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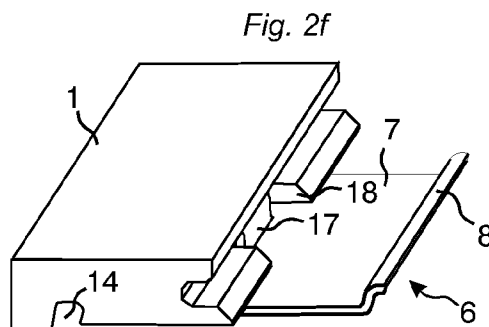
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(54) Title: MECHANICAL LOCKING SYSTEM FOR FLOOR PANELS



(57) Abstract: Building panels, especially floor panels are shown, which are provided with a locking system comprising several clips connected to a panel edge comprising a recess formed in a lower lip or in the tongue.

## MECHANICAL LOCKING SYSTEM FOR FLOOR PANELS

### TECHNICAL FIELD

The disclosure generally relates to the field of mechanical locking systems for floor panels and building panels. The disclosure shows floorboards, locking systems and production methods.

### 5                   FIELD OF APPLICATION OF THE INVENTION

The present invention is particularly suitable for use in thin floating floors, which are formed of floor panels which are joined mechanically with a locking system preferably integrated with the floor panel, i.e. mounted at the factory, are made up of one or more upper layers of thermoplastic or thermosetting  
10 material or wood veneer, an intermediate core of wood-fibre-based material or plastic material and preferably a lower balancing layer on the rear side of the core. The invention can also be used for joining building panels which preferably contain a board material for instance wall panels, ceilings, furniture components and similar. Parts of the locking system may also be supplied as  
15 separate components, which may be connected to a panel during installation.

The following description of prior-art technique, problems of known systems and objects and features of the invention will therefore, as a non-restrictive example, be aimed above all at this field of application and in particular at thin panels formed as rectangular floor panels with long and shorts edges  
20 intended to be mechanically joined to each other on both long and short edges.

The long and short edges are mainly used to simplify the description of the invention. The panels may be square. It should be emphasised that the invention can be used in any floor panel on long and/or short edges and it may be  
25 combined with all types of known locking system that lock the panels in the horizontal and/or vertical direction.

The following description of prior-art technique, problems of known systems and objects and features of the invention will, as a non-restrictive example, be

aimed above all at floor panels and especially at thin resilient thermoplastic floor panels such as so called luxury vinyl tiles, generally referred to as LVT,

### BACKGROUND OF THE INVENTION

LVT flooring usually comprises a transparent wear layer which may be coated  
5 by a UV cured PU lacquer, a decorative plastic foil and one or several core layers which generally are of different density and hardness. Relevant parts of this prior art description are also a part of the invention.

Thin LVT floors with a thickness of 2-3 mm have traditionally been installed by  
gluing to the sub floor. Recently LVT floors have been introduced on the  
10 market that comprises a mechanical locking system, which allows a floating installation without glue. This facilitates installation and eliminates a lot of work to prepare the sub floor for gluing.

Such LVT floors have generally a thickness of about 5 mm. This thickness is  
mainly required in order to form the locking system. The panel itself is strong  
15 and flexible and a thickness of about 3 mm would in many application be sufficient but can not be used since it is not possible to form a strong and cost efficient locking system in such thin floors.

Such problems related to minimum thickness requirements due to the forming  
of locking systems are also applicable in other thin floor panels such as  
20 laminate floors and wood powder based floors where material and weight savings may be accomplished with lower thicknesses, preferably below 6 mm.

Laminate flooring usually comprise a core of a 6-12 mm fibre board, a  
0.2-0.8 mm thick upper decorative surface layer of laminate and a 0.1-0.6 mm  
25 thick lower balancing layer of laminate, plastic, paper or like material. A laminate surface comprises melamine-impregnated paper. The most common core material is fibreboard with high density and good stability usually called HDF – High Density Fibreboard. Sometimes also MDF – Medium Density Fibreboard – is used as core.

30 Laminate floor panels of this type have been joined mechanically by means of so-called mechanical locking systems. These systems comprise locking

means, which lock the panels horizontally and vertically. The mechanical locking systems are usually formed by machining of the core of the panel. Alternatively, parts of the locking system can be formed of a separate material, for instance aluminium or HDF, which are integrated with the floor panel, i.e. joined with the floor panel in connection with the manufacture thereof.

The main advantages of floating floors with mechanical locking systems are that they are easy to install. They can also easily be taken up again and used once more at a different location.

#### 10 DEFINITION OF SOME TERMS

In the following text, the visible surface of the installed floor panel is called "front side", while the opposite side of the floor panel, facing the sub floor, is called "rear side". The edge between the front and rear side is called "joint edge". By "horizontal plane" is meant a plane, which extends parallel to the front side. Immediately juxtaposed upper parts of two adjacent joint edges of two joined floor panels together define a "vertical plane" perpendicular to the horizontal plane. By "vertical locking" is meant locking parallel to the vertical plane. By "horizontal locking" is meant locking parallel to the horizontal plane. By "up" is meant towards the front side, by "down" towards the rear side, by "inwardly" mainly horizontally towards an inner and centre part of the panel and by "outwardly" mainly horizontally away from the centre part of the panel.

#### RELATED ART AND PROBLEMS THEREOF

For mechanical joining of long edges as well as short edges in the vertical and horizontal direction perpendicular to the edges several methods may be used. One of the most used methods is the angle-snap method. The long edges are installed by angling. The short edges are locked by horizontal snapping. The vertical connection is generally a tongue and a groove and the horizontal connection is a strip with a locking element that cooperates with a locking groove in the adjacent edge.

Similar locking systems may also be produced with a rigid strip and they are connected with an angling-angling method where both short and long edges are angled into a locked position.

5 Advanced so-called fold down locking systems with a separate and flexible tongue on the short edges have been introduced where both the long and short edges are locked with an angling action.

It is known that a locking strip may be formed of a separate material such as aluminium and that such strip may be clamped in undercut grooves. Such systems are described in WO94/26999. The separate metal strip may be  
10 used to lock very thin panes with a thickness of about 3 mm provided that the core is made of a strong material for example compact laminate or a high quality HDF and that the strip extends along essentially the whole edge. The strip is used to accomplish vertical and horizontal locking.

WO 99/66152 describes a locking system with a tongue and a tongue groove  
15 and a separate metal strip that is attached to the lower lip of the tongue groove and that in locked position is located vertically under the tongue. Such locking system is not suitable for thin flooring since the thickness must be sufficient to form the tongue groove and a connecting part for the strip under the groove. Generally 1/3 of the panel thickness is used to form the upper lip,  
20 1/3 is used to form the tongue and 1/3 remains to form the lower lip, The available material thickness that may be used to form the strip under the tongue is generally less than 1/3 of the panel thickness. A connection to the outer part of the lower lip is also disadvantage in panels with a soft and flexible core such as LVT. A lower lip formed in soft and flexible material  
25 bends downwards when the strip is exposed to rather low separation forces and a strong strip will not improve the locking strength due to inferior connection to the panel edge.

It is known from CN 201588375 that clips may be used to accomplish horizontal and vertical locking. Such clips may provide cost advantages over  
30 a locking strip that extends along the whole edge. A disadvantage is that a considerable part of the edge between the clips is not locked vertically and

the edges will move vertically when exposed to high load especially if the floor panels are thin and flexible.

US 2001/0010139 A1 shows a locking system similar to embodiments shown in WO 94/26999. A separate clip is connected to an outer part of a lower lip  
5 that is positioned beyond an upper lip. The geometry of the lower lip, the tongue and the tongue groove is not suitable to form a strong locking in soft and flexible core materials.

It is also known from WO 2013/025165 that a tongue and a groove formed in one piece with the core may be used for vertical locking and several strip  
10 parts spaced from each other may be attached to an edge in order to obtain horizontal locking. A disadvantage is that such locking system are not suitable for thin floors since the strip part is connected in a separate groove that extend along the whole edge and that is located under the lower part of the tongue. The connection of the strip part is not sufficient to prevent backwards  
15 bending of the strip body and edge separation when the edges are exposed to pulling forces. This is a disadvantage in thin laminate floors and floors with a rather soft core such as LVT floors.

It would be an advantage if separate clips that comprise a stronger material than the core may be used to accomplish a horizontal locking in thin floors  
20 and if such horizontal locking may be combined with a vertical locking comprising a tongue and a groove that extends along the whole edge and is made in one piece with the core.

#### SUMMARY OF THE INVENTION AND OBJECTS THEREOF

An overall objective of the present invention is to provide an improved and  
25 more cost efficient locking system for primarily adjacent long edges of thin and flexible floor panels that may be locked to each with angling.

A first specific objective is to provide a locking system for thin flooring comprising a tongue and groove for vertical connection and a separate clip that may be attached to the panel edge and provide a strong locking in panels  
30 with a thin and flexible core.

A second specific objective is to provide a flooring system comprising two types of panels that may be locked in a more flexible way in order to allow installation of advanced floor patterns.

5 The above objects of the invention may be achieved by embodiments of the invention.

According to a first aspect of the invention building panels are provided with a locking system comprising a tongue at a second edge of a second panel. The tongue is configured to cooperate with a tongue groove at a first edge of a first panel for locking in a vertical direction. The tongue groove comprises  
10 an upper lip and a lower lip. The locking system further comprises one or more clips attached to the first edge and a downwardly open locking groove formed at the second edge. Each clip comprises an upwardly extending locking element, which is configured to cooperate with the locking groove for locking the first edge and the second edge in a horizontal direction. The clip  
15 comprises a clip body at a rear side of the first panel. Said clip body is provided with an inner part, which extends inwardly from the first edge and an outer part, which extends outwardly from said first edge. The inner strip part comprises a fixing element that cooperates with a downwardly open fixing groove, formed on the rear side of the first panel, for locking the clip to the  
20 first edge in a horizontal direction. The clip comprises a locking protrusion that protrudes upwardly from the clip body. The locking protrusion is configured to lock the clip to the first edge in a vertical direction. The lower lip or the tongue comprises a recess and the locking protrusion is in a locked position positioned in the recess.

25 The locking protrusion may have a part that is located in the tongue groove.

A part of the locking protrusion may be located below the tongue.

The locking protrusion may be spaced horizontally inwardly in the tongue groove beyond the outer tip of the tongue.

The locking protrusion may comprise a first part that extends upwardly from  
30 the clip body and a second part that extends inwardly into the tongue groove.

The locking protrusion may be located inwardly and spaced horizontally from the vertical plane

The panel may comprise a core of plastic material.

The panel may comprise a surface of thermoplastic material.

- 5     The panel may comprise a core with an upper core layer and a lower core layer and the locking protrusion may protrude vertically beyond the lower core layer.

According to a second aspect of the invention a flooring system is provided comprising a first panel and a second panel provided with a locking system  
10     comprising clips. Said clips being arranged at a first edge and at an opposite second edge of the first and the second panel. The locking system is configured to lock the first edge of the first panel to the second edge of the second panel in a horizontal and a vertical direction.

15     The first edge and the second edge may each comprises a horizontal groove comprising a lower lip.

Each clip may comprise a vertically extending locking protrusion with an upper part that is located essentially above the lower lip of the first and the second panel, respectively.

20     Each lower lip may be spaced horizontally and inwardly from an upper part of the edge.

### BRIEF DESCRIPTION OF THE DRAWINGS

The disclosure will in the following be described in connection to exemplary embodiments and in greater detail with reference to the appended exemplary drawings, wherein:

- 25     Figs 1a-f             illustrates locking systems according to known technology.
- Figs 2a-f             illustrate a clip that may be used to lock thin floor panels according to an embodiment of the invention.
- Figs 3a-h             illustrate clips and a production methods to connect a clip to an edge according to embodiments of the invention.



- Figs 4a-c illustrate a locking system according to an embodiment of the invention.
- Figs 5a-d illustrate a locking system according to an embodiment of the invention.
- 5 Figs 6a-c illustrate a locking system according to an embodiment of the invention.
- Figs 7a-d illustrate a locking system according to an embodiment of the invention.
- 10 Figs 8a-c illustrate a locking system and a LVT floor panel with a core comprising several layers according to an embodiment of the invention.
- Figs 9a-b illustrate a panels with clips on long and short edges according to an embodiment of the invention.
- 15 Figs 10a -10e illustrate A and B panels comprising clips on both adjacent edges.

### DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Figures 1a-1f show known locking systems. Figure 1a shows a conventional locking system formed in one piece with the core 5 and configured to lock with angling. The floor panel 1, 1' comprises a locking system that has a tongue 10 and a tongue groove 9 that lock vertically and a strip 5 with a locking element 8 that cooperates with a locking groove 14 and locks the edges horizontally.

Figure 1b and 1c shows a locking system with a separate strip 5 that comprises a locking protrusion 17 connected to a lower lip 12 of the tongue groove 9 that protrudes beyond a vertical plane VP. The locking protrusion 17 is located under a horizontal plane HP that intersects the lower part of the tongue 10. Such locking system may not provide sufficient locking strength in thin and flexible core material since the lower lip 12 and the outer part of the

strip 5 will bend downwards when the edges are exposed to pulling forces and the locking element 8 will slide out from the locking groove 14.

Figures 1d – 1f show similar locking systems comprising a plastic or metal clip 6 with a locking protrusion 17 connected to an upper part of the lower lip 12 which is located under the tongue 10 and under the cooperating locking surfaces between the tongue and the lower lip 12. The clip is connected to an outer part of a lower lip 12 that is positioned beyond the upper lip and beyond the vertical plane VP.

To facilitate understanding of the described invention, several locking systems in the figures are shown schematically. It should be emphasised that improved or different functions can be achieved using combinations of the preferred embodiments.

All embodiments may be used separately or in combinations. Angles, dimensions, rounded parts, spaces between surfaces etc. are only examples and may be adjusted within the basic principles of the invention.

Figures 2a – 2f show a first embodiment of the invention.

Figure 2a show a cross section of a first and second panel 1, 1' each provided with a surface layer 2 comprising a transparent wear layer 20 which may be coated by a UV cured PU lacquer. The first and the second panels 1, 1' are preferably LVT panels. A decorative plastic foil 21 is attached to a core 3 and under the transparent layer 20. The core 3 that preferably comprises a thermosetting plastic material with a filler may have several core layers, which may have different density and hardness. The locking system comprises a tongue 10 at the second edge of the second panel 1', a tongue groove 9 at a first edge of the first panel and a clip 6, that preferably is formed by punching a metal sheet, for example a 0,3 – 0,6 mm aluminium or steel sheet. The clip 6 comprises a clip body 7 at a rear side of a first panel 1. The clip body comprises an inner part IP that extends inwardly from a first edge of the first panel and an outer part OP that extends outwardly from the first edge of the first panel 1.

The clip 6 comprises a fixing element 16 located in a fixing groove 15 in the first panel 1 and a locking element 8 located in a locking groove 14 formed in an adjacent second panel 1' that lock the panel edges horizontally and prevents horizontal separation. The clip 6 comprises a locking protrusion 17  
5 formed on the strip body 7 between the locking element 8 and the fixing element 16. The locking protrusion 17 projects vertically upwardly from the strip body and is located in a recess 18 formed in the lower lip 12 of the tongue groove 9. The recess 18 extends vertically from an upper to a lower part of the lower lip 12. The locking protrusion 17 is in this embodiment  
10 located such that it is displaced inwardly from the vertical plane VP. A part of the locking protrusion 17 extends inwardly into the tongue groove 9 and beyond the outer part of the tongue 10. An upper part of the locking protrusion 17 is preferably located above a horizontal plane HP that intersects the lower part of the tongue 10 and the upper part of the lower lip 12. The  
15 locking protrusion 17 connects the clip 6 vertically to the first panel 1 edge and prevents downward bending of the clip 6 when the edges of the first 1 and the second 1' panels are exposed to separation forces. The locking protrusion 17 prevents a displacement of the clip 6 inwardly such that the clip 6 is accurately fixed and positioned in a pre-determined position by the  
20 locking protrusion 17 and the fixing element 16.

An advantage is that the clip 6 may be connected to the core 3 in a horizontal plane HP that is located above the lower lip 12 and to an edge part that is more rigid than an outer part of the lower lip. The whole vertical extension of the lower lip 12 and tongue groove 9 may be used to accomplish a strong  
25 connection without any essential negative effect on the vertical tongue 10 and tongue groove 9 connection since only a small part of the lower lip 12 will be partially removed when the recess 18 is formed. The upper contact surfaces between the tongue 10 and the upper lip 11 are unchanged and may provide an unchanged sealing against moisture penetration into the joint. The locking  
30 protrusion may be connected to an edge part that comprises sufficient material to allow a strong connection even when the panels are thin for example 3-4 mm and comprise a core 3 of flexible material, such as

thermoplastic material mixed with a filler, which is a material composition generally used in LVT floors.

Figure 2b is a top view of the clip 6. Figure 2c shows a clip 6 that has a length direction L along the edge and a width direction W perpendicular to the length. A clip with a length of about 3 cm and a width of about 2 cm may provide a locking strength that corresponds to a pulling force of about 200 N. 10 clips/m are sufficient to provide a locking strength on a long edge of about 2000 N.

Figure 2d shows an edge section 1 that comprises a recess 18 formed in the lower lip 12. Figure 2e shows the same edge section 1 with the surface layer 2 pointing downwards and the recess 18 formed in the lower lip 12.

Figure 2f shows a clip 6 connected to an edge section 1. The locking protrusion is located in a recess 18 formed in the lower lip 12.

Figure 3a shows that the locking system may be locked with angling. The lower lip 12 comprises preferably a sliding surface 19 that guides the tongue 10 into the tongue groove 9 during angling but also during horizontal snapping. The sliding surface 19 and a part of the lower lip 12 are located above the outer part OP of the clip body 7.

Figure 3b shows that the clip 6 may be connected with angling and pressing of the fixing element 16 with a pressing tool P into the fixing groove 15. The recess 19 is preferably formed by a vertically rotating tool T that cuts the edge as a saw blade.

Figures 3c, 3d and 3e show that the clip 6 may be connected by a horizontal displacement and pressing against the fixing element 16 such that a bending of the fixing element 16 takes place.

Figure 3f shows that the fixing element 16 may be pressed into the core 3 and the fixing groove 15 is formed by the fixing element 16. The fixing groove may be pre cut with a knife. Glue may also be used to connect the clip 6 to a panel edge. Glue may in some applications replace the fixing groove 15 and the fixing element 16.

Figure 3g shows that several clips 6a, 6b may be formed by punching a metal sheet and may be inserted after separation from a clip blank comprising several clips. Figure 3h shows that the clip 6 may have several locking protrusions 17a, 17b.

5     Figures 4a – 4c show that the clip 6 may comprise guiding parts 22 having an upwardly extending sliding surface 19 that may facilitate the guiding of the tongue 10 into the tongue groove 9 during angling and/or horizontal snapping. The guiding part 22 may also be used to position the clip 6 horizontally against the lower lip 12.

10    Figures 5a - 5d show that the recess 18 may be formed in an upper surface of the lower lip 12 and extend along a part of the lower lip.

Figures 6a - 6c show that the recess 18 may be formed in a lower part of the tongue 10 as shown in figure 6c where the panel 1' is shown with the rear side pointing upwards. The locking protrusion 17 is in locked position  
15    connected into the tongue groove 9 and located in the recess 18 formed in the lower part of the tongue 10.

Figures 7a and 7b show that the recess 18, 18' may extend from the tongue 10 and to the locking groove 14 in order to accommodate the outer part OP of the clip 6 that extends beyond the upper edge of the panel 1. Figures 7a and  
20    7b show that the clip 6 may be an extruded section, for example a plastic or aluminium section.

Figures 8a and 8b show panels 1, 1' comprising a core 3 with an upper core layer 4a and a lower core layer 4b layer and wherein the locking protrusion 17 protrudes vertically beyond the lower layer 4b. Figure 8c shows that the core  
25    3 may comprise a glass fibre layer 4c and the upper part of the locking protrusion may be located above such glass fibre layer 4c.

Figure 9a shows a floor panel 1 comprising several clips 6 and recesses 18a on one of the long edges and several recesses 18b on the opposite long edge. The panel comprises a locking system on the short edges that is  
30    formed in one piece with the core. Figure 9b shows a locking system comprising clips 6 on long and short edges.

Figures 10a – 10e show that all embodiment of this disclosure may be adapted such that a flooring system may comprise a first A panel and a second B panel comprising clips 6 on at least two opposite edges, a first edge 23a and a second edge 23b. The locking system is configured such that a  
5 first edge 23a of a first A panel may be locked to a second edge 23b and a first edge 23a of a second panel B.

Figure 1a shows a cross section C1 – C1 of two adjacent edges 23a and 23b according to figure 10e. Both edges comprise a horizontal groove 9a and 9b and a lower lip 9a, 9b. The locking protrusion 17 is preferably located  
10 essentially above the lower lip 12a and the lower lip is preferably spaced horizontally from the vertical plane VP.

Figure 10b show the cross section C2 – C2 in figure 10d and figure 10c shows the cross section C1 – C1 in locked position.

The clips are offset along the adjacent edges such that they may be inserted  
15 between each other.

Figure 10d shows that a first edge 23a of a first panel A may be locked to a second edge 23b of a second panel B. Figure 10e shows that a first edge 23a of the first panel A may also be connected to a first edge 23a of the second panel B.

20 The above-described locking system may be used to lock all types of floor panels. Ceramic tiles may be installed with a space between the upper edges. This allows that the outer part of the lower lip 12 may be located at the vertical plane VP or may even protrude horizontally beyond the vertical plane VP and the upper part of the edge.

25

## CLAIMS

1. Building panels provided with a locking system comprising a tongue (10) at a second edge of a second panel (1'), the tongue being configured to cooperate with a tongue groove (9) at a first edge of a first panel (1) for  
5 locking in a vertical direction, the tongue groove (9) comprising an upper lip (11) and a lower lip (12), the locking system further comprising one or more clips (6) attached to the first edge and a downwardly open locking groove (14) formed at the second edge, each clip (6) comprises an upwardly extending locking element (8), which is configured to cooperate with the locking groove  
10 (14) for locking the first edge and the second edge in a horizontal direction characterised in:

that the clip (6) comprises a clip body (7) at a rear side of the first panel (1), said clip body (7) is provided with an inner part (IP), which extends inwardly from the first edge, and an outer part (OP), which extends outwardly  
15 from said first edge,

that the inner strip part (IP) comprises a fixing element (16) that cooperates with a downwardly open fixing groove (15), formed on the rear side of the first panel (1), for locking the clip (6) to the first edge in a horizontal direction,

20 that the clip (6) comprises a locking protrusion (17), which protrudes upwardly from the clip body (7), said locking protrusion (17) is configured to lock the clip (6) to the first edge in a vertical direction,

the lower lip (12) or the tongue (10) comprises a recess (18), and

that the locking protrusion (17) is in a locked position positioned in the  
25 recess (18).

2. The building panels as claimed in claim 1, wherein a part of the locking protrusion (17) is located in the tongue groove (9).

3. The building panels as claimed in claim 1 or 2, wherein a part of the locking protrusion (17) is located below the tongue (10).

4. The building panels as claimed in any one of the preceding claims 1-3, wherein said locking protrusion (17) is spaced horizontally inwardly in the tongue groove (9) beyond the outer tip of the tongue (10)

5 5. The building panels as claimed in any one of the preceding claims 1-5, wherein the locking protrusion (17) comprises a first part (17a) that extends upwardly from the clip body (7) and a second part (17b) that extends inwardly into the tongue groove (9).

6. The building panel as claimed in any one of the preceding claims 1-5 wherein the locking protrusion is located inwardly and spaced horizontally  
10 from the vertical plane

7. The building panels as claimed in any one of the claims 1-6, wherein the panel comprises a core of plastic material

8. The building panels as claimed in any one of the preceding claims 1-7, wherein the panel comprises a surface of thermoplastic material

15 9. The building panels as claimed in any one of the preceding claims 1-8, wherein the panel comprises a core (3) with an upper core layer (4a) and a lower core layer (4b) and wherein the locking protrusion (17) protrudes vertically beyond the lower core layer (4b).

10. A flooring system comprising a first panel (A) and a second panel (B)  
20 being provided with a locking system comprising clips, said clips (6) being arranged at a first edge (23a) and at an opposite second edge (23b) of the first and the second panel (A,B), characterized in that the locking system is configured to lock the first edge (23a) of the first panel (A) to the second edge (23b) of the second panel (B) in a horizontal and a vertical direction.

25 11. The flooring system as claimed in claim 10, wherein the first edge (23a) and the second edge (23b) each comprises a horizontal groove (9a, 9b) comprising a lower lip (12a,12b).

12. The flooring system as claimed in claim in claim 11, wherein each clip (6) comprises a vertically extending locking protrusion (17) with an upper



part that is located essentially above the lower lip (12a, 12b) of the first and the second panel, respectively.

13. The flooring system as claimed in claim in claim 12, wherein each lower lip is spaced horizontally and inwardly from an upper part of the edge.

Fig. 1a

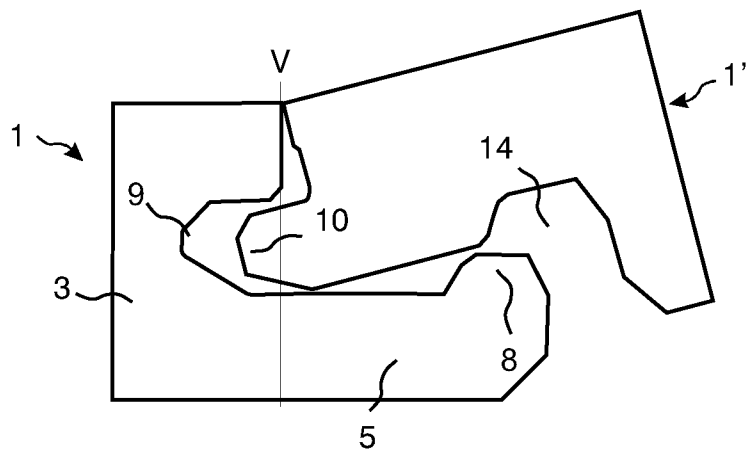


Fig. 1b

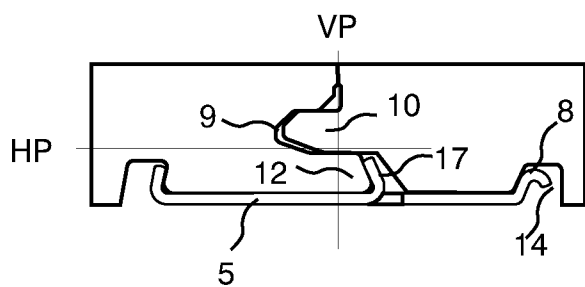


Fig. 1c

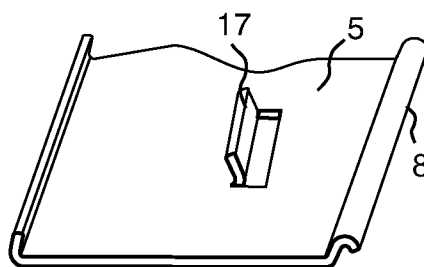


Fig. 1d

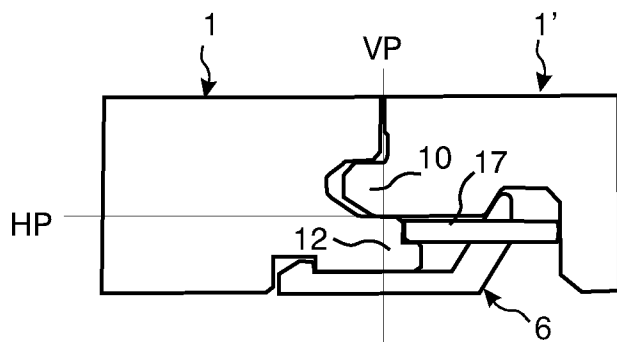


Fig. 1e

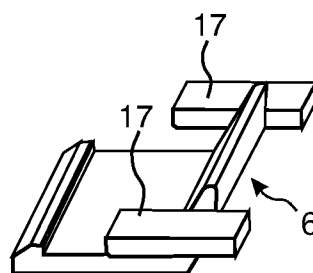
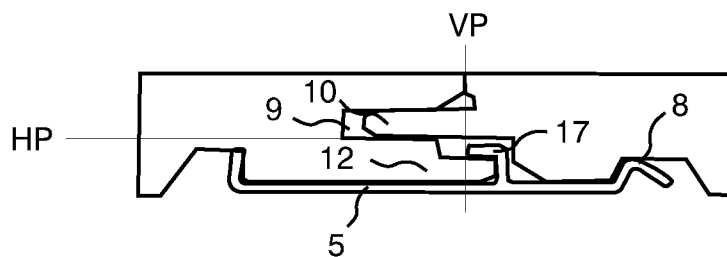
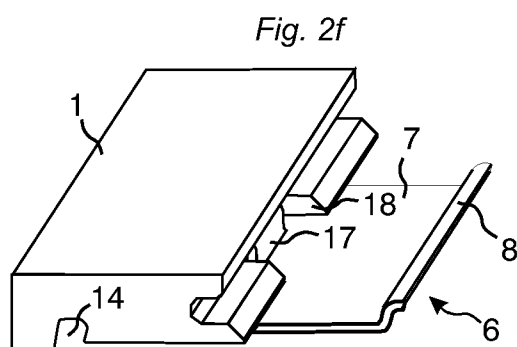
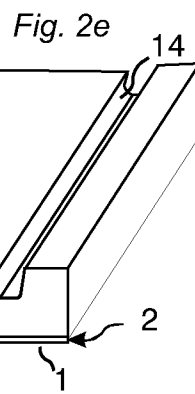
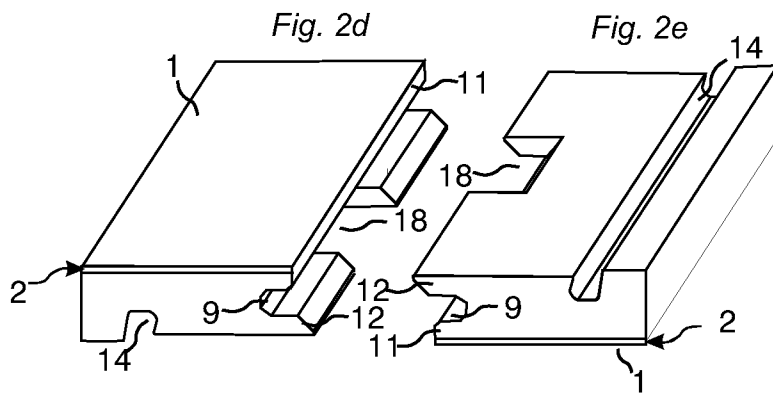
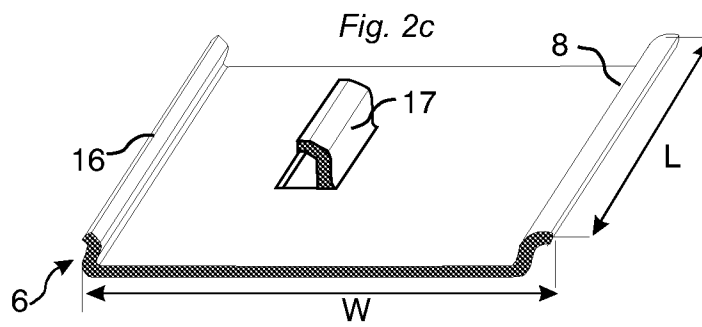
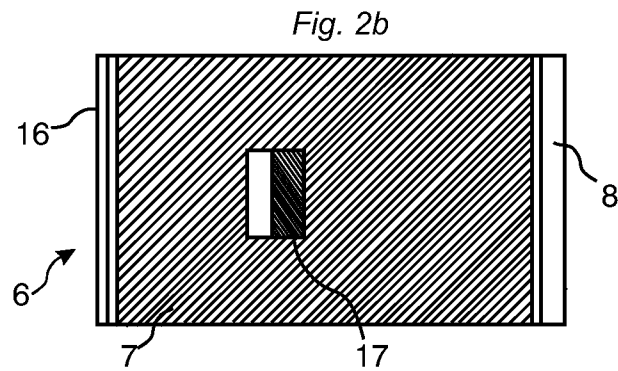
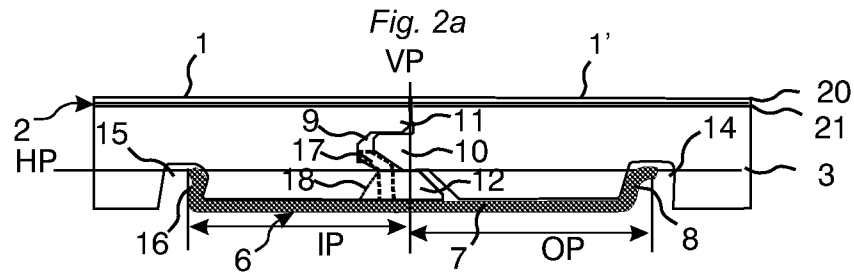


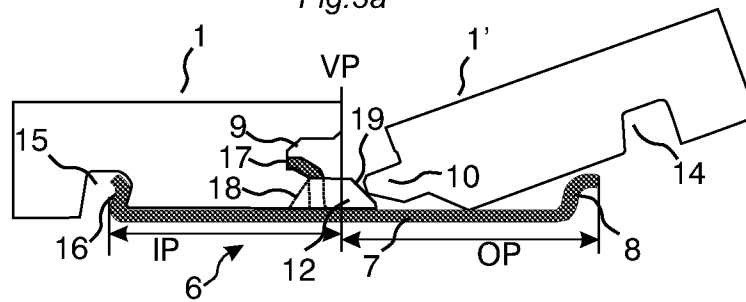
Fig. 1f



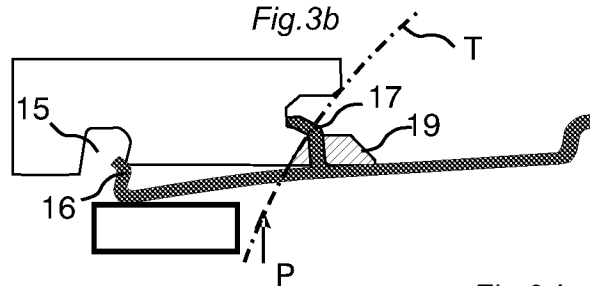
KNOWN TECHNOLOGY



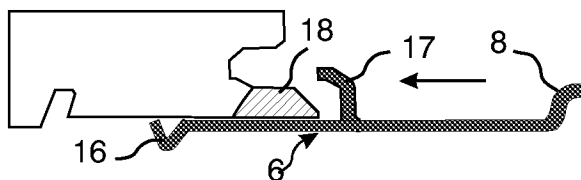
*Fig.3a*



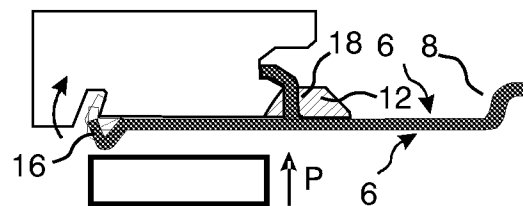
*Fig.3b*



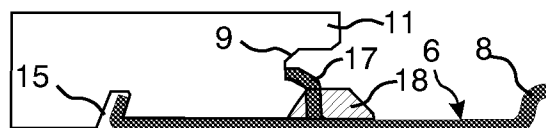
*Fig.3c*



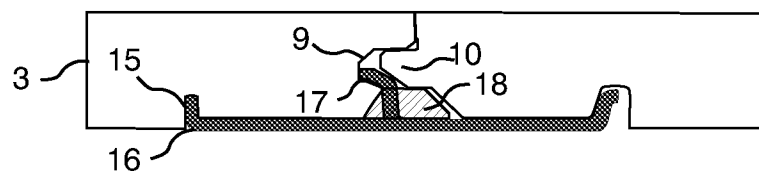
*Fig.3d*



*Fig.3e*



*Fig.3f*



*Fig.3g*

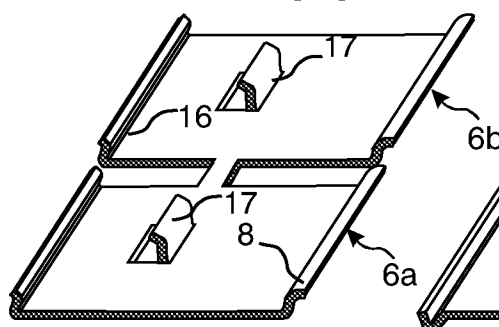


Fig.3h

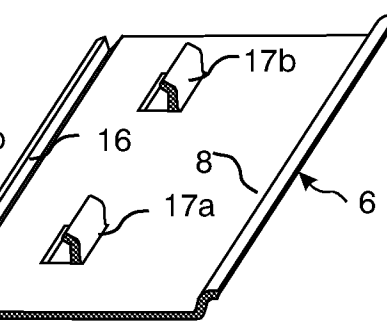


Fig. 4a

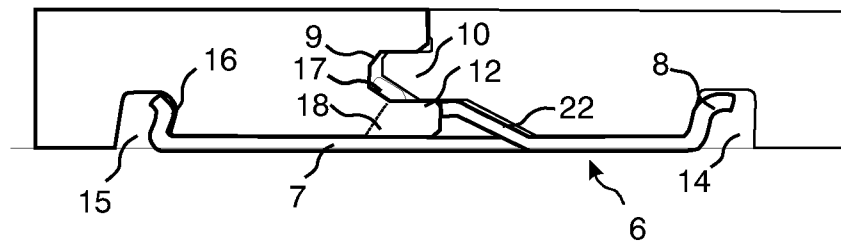


Fig. 4b

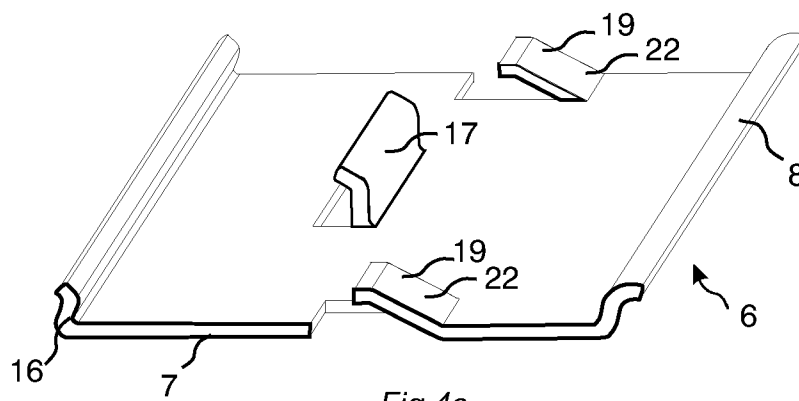


Fig. 4c

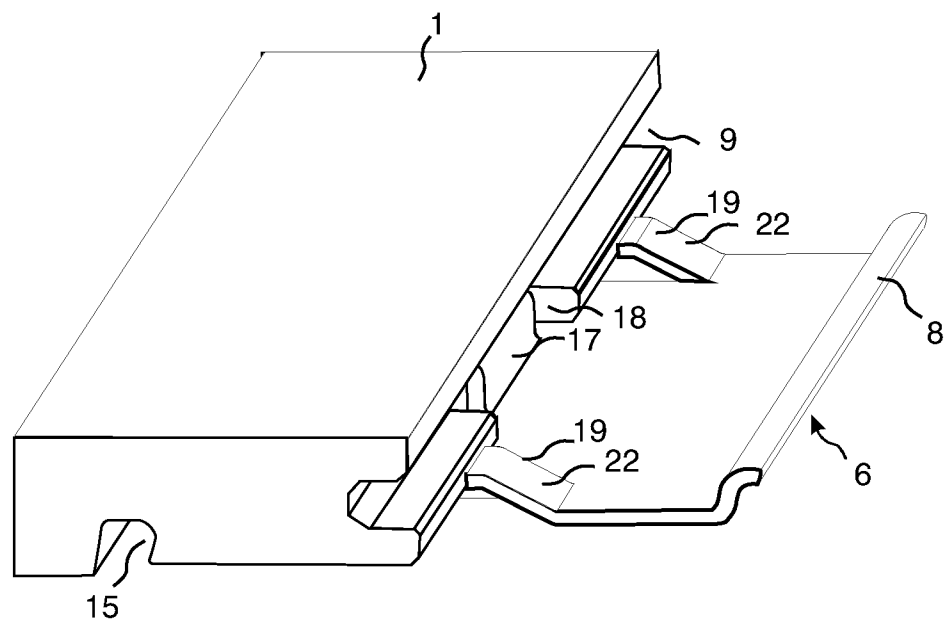


Fig.5a

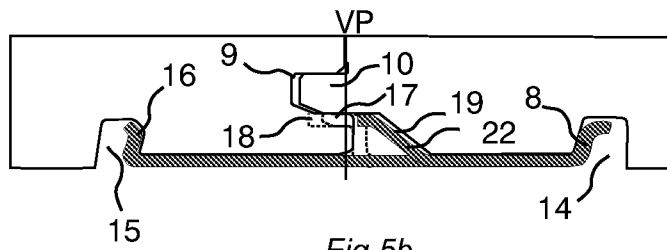


Fig.5b

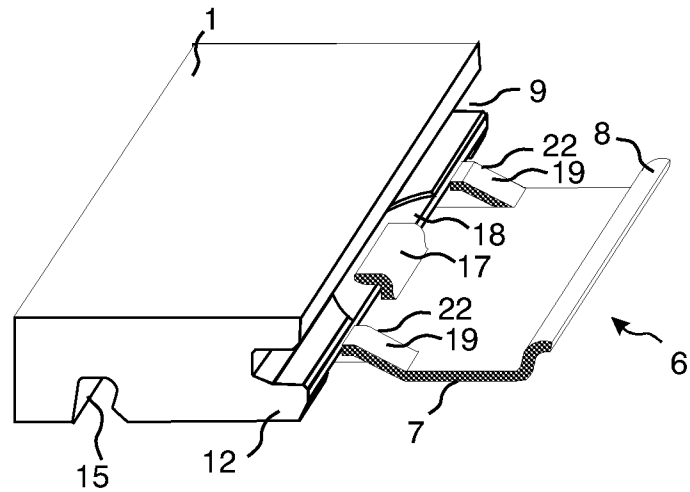


Fig.5c

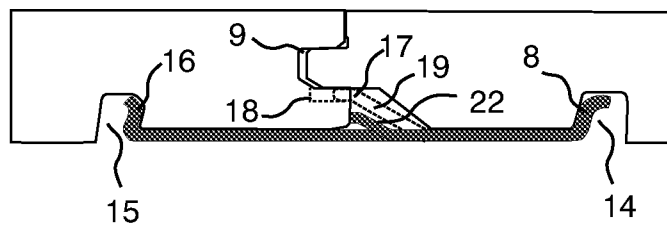
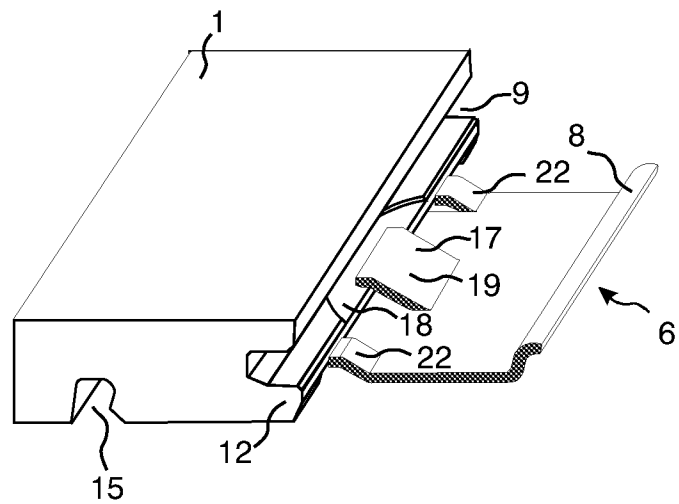


Fig.5d



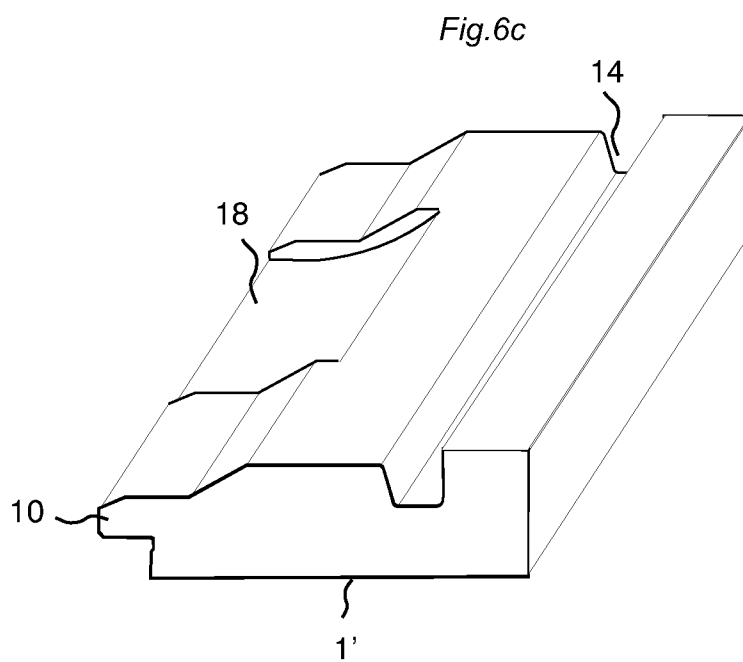
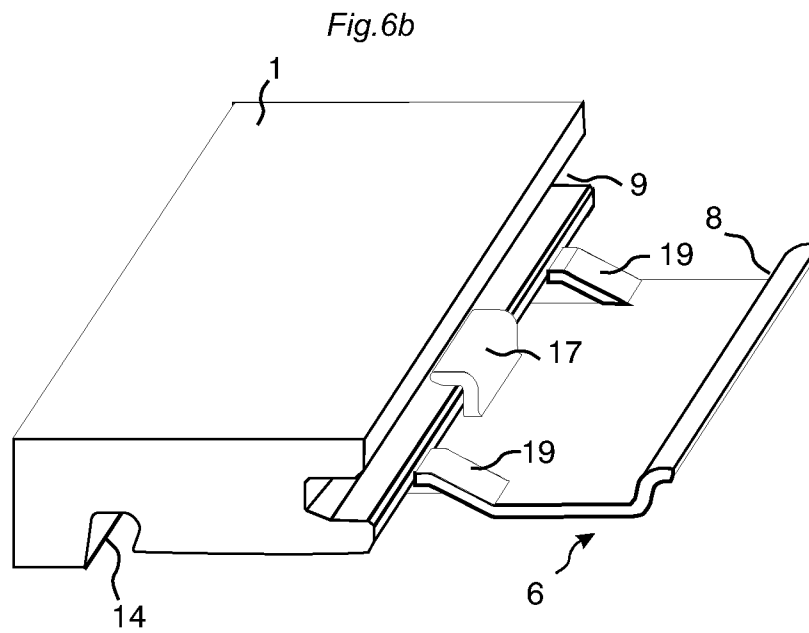
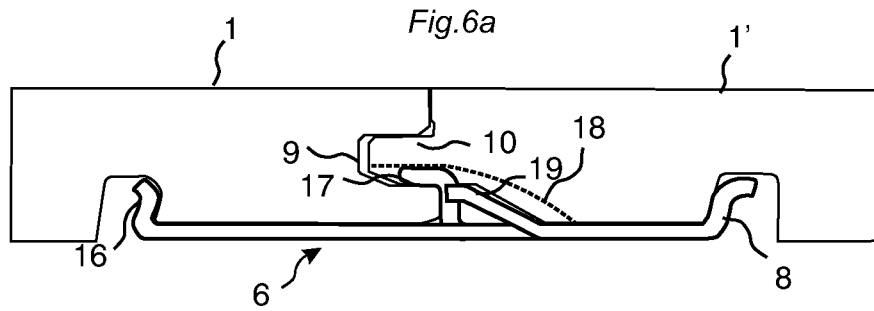


Fig.7a

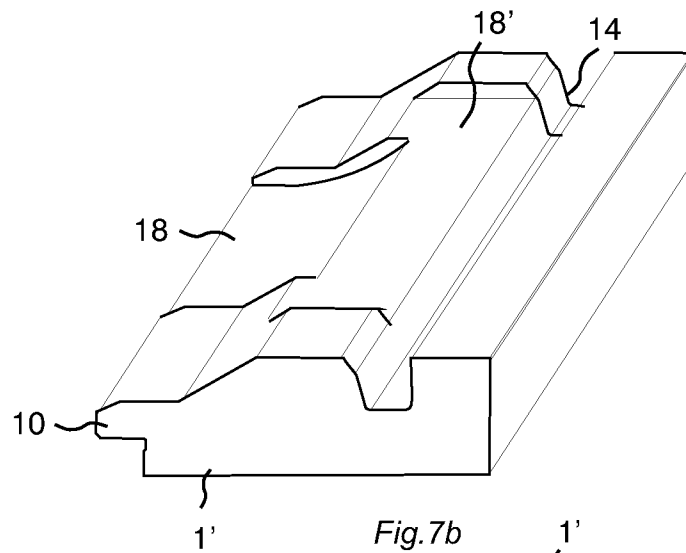


Fig.7b

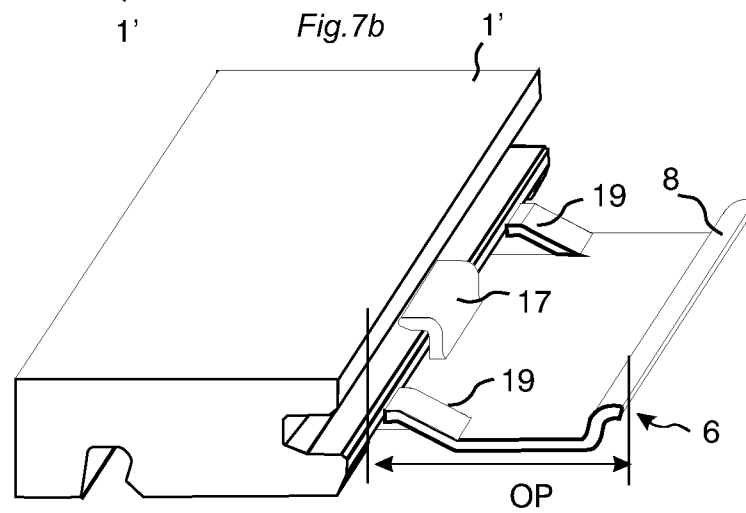


Fig.7c

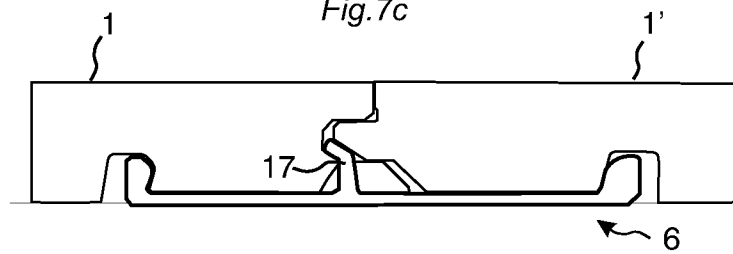


Fig.7d

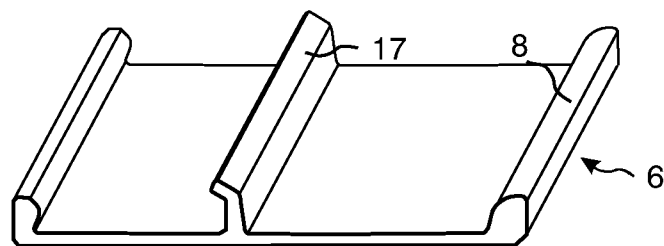




Fig.8a

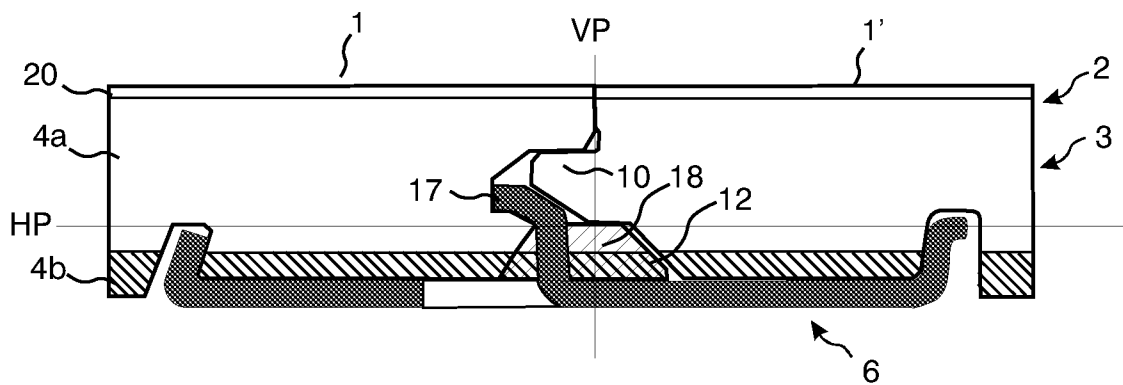


Fig.8b

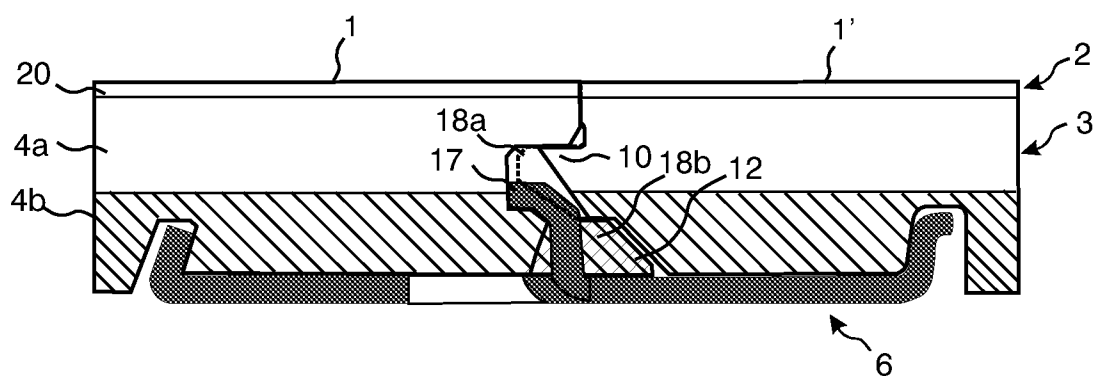


Fig.8c

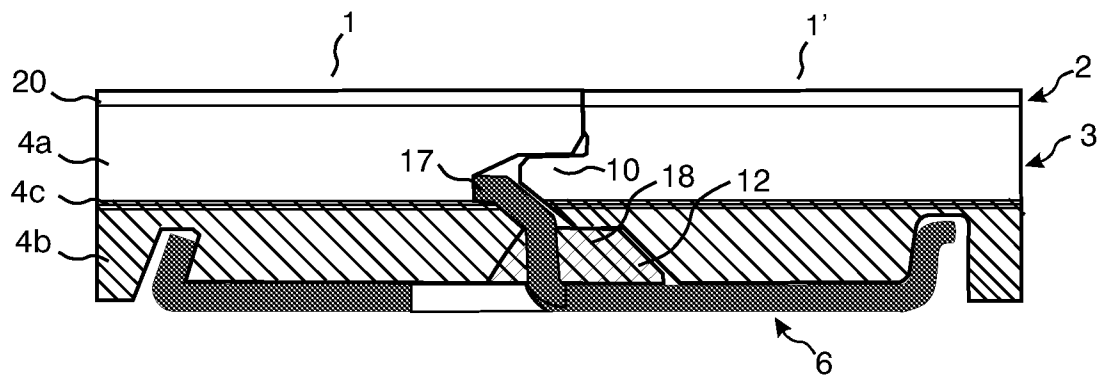


Fig.9a

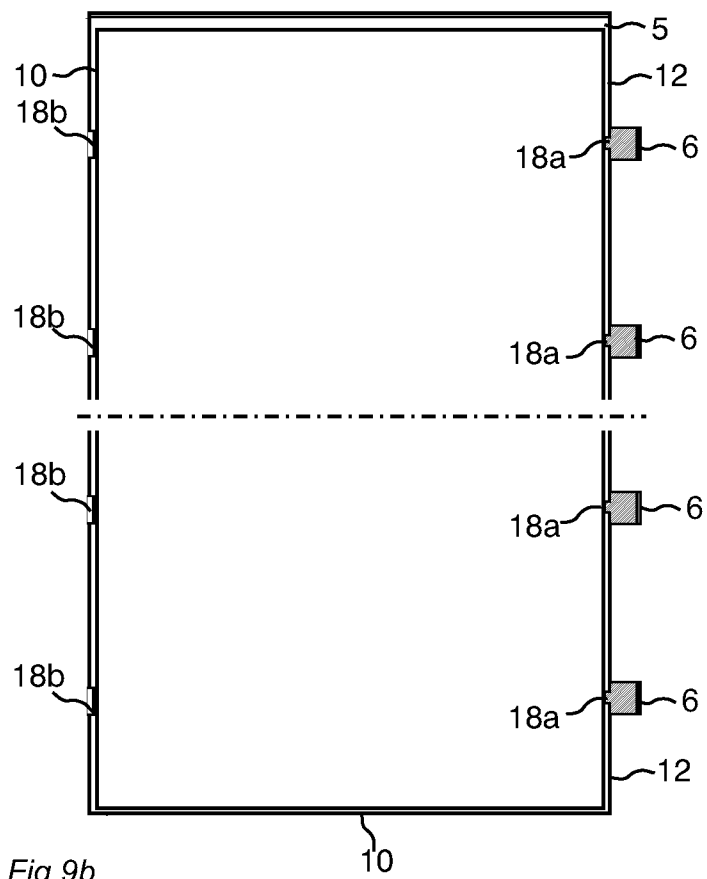
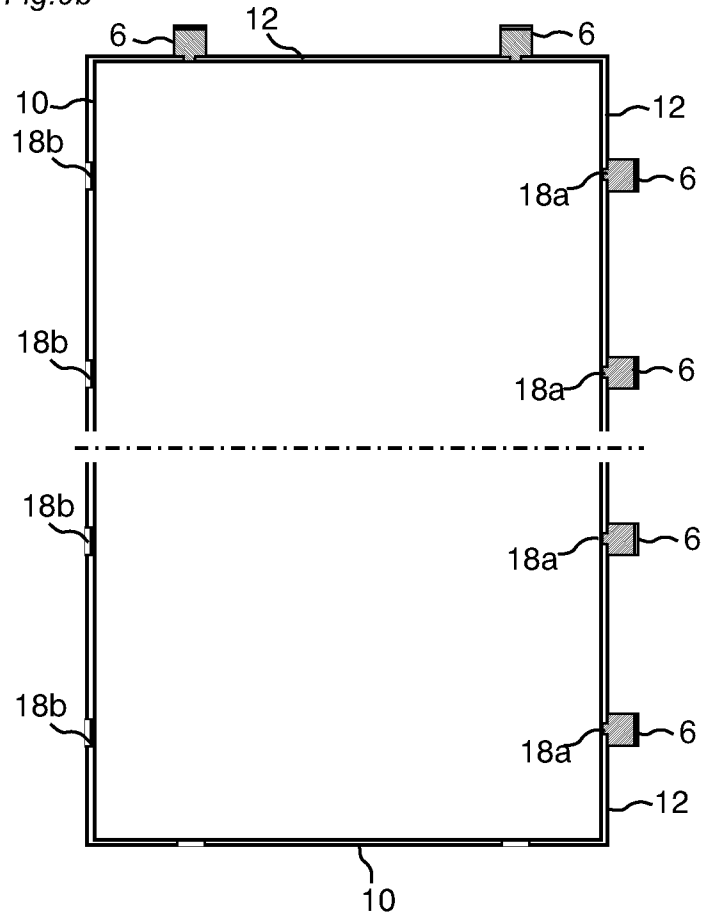
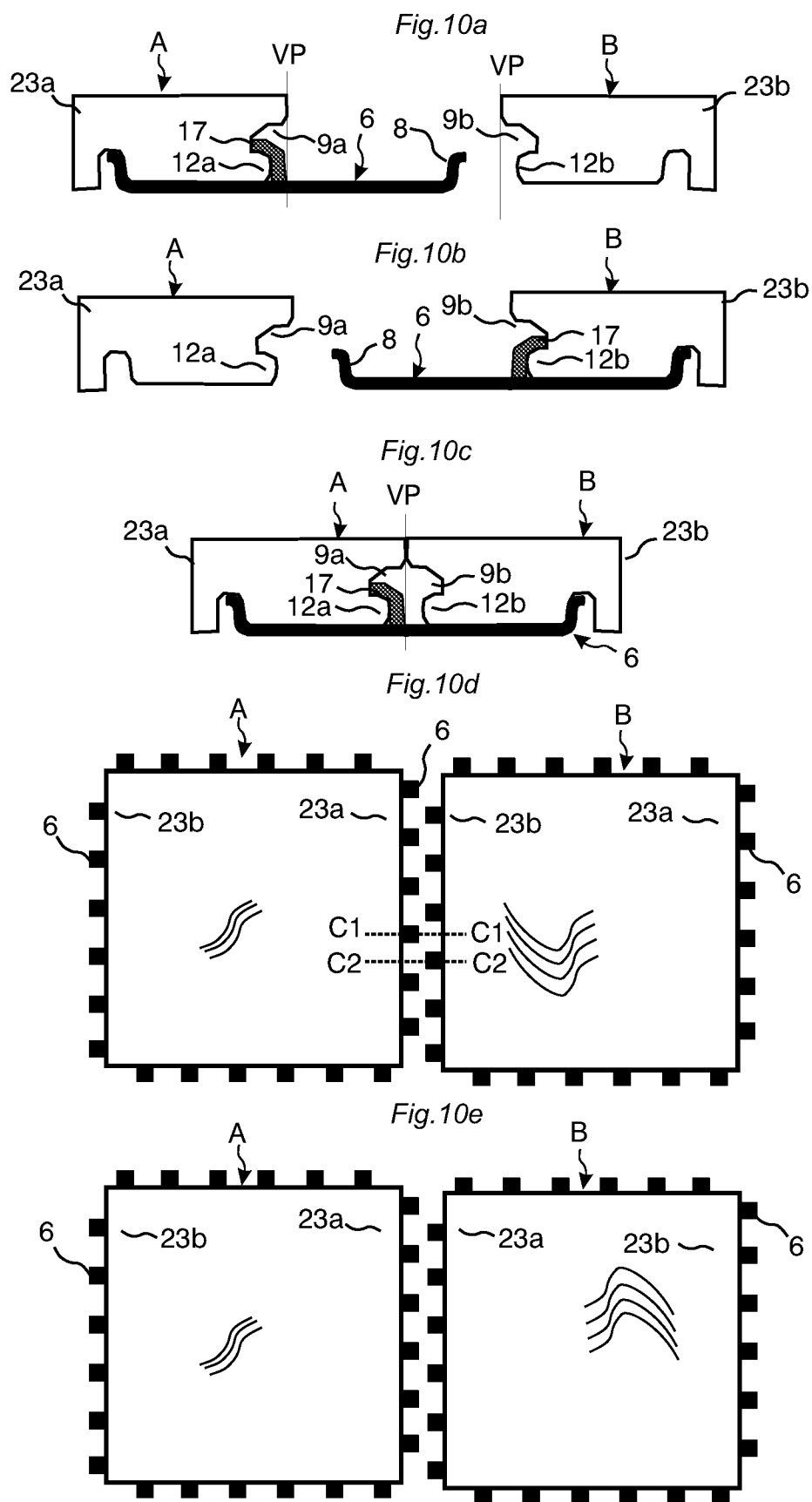


Fig.9b





## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE2014/051251

## A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E04F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2013025165 A1 (VAELINGE FLOORING TECHNOLOGY AB ET AL), 21 February 2013 (2013-02-21); abstract; page 21, line 24 - line 26; figures 4c, 12a, 19a, 19d; claim 1 --	1-9
X	US 20010010139 A1 (DE KERPEL JOHAN ET AL), 2 August 2001 (2001-08-02); abstract; figures 1a-3 --	1-9
A	US 20130047536 A1 (PERVAN DARKO), 28 February 2013 (2013-02-28); abstract; paragraphs [0003], [0086], [0113]; figures 6a-d, 21a-d --	1-9

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

13-03-2015

Date of mailing of the international search report

16-03-2015

Name and mailing address of the ISA/SE

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**INTERNATIONAL SEARCH REPORT**

International application No.  
PCT/SE2014/051251

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20110016815 A1 (YANG FENG-LING), 27 January 2011 (2011-01-27); abstract; figures 1-2B -- -----	1-9

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE2014/051251

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The following separate inventions were identified:

- 1: Claims 1-9 directed to building panels provided with a locking system.
- 2: Claims 10-13 directed to a flooring system comprising a first panel (A) and a second panel (B) being provided with a locking system.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-9

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

**Continuation of:** second sheet  
**International Patent Classification (IPC)**  
***E04F 15/02*** (2006.01)

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2014/051251

WO	2013025165 A1	21/02/2013	CN	103748299 A	23/04/2014
			EP	2744954 A1	25/06/2014
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			CN	103748300 A	23/04/2014
			EP	2751356 A1	09/07/2014
			JP	2014525527 A	29/09/2014
			KR	20140068068 A	05/06/2014
			WO	2013032391 A1	07/03/2013
US	20110016815 A1	27/01/2011	EP	2292871 A1	09/03/2011
			TW	M373948 U	11/02/2010
			US	8276343 B2	02/10/2012