvinylchlorid, hvilket kompositmateriale har et Youngs modul på mere end 4 GPa.
2. Gulvpanel ifølge krav 1, **kendetegnet ved, at** delen af den nedre overflade (8a) af noten (8)
- 20 stødende op til den anden sidevæg (7) mindst delvis strækker sig i den horisontale retning.
3. Gulvpanel ifølge krav 1 eller 2, **kendetegnet ved, at** den nedre overflade (12) af feren (6) i alt væsentligt strækker sig horisontalt.
4. Gulvpanel ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** den nedre overflade (12) af feren (6) har en afrundet overflade ved dens distale ende.
- 25 5. Gulvpanel ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** forholdet mellem dybden af noten og den højeste højde af noten er større end to.
6. Gulvpanel ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** mindst én af overfladerne af paneldelen over feren og over noten i alt væsentligt strækker sig udefter fra feren i den opadgående retning.

7. Fremgangsmåde til samling af gulvpaneler ifølge et hvilket som helst af kravene 1-6, hvilken fremgangsmåde omfatter følgende trin:
- A) placering af et første gulvpanel (1b) på et bærende gulv (2),
- 5 B) placering af et andet gulvpanel (1a) på det bærende gulv (2) med dets fer (6) rettet mod noten (8) i det første gulvpanel,
- C) flytning af det andet gulvpanel (1a) mod det første gulvpanel (1b) for at indføre feren (6) i det andet panel (1a) i noten (8) i det første panel (1b), indtil fremspringet (14) rører den øvre overflade (9) af noten (8),
- 10 D) og samtidig opadgående drejning og flytning af det første gulvpanel (1b) mod det andet gulvpanel (1a), hvorunder den øvre overflade (13) af feren (6) i det andet gulvpanel (1a) understøtter den øvre overflade (9) af noten (8) i det første gulvpanel 1(b), eller samtidig opadgående drejning og flytning af det andet gulvpanel (1a), hvorunder den nedre overflade (8a, 8b) af noten (8) i det første panel (1b) understøtter den nedre overflade (12) af feren.
8. Fremgangsmåde til samling af gulvpaneler ifølge krav 7, **kendetegnet ved, at**, under trin, D) hældningsvinklen mellem det første og det andet gulvpanel er mindre end 3 %.
- 15 9. Fremgangsmåde til fremstilling af et gulvpanel ifølge et hvilket som helst af kravene 1 - 6, hvilken fremgangsmåde omfatter følgende trin
- blanding af træfibre eller træslib og pvc;
  - ekstrudering af den således opnåede blanding for at fremstille gulvpanelet; og
  - 20 - opskæring af ekstrusionsproduktet i længder.
10. Fremgangsmåde ifølge krav 9, **kendetegnet ved, at** gulvpanelet efterfølgende børstes.

DRAWINGS

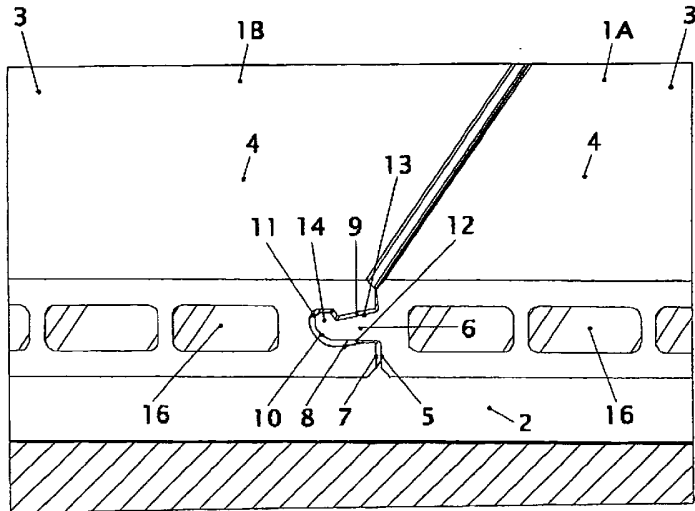


Fig. 1

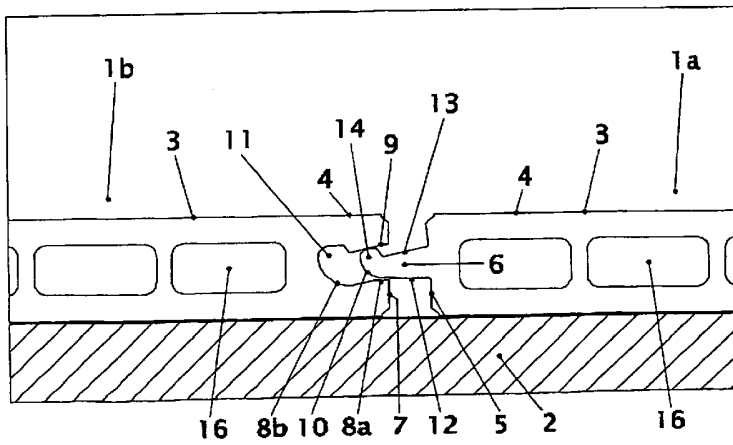


Fig 2.

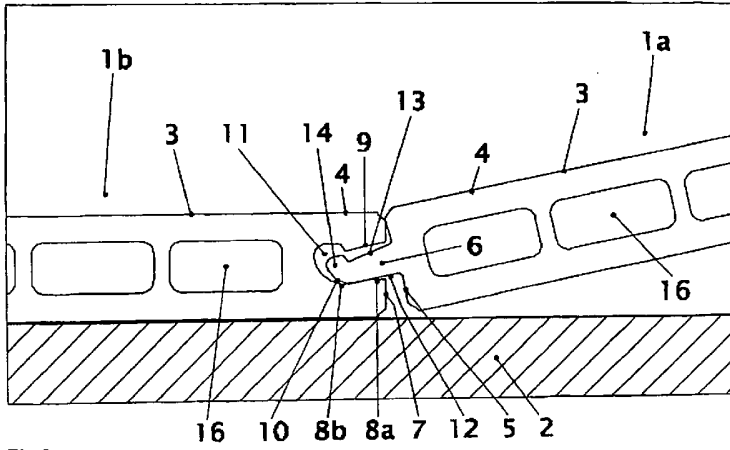


Fig 3

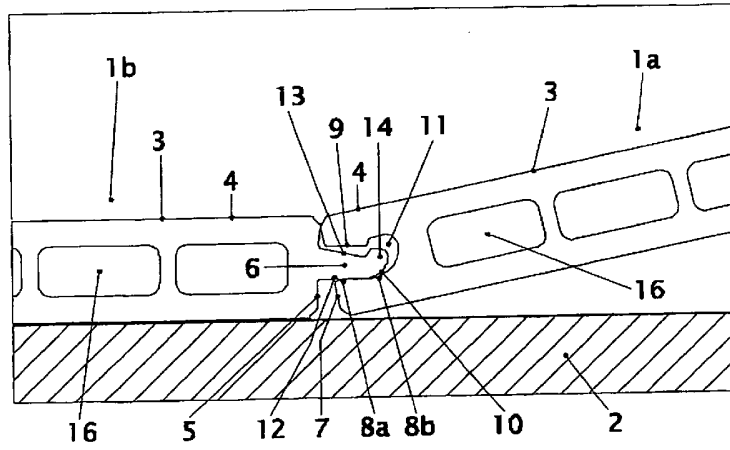


Fig 4