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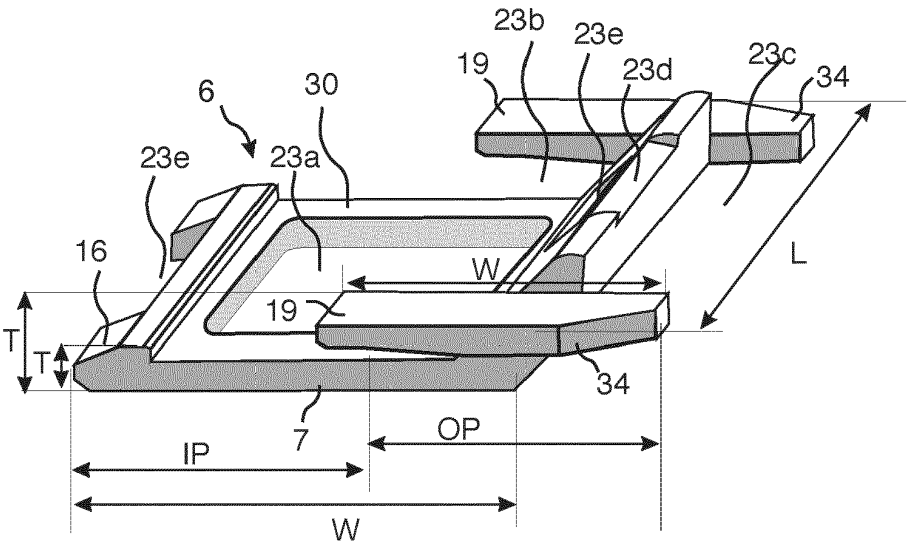
(54) **MECHANICAL LOCKING SYSTEM FOR FLOOR PANELS**

(57) The disclosure relates to a strip part 6 configured to lock panels in a horizontal direction and to be fixed to a panel edge of one of the panels. The strip part comprises a strip body 7 with an inner part IP configured to be fixed under the panel edge and an outer part OP configured to extend outside the panel edge. The inner part comprises a fixing element 16 configured to lock the strip part to the panel edge in a horizontal direction. The outer part comprises a locking protrusion 19 located above the strip body and which is configured to lock the strip part to the panel edge vertically, and a locking element configured to lock the panels in the horizontal direction. Moreover, the inner part comprises a cavity 23 formed in the strip body and located between the fixing element and the locking protrusion.

Fig. 12a



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Description

TECHNICAL FIELD

[0001] 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.

FIELD OF APPLICATION OF THE INVENTION

[0002] Embodiments of the present invention are particularly suitable for use in floating floors, which are formed of floor panels which are joined mechanically with a locking system integrated with the floor panel, i.e. mounted at the factory, are made up of one or more upper layers of wood or wood veneer, decorative laminate, powder based surfaces or decorative plastic material, an intermediate core of wood-fibre-based material or plastic material and preferably a lower balancing layer on the rear side of the core. Floor panels of solid wood or with a surface layer of cork, linoleum, rubber or soft wear layers, for instance needle felt glued to a board, printed and preferably also varnished surface and floors with hard surfaces such as stone, tile and similar materials are included. Embodiments of the invention may also be used for joining building panels which preferably contain a board material for instance wall panels, ceilings, furniture components and similar.

[0003] The following description of known 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 panels formed as rectangular floor panels with long and shorts edges intended to be mechanically joined to each other on both long and short edges.

[0004] The long and short edges are mainly used to simplify the description of embodiments of the invention. The panels may be square. Embodiments of the invention are preferably used on the long edges. It should be emphasised that embodiments of the invention may be used in any floor panel and it may be combined with all types of known locking system formed on the short edges, where the floor panels are intended to be joined using a mechanical locking system connecting the panels in the horizontal and/or vertical directions on at least two adjacent edges.

BACKGROUND OF THE INVENTION

[0005] 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 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.

[0006] 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 may 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.

[0007] The main advantages of floating floors with mechanical locking systems are that they are easy to install. They may also easily be taken up again and used once more at a different location.

DEFINITION OF SOME TERMS

[0008] 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 outer part of the surface layer. 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.

[0009] 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

[0010] 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 panel is then displaced in locked position along the long side. The short edges are locked by horizontal snapping. The vertical connection is generally a tongue and a groove. During the horizontal displacement, a strip with a locking element is bent and when the edges are in contact, the strip springs back and a locking element enters a locking groove and locks the panels horizontally. Such a snap connection is complicated since a hammer and a tapping block has to be used to overcome the friction between the long edges and to bend the strip during the snapping action.

[0011] 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.

[0012] It is known that a locking strip may be formed of a separate material such as aluminium or HDF and that such strip may be clamped in undercut grooves or attached into a horizontally extending groove formed at an edge of a panel by snapping and/or turning. Such systems are described in WO 94/26999 and WO 03/083234 (Valinge Innovation AB). It is also known that several strip parts spaced form each other may be attached to a long side edge in order to obtain further cost savings.

[0013] Figures 1a and 1b show a known locking system that is locked with angling. The horizontal locking is obtained by a locking strip 6 with a locking element 8 formed at one panel edge 1 that locks into a locking groove 14 formed in another adjacent panel edge 1'. The forming of the strip 6 creates a waste as shown in figure 1b.

[0014] Figure 1c shows a known locking system with a separate aluminium strip 6 attached to a lower part of a panel edge. A part of the strip 6 is bent around inwardly inclined vertically extending surfaces. Such connection of the strip 6 to the panel edge is made in a separate operation than the machining of the edge. The strip comprises three different cross section A-A, B-B and C-C. Each cross section comprises the same material thickness since the strip is formed from a 0,6 mm aluminium sheet. The length L of the strip is the same along the width W. The part of the strip that extends from the edge comprises a small cavity 23, which is formed when a part of the strip body is punched and bent around a panel edge.

[0015] Figure 1d shows a strip 6, which is attached with snapping into a horizontally extending groove. This strip is formed by machining and has the same cross section along its length.

[0016] Such locking systems suffer from several disadvantages. The material content is high due to the design and only limited material savings may be reached. This fixing of the strip to the edge is rather complicated and slow.

[0017] Figure 2a - 2c show a locking system with a separate displaceable tongue 10a inserted in a horizontally extending displacement groove 10b formed on the short edge of a panel. The separate tongue is inserted in high speed and is mainly used to obtain higher flexibility when the panels are locked with a vertical snapping. The short side production speed is however considerably lower than the long side production speed and conventional inserting methods that are used to insert flexible tongues are not suitable to be used at long edges to insert several strips one after each other.

[0018] Figure 3a shows a conventional panel with a strip 6 that extends along the whole long edge. Material savings may be increased if several strip parts 6 are connected on a long side of a panel as shown in figure 3b.

[0019] Wood and laminate panels are produced with a production speed on long edges of 1 - 5 m/sec. This means that 5 - 25 strip parts must be inserted each second if for example five strip parts per metre are attached at an edge. Known separate strips and fixing methods are not adapted to such high-speed production and separate strip parts are not able to compete with the conventional machining where the strip is machined in one piece with the panel edge.

[0020] It would be a major advantage if separate strip parts that comprise less material and that may be inserted in high speed could be used to replace the machined strip especially in a long edge locking system.

SUMMARY OF THE INVENTION

[0021] An overall objective of embodiments of the present invention is to provide an improved and more cost efficient locking system for primarily rectangular floor panels with long and short edges installed in parallel rows, which allows that the edges may be locked to each with angling, and/or horizontal snapping and/or vertical snapping.

[0022] Another specific objective is to provide production method that allows an efficient high-speed connection of several strip parts into an edge of a floor panel.

[0023] The above objects of embodiments of the invention may be achieved wholly or partly by locking systems and floor panels according to the disclosure. Embodiments of the invention are evident from the from the description and drawings.

[0024] A first aspect of the invention is building panels provided with a locking system for vertical and horizontal locking of a first edge of a first panel and a second edge of a second adjacent panel. The locking system comprises a tongue and a tongue groove for vertical locking and strip parts attached to the first edge for horizontal locking. Each strip part comprises an upwardly extending locking element configured to cooperate with a downwardly open locking groove formed at the second edge. The strip part comprises a strip body with an inner part that extends inwardly from the first edge and at a rear side of the first panel and an outer part that extends outwardly from said first edge. The inner strip part comprises a fixing element that cooperates with a downwardly open fixing groove, formed in the rear side of the first panel, and locks the strip part to the first edge in a first horizontal direction. The strip part comprises a locking protrusion, located above the strip body, that locks the strip to the first edge vertically and in a second horizontal direction against a holding protrusion formed at the first edge. The strip part is configured to be attached to the first edge with an essentially horizontal snapping action. The strip part comprises upper and lower guiding surfaces that are essentially parallel with the strip part body.

[0025] The strip part may comprise a locking protrusion that protrudes horizontally from the locking element.

[0026] The locking protrusion may comprise a sliding surface that during locking is in contact with the adjacent edge.

[0027] The locking protrusion may be spaced vertically from the strip body

[0028] The strip body may comprise a cavity in the inner part.

[0029] The length of the strip part may vary along its width.

[0030] The fixing element may comprise a flexible locking part that locks against a wall of the fixing groove.

[0031] A second aspect of the invention is a strip blank comprising several strip parts configured to lock panels horizontally and to be fixed to a panel edge by essentially horizontal snapping. The strip blank comprises at least two strip parts located side by side in at least two parallel rows.

[0032] A third aspect of the invention is a method to fix several strip parts to an edge of a panel. Each strip part comprises a strip body that extends inwardly from the edge at the rear side of the panel and is configure to lock two adjacent panels horizontally and to be fixed to a panel edge by essentially horizontal snapping. The method comprises the steps of:

separating strip parts from a strip blank that comprises at least two strip parts located side by side in at least two parallel rows;

displacing the strip parts essentially vertically in front of several hammers;

pressing and snapping the strip parts by the hammers to a panel edge by an essentially horizontal displacement; and

activating the hammers one after each other when the panel is displaced horizontally in relation to the hammers.

[0033] A fourth aspect of the invention is building panels provided with a locking system for vertical and horizontal locking of a first edge of a first panel and a second edge of a second adjacent panel. The locking system comprises a tongue and a tongue groove for vertical locking and strip parts attached to the first edge for horizontal locking. Each strip part comprises an upwardly extending locking element configured to cooperate with a downwardly open locking groove formed at the second edge. The strip part comprises a strip body with an inner part that extends inwardly from the first edge and at a rear side of the first panel and an outer part that extends outwardly from said first edge. The inner part comprises a fixing element that cooperates with a downwardly open fixing groove formed on the rear side of the first panel and that locks the strip part to the first edge in a horizontal direction. The strip part comprises a locking protrusion, located above the strip body that locks the strip part to the first edge vertically against a holding protrusion formed at the first edge. The strip part comprises polymer material and is formed by injection moulding.

[0034] The inner part may comprise several cavities.

[0035] The outer part may comprise a cavity.

[0036] The cavity may comprise a wall with a wall thickness, which is smaller than the width of the cavity.

[0037] The length of the strip part may vary along its width.

[0038] The fixing element may comprise a flexible locking part that locks against a wall of the fixing groove.

[0039] The building panel may be a floor panel.

[0040] A fifth aspect of the invention is a strip part, configured to lock panels horizontally and to be fixed to a panel edge. The strip part comprises a strip body with an inner part configured to be fixed under the panel edge and an outer part configured to extend outside the panel edge. The inner part comprises a fixing element configured to lock the strip part to the panel edge in a horizontal direction. The outer part comprises a locking protrusion, located above the strip body and configured to lock the strip part to the panel edge vertically, and a locking element configured to lock the panels in a horizontal direction. The inner part comprises a cavity formed in the strip body and located between the fixing element and the locking protrusion.

[0041] The fixing element may comprise a flexible locking part that prevents the strip part to be released from the panel edge by angling.

[0042] The flexible locking part may comprise a flexible protrusion extending along the fixing element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043] 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:

Figs 1a-d	illustrate locking systems according to known technology.
Figs 2a-c	illustrate a flexible and displaceable tongue according to known technology.
Figs 3a-3b	illustrate floorboards with locking systems according to known technology.
Figs 4a-d	illustrate a locking system according to an embodiment of the invention.
Figs 5a-f	illustrate a method to fix the strip to an edge according to an embodiment of the invention.
Figs 6a-b	illustrate an inserting method according to an embodiment of the invention.
Figs 7a-d	illustrate locking by horizontal snapping according to an embodiment of the invention.
Figs 8a-e	illustrate locking by horizontal and vertical displacement according to an embodiment of the invention.
Figs 9a-d	illustrate embodiments of the invention
Figs 10a-d	illustrate vertical snapping with a separate tongue according to an embodiment of the invention.
Figs 11a-h	illustrate embodiments of the invention.

Figs 12a-f illustrate methods according to embodiments of the invention to reduce material content in injection moulded spring parts.
Figs 13a-f illustrate fixing of a strip according to an embodiment of the invention that comprises a locking extension
Figs 14a-c illustrate a panel with strip parts according to an embodiment of the invention.
Figs 15a-d illustrate forming of strip parts by machining according to an embodiment of the invention.
Figs 16a-d illustrate forming of strip parts by machining according to an embodiment of the invention.
Fig 17 illustrates a strip blank according to an embodiment of the invention.
Figs 18a-d illustrate different embodiments of the invention.
Figs 19a-d illustrate a strip part with a flexible locking part.
Figs 20a-e illustrate fixing of a strip part with horizontal displacement and turning.
Figs 21a-d illustrate embodiments of strip parts and fixing of strip parts.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0044] To facilitate understanding, several locking systems in the figures are shown schematically. It should be emphasised that improved or different functions may be achieved using combinations of the embodiments.

[0045] 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.

[0046] Figures 4a-4d show a locking system according to embodiments of the invention that may be connected with angling. Figure 4a shows a strip part 6 comprising a strip body 7 with a fixing element 16 at an outer part, an upwardly extending locking element 8 at an opposite and outer part of the strip body and a locking protrusion 19 that preferably extends essentially horizontally towards the fixing element. The upper part of the locking element 8 comprises an upper guiding surface 22 and the strip body 7 comprises a lower guiding surface that facilitates the fixation of the strip 6 to an edge of a first panel 1' as shown in figures 5a - 5e. The locking protrusion 19 comprises a sliding surface 20 that facilitates the insertion of a tongue 10 into a tongue groove 9 during angling as shown in figure 4b. The panel edge comprises a fixing groove 15 that is open towards the rear side of the panel and a holding protrusion 18 extending from a lower part of the panel edge. The fixing element 16 is locked into the fixing groove 15 wherein essentially vertical locking surfaces 17a and 17b grip behind each other such that the strip is locked horizontally to the panel edge. The locking protrusion 19 is locked to the holding protrusion 18 vertically wherein a lower horizontal locking surface 24 on the locking protrusion 19 overlaps an upper horizontal locking surface 25 formed on the holding protrusion 18. The locking protrusion 19 comprises preferably a strip locking surface 26 that cooperated with an edge locking surface 27 formed on the panel edge and locks the strip part 6 horizontally. The strip part is locked horizontally by the active locking surfaces comprising the strip and the edge locking surfaces 26,27 and the cooperating fixing surfaces 17a, 17b. The strip part 6 is locked vertically by lower and upper horizontal locking surfaces 24,25 and by the upper part of the strip body 28 and the lower part of the edge 29 as shown in figure 4b. The locking element may have a locking angle A of preferably about 40 - 90 degrees against a horizontal plane. A high locking angle A gives a strong locking but requires a larger locking distance LD which is the distance from the vertical plane VP, where the upper edges are in contact, and to the upper part of the locking surface 11 of the locking element 8. The strip part comprises an inner part IP that extends inwardly from the edge at a rear side of the panel edge and an outer part OP that extends from the edge. The strip has a length direction L along the joint, a width W direction in a horizontal direction perpendicular to the length and a thickness direction T vertically and perpendicularly to the width W as shown in figures 4c and 4d. The thickness of the strip body 7 varies along the width and this facilitates the connection of the strip 6 to the edge. The thickness of the locking protrusion may also vary. Preferably there is a space S between the holding and locking protrusions 18,19, the strip body 7 and the locking element 8 as shown in figure 4b. Such a space S may be used to increase the flexibility of the strip and to facilitate the connection of the strip to the edge.

[0047] Figures 5a - 5e show a method to fix a strip part 6, as described in figures 4a-4d, to an edge a panel. The panel 1 is during machining of the edges positioned with the surface pointing downwards. It is preferred that the strip part is fixed to the panel in the same machining equipment that forms the edge by rotating tools. This puts special requirement on the inserting method, especially if several strip parts are to be fixed in high speed to a long side edge of a panel. The strip parts are preferably separated from a strip part blank, comprising several strip parts, and displaced vertically to the same level as the panel edge as shown in figure 5a. The strip parts are guided by upper 31 and lower 32 guiding rails and pushed by a hammer 30 towards the edge of the pane 1. The strip is connected to the edge with an essentially horizontal snapping action whereby the fixing element 16 enters partly or completely into the fixing groove 15 and the locking protrusion 19 overlaps the holding protrusion 18. Such a connection may be accomplished in high speed and accuracy due to the flexibility of the strip parts and the precise guidance of the guiding rails. The strip part 6 is after connection displaced laterally in the direction of the long edges by the panel that is displaced relative the fixing equipment. A final connection of the fixing

element 16 into the fixing groove 15 is preferably made with a wheel 33 that presses the fixing element 16 into the fixing groove 15 as shown in figure 5e. The fixing element 16 may press against two opposite walls of the fixing groove 15 as shown in figure 5d and 5e. Figure 5f shows that bevels or rounded sections 34a, 34b may be formed on the outer part of the strip part and/or the panel edge in order to facilitate snapping. The strip body 7 may also be thinner at an outer portion than at an inner portion in order to facilitate snapping and to save material. Bevels or rounded sections may also be formed on the outer parts of the holding and locking protrusions 18,19. The horizontal locking surfaces may be essentially horizontal or inclined.

[0048] Figures 6a and 6b show a method that may be used to increase the production speed such that it may be possible to insert up to 30 strip parts per second and more. The strip parts are in these figures shown with the locking element 8 pointing upwards. The strip parts 6 are produced in strip blanks 50 comprising several strip parts attached to each other in parallel rows. Each row may comprise for example 5 - 10 strip parts 6a-6e or more as shown in figure 6b. The strips are separated and moved to a position, preferably vertically, in front of several hammers 30a - 30e that preferably are located behind each strip in the row. The whole strip part row is inserted by the hammers that push the strip parts one after each other towards the panel edge. The spacing between the strips parts attached to an edge is obtained by the time difference that the hammer action is activated by a computer system.

[0049] Figures 7a - 7d show that the strip part 6 may be used in locking systems that are locked with horizontal snapping where a part of the strip is bent during snapping. The locking protrusion 19 is in this embodiment connected to the strip body 7. A part of the locking protrusion 19 comprises a guiding surface 22 as shown in figure 7d.

[0050] Figures 8a-8b shows that horizontal snapping may be obtained by a locking element 8 that is flexible and bends during locking.

[0051] Figures 8c -8d shows that the locking system may be locked by vertical displacement. The locking is accomplished by a flexible locking element 8 that bends during the vertical displacement of the panel edges.

[0052] Figure 8e shows that a part of the locking element 8 and the locking protrusion 19 may comprise guiding surfaces 22.

[0053] Figures 9a - 9d show that a tongue 10a may be formed on the first panel 1 comprising the strip part 6 and this may be used to facilitate for example a connection with vertical displacement.

[0054] Figures 10a-10d show that the strip part 6 may comprise a pulling extension 13 that pulls a displaceable tongue 10a into a tongue groove 9 during vertical displacement of the panels. The strip part 6 is made of several cross sections which allowed that guiding rails may be locate on each side of a locking element 8 and a locking protrusion 19.

[0055] Figures 11a- 11h show a strip part 6 that is formed by injection moulding. This production method makes it possible to form advanced three dimensional strip parts, which are optimized to save material. The locking protrusion 19 is formed as two parts 19a, 19b that are spaced from each other by a cavity 23. The locking protrusions are connected to the edges of the locking element 8 as shown in figure 11b. Figures 11c and 11d show that such locking protrusions may comprise a locking extension 34 that extends horizontally on each side of the locking element 8 such that a cavity 23a is formed between the extensions. Such extension may comprise guiding surfaces 31,32 and may be used to guide the strip part with high precession during production when the strip part is fixed to the edge as shown in figure 11h.

[0056] Figure 11e shows a three-dimensional view of a first panel 1 provided with a strip part 6.

[0057] Figure 11f illustrates assembling a first panel 1 with a second adjacent panel.

[0058] Figure 11c shows that the locking extension 34 or any other part of the strip may be in contact with an inner wall of the locking groove 14 and that the panels 1, 1' are locked with a small space S between the upper edges. Such locking system may be used in, for example, floors that are glued down to the sub floor and where a small space gives room for swelling of the edges such that the so called "topping" of the edges may be avoided. The strip parts may be used to position floor panels that are glue down and to keep the floor panels in correct position until the glue cures. Only a few strip parts with rather low material content are needed to facilitate glue down installation.

[0059] Figures 12a - 12f show that considerable material reductions may be reach with a strip part 6 that is three-dimensional and comprises several cavities 23a-23e. The strip part is preferably formed by injection moulding of a polymer material that preferably comprises glass fibres. Cavities may be formed in the strip body 23a, in the locking protrusion 23b, in the locking extension 23c, in the locking element 23d and in the fixing element 23e. The strip part 6 and the cavities have a length L in a direction along the panel edge, a width W perpendicular to the edge and a thickness T in the vertical direction. The length L of the strip part may vary along the width W, the width W may vary along the length L and the thickness may vary along the length L.

[0060] Figures 12b - 12f show alternative embodiments of a three-dimensional strip part 6. The strip part may have several cavities 23a, 23f formed in the strip body and/or in the locking protrusion 19 as shown in figure 12b. A cavity 23 has preferably a wall 40 with a wall thickness WT that is smaller than the width of the cavity. Such three dimensional forms will provide considerable cost savings.

[0061] Figure 12c shows a strip part without a locking extension 34. Figure 12d-12f shows that the cavities may have different forms and that the fixing element 16 may be discontinuous. Figure 12e show a locking extension

34 that extends from a middle part of the locking element and that may be used as guiding according to the principle shown in figure 13c.

[0062] Figures 13a - 13f show a production method to fix a strip part 6 to a panel edge. The strip parts comprise locking extensions 34 that are used to guide the strip part during production when the strip part is fixed to the edge of the panel. It is preferred that strip parts are factory connected but they may of course be connected to a panel during installation.

[0063] The strip parts are displaced in strip blanks towards a displacement device 35 that preferably displaces the strip parts vertically to a plane in front of several hammers 30a-30c. The strip parts are preferably also separated from each other and from the blank 50 by the displacement device. Figure 13a shows a strip blank 50 seen from above and figure 13b show the cross section seen from the side. Figures 13c - 13f show how a strip part is fixed to an edge with essentially a snapping action when the strip part is guided with high precision by the guiding rails 31, 32 and the locking protrusion 19 with its locking extension 34. The strip body 7 may bend but also turn in relation to the locking protrusion 19 as shown in figure 13e. The connection between the locking element 8 and the locking protrusion may be formed such that a small turning may take place and this may facilitate the insertion of the strip and reduce the requirements on the flexibility of the strip body 7. A snapping may be obtained even if the strip body 7 is rather rigid and compact since the turning in relation to the locking protrusion 19 may be sufficient to allow a snapping action. The locking protrusion 19 may also be flexible and bend during the fixation of the strip. The hammer may comprise a hammer groove 35 as shown in figure 13c and this may be used to feed and position the strip parts as a complement or alternative to guiding rails. The guiding surfaces may in such an embodiment be somewhat inclined.

[0064] Figure 14a shows a part of panel with strip parts on the long and on the short edges. The strip blank comprises preferably the same number of strip parts that are connected to an edge. The strip parts may have a length of, for example, about 1 - 10 cm. Each strip part may be designed to handle a locking force of 10 - 100 kg. The distance between the strip parts may be 5 - 20 cm. As a non restricted example it may be mentioned that a preferred embodiment for a laminate flooring panel with a length of about 1,2 m is a panel that comprises 6 strip parts which are about 4 cm long and attached with a centre distance of about 20 cm and 10 cm from the short edges. Each strip part may be designed such that it has a locking strength of about 60 kg in the horizontal direction. The locking system will have a locking strength of 300 kg/m and this is generally sufficient for a laminate floor.

[0065] Strip parts are especially suitable for thicker laminate floorings with a thickness of 9 - 15 mm, high quality floors with a HPL, plastic or powder based surface or solid wood floors. The material waste in such floors is considerable when a locking system is formed with a conventional machined strip made in one piece with the core. Strip parts are also suitable in so called plastic LVT floors that have an expensive and soft core, which is not suitable to form a rigid strip.

[0066] Parquet flooring with a lamella core are difficult to machine since the machining is made cross wise to the fibre orientation in the lamellas. Strip parts may solve such problems.

[0067] The cost to produce a conventional locking system in solid wood floor is very high and the locking system is generally of a low quality. The stress on the locking system is very high due to the fact that the edges and the strip swells, shrinks and bends. Separate strip parts are therefore especially suitable for this application.

[0068] Preferably, the long edges may comprise a locking system with strip parts that may be locked by angling and the short edges may comprise a locking system with cooperating hooks that may be locked by vertical folding.

[0069] Strip parts on any of the opposite long or short edges may be combined with all known locking systems on the other opposite edges.

[0070] The invention does not exclude strip parts attached on both opposite edges that lock between each or into each other along the joint.

[0071] Strip parts may also be used to decrease the friction along the joint in order to facilitate displacement and horizontal snapping of the short edges. Plastic material may have a low friction and the contact area between the strips and the locking groove 14 in an adjacent edge may be reduced by more than 80% compared to a conventional locking system.

[0072] Strip part may also be used to increase friction between long edges and prevent displacement along the edges such that the short edges are locked horizontally by the long edges. Special protrusions extending vertically or horizontally from the locking element 8 and/or additional flexible locking elements that press against the edge of the adjacent panel 1', preferably against a part of the locking groove 14, may easily be formed on the strip parts by injection mouldings.

[0073] The strip parts may compose special material such as, for example, wax that facilitates angling and/or snapping and that reduces the risk for squeaking sound after installation.

[0074] Figures 15a - 15c show that strip blanks 50 and strip parts 6 may be formed by machining of a wood based or plastic based sheet material. A locking extension 34 may be formed on the strip body that, as shown in this embodiment, extends horizontally beyond the locking element. Figure 15d shows that the strip blank 50 may comprise a long extruded or machined section that is prior to fixing divided into several strip parts 6a, 6b by a rotating tool that also forms locking extensions as shown in figure 16c.

[0075] Figures 16a - 16d show a production method to form strip blanks 50 and strip parts 6 by machining of a wood based or plastic based sheet material. The cross

sections are formed by rotating tools To1, To2, To3 and To4. The sections are thereafter partly separated by a rotating tool To5 cross wise and finally separated by a punching tool To6 during the fixing of the strip part6.

[0076] Figure 17 shows a strip blank 50 with cavities 34 formed by punching between strip parts in order to facilitate the final separation. The strip blank 50 comprises at least two strip parts 6a, 6b connected side by side in at least two rows R1 and R2. A strip part may preferably comprise 5-10 strip parts connected side by side in 5 - 30 rows. The strip blanks are preferably designed such that they may be stacked on top of each other.

[0077] Figure 18a shows a strip part that is connected into a groove formed in an edge. Such known strip part may also be produced in strip blanks according to the described production methods. One disadvantage with strips that are inserted into a horizontally extending groove formed in the panel edge is that the core must be made of a material with sufficient flexibility. A strip 6 that has a flexible inner part may solve this problem. Such a strip may be formed as an injection-moulded component that comprises two cross sections 6a, 6b along its length as shown in figures 18c and 18d.

[0078] Figures 19a-d show a strip part 6 that may be used to for example lock solid wood floors that have a considerable swelling and shrinking across the fibre direction. Figure 19a shows the strip part 6 seen from above and figure 19b shows a cross section. The fixing element 16 comprises a flexible locking part 41 and an undercut 15a formed in the fixing groove 15 that prevent the strip part 6 to be disconnected during transport and installation. The flexible locking part 41 is prevented to flex vertically upwards by a blocking part 42 when the flexible locking part 41 is compressed towards the fixing element 16 and under the blocking part 42. The strip part comprises cavities 23a, 23b in its inner and outer parts with walls 40a, 40b that may be essentially parallel with the width W of the strip part 6 or they may be rounded or curved such that the strip part may be flexible along its width W. This flexibility may be used to compensate swelling and shrinking of the floor panel or to compensate production tolerances.

[0079] Figure 19c and 19d show that the strip part may be connected to an edge comprising the tongue 10 or the tongue groove 9.

[0080] Figures 20a - 20e show fixing of a strip part 6 comprising a fixing element 16 with a flexible locking part 41. The strip part is displaced vertically or horizontally in an angled position towards the panel edge such that it reaches a position where the holding and locking protrusions 18,19 partially overlap each other and the flexible locking part 41 is in contact with an edge part 15b of the fixing groove 15 as shown by figures 20a,b. The edge part 15b comprises preferably an essentially vertical edge. The strip part is thereafter pressed horizontally inwardly such that the flexible locking part 41 is compressed and the strip part is angled such that the fixing element 16 is inserted into the fixing groove 15 as shown in figures 20c,d. There may be a play 43b between the fixing groove 15 and the fixing element 16 and such a play facilitates fixing with angling. The fixing element and the fixing groove may have locking surfaces that exceed 90 degrees. Figure 20e shows that the pre tension of the flexible locking part 41 will press the strip part outwardly such that the locking surfaces 17 are in contact and the strip part will be firmly connected to the panel edge.

[0081] The strip parts 6 may be produced and delivered as individual elements. They may have a form that makes it possible to position the individual strip parts side by side automatically by shaking, rotation etc. as shown in figure 21a.

[0082] The strip parts may have one or several flexible locking parts 41 that may be formed in the fixing element as snapping tabs or snapping hooks. The flexible locking parts are preferably formed as flexible protrusions 44a, 44b extending and flexing along the fixing element 16 and in the length direction L of the strip part 6. A pair of flexible protrusions 44a, 44b may be oriented towards each other as shown in figure 21a or away from each other as shown in figure 21b. The cooperating blocking part 42 is preferably located opposite an outer part of a flexible protrusion.

[0083] Figure 21b shows that flexible parts or protrusions 44c,d with cooperating blocking parts 42b may also be formed on the holding protrusion 18 and this allows that the strip part 6 may be connected to a panel edge with vertical snapping. Flexible parts or protrusions 44e that lock against a wall of the locking groove 14 and cooperating blocking parts 42c may also be formed on the locking element 8 and this may be used to prevent the locking element 8 to snap out from the locking groove 14 in order to increase the locking strength. All embodiments may be partly or completely combined with each other.

[0084] Strip parts 6a-f may be fixed to the edge by a displacement along the panel edge. A pressure force P1 may be used to displace the strip parts along the edge until they reach an end position where they are pressed horizontally P2 and vertically P3 such that they may be connected to the panel edge as shown in figures 20a-e. Wheels and rulers may be used to displace and angle the strip parts into the required positions. The mechanical connection may be combined with glue.

[0085] Figure 21d shows that a strip part 6 with a flexible locking part 41 may be connected to a panel edge with an essentially horizontal snap action.

EMBODIMENTS

[0086]

Item 1. Building panels provided with a locking system for vertical and horizontal locking of a first edge of a first panel (1) and a second edge of a second adjacent panel (1'), said locking system comprises a tongue (10) and a tongue groove (9) for vertical locking and strip parts (6) attached to the first edge

for horizontal locking, each strip part (6) comprises an upwardly extending locking element (8) configured to cooperate with a downwardly open locking groove (14) formed at the second edge **characterised** in that each strip part (6) further comprises:

- a strip body (7) with an inner part (IP) that extends inwardly from the first edge and at a rear side of the first panel (1) and an outer part (OP) that extends outwardly from said first edge, the inner 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), and locks the strip part (6) to the first edge in a first horizontal direction;

- a locking protrusion (19), located above the strip body (7), that locks the strip to the first edge vertically and in a second horizontal direction against a holding protrusion (18) formed at the first edge; and

- upper (22) and lower (21) guiding surfaces that are essentially parallel with the strip part body (7), and that the strip part is configured to be attached to the first edge with an essentially horizontal snapping action.

Item 2. The building panels according to item 1, wherein the locking protrusion (19) protrudes from the locking element (8).

Item 3. The building panels according to item 1 or 2, wherein the locking protrusion (19) comprises a sliding surface (20) that during locking is in contact with the second edge.

Item 4. The building panels according to any one of the preceding items 1-3, wherein said locking protrusion (19) is spaced vertically from the strip body (7)

Item 5. The building panels according to any one of the preceding items 1-4, wherein the strip body (7) comprises a cavity (23) in the inner part (IP).

Item 6. The building panels according to any one of the preceding items 1-5, wherein the length (L) of the strip part (6) varies along its width (W)

Item 7. The building panels according to any one of the preceding items 1-6, wherein the fixing element (16) comprises a flexible locking part (41) that locks against a wall of the fixing groove (15)

Item 8. A strip blank (50) comprising several strip parts (6) configured to lock panels (1,1') horizontally and to be fixed to a panel edge by essentially horizontal snapping, **characterised** in that the strip blank comprises at least two strip parts (6a, 6b) located side by side in at least two parallel rows (R1,R2).

Item 9. A method to fix several strip parts (6) to an edge of a panel (1), each strip part comprises a strip body that extends inwardly from the edge and at the rear side of the panel and is configured to lock two adjacent panels (1,1') horizontally and to be fixed to a panel edge by essentially horizontal snapping, wherein the method comprises the steps of:

separating strip parts (6) from a strip blank (50) that comprises at least two strip parts (6a,6b) located side by side in at least two parallel rows (R1,R2) (30;

displacing the strip parts essentially vertically in front of several hammers (30a, 30b);

pressing and snapping the strip parts by the hammers (30a, 30b) to a panel edge by an essentially horizontal displacement; and

activating the hammers (30a,30b) one after each other when the panel (1) is displaced horizontally in relation to the hammers.

Item 10. Building panels provided with a locking system for vertical and horizontal locking of a first edge of a first panel (1) and a second edge of a second adjacent panel (1'), said locking system comprises a tongue (10) and a tongue groove (9) for vertical locking and strip parts (6) attached to the first edge (1) for horizontal locking, each strip part (6) comprises an upwardly extending locking element (8) configured to cooperate with a downwardly open locking groove (14) formed at the second edge **characterised** in that each strip part (6) further comprises:

a strip body (7) with an inner part (IP) that extends inwardly from the first edge and at a rear side of the first panel (1) and an outer part (OP) that extends outwardly from said first edge, the inner 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), and that locks the strip part (6) to the first edge in a horizontal direction, the inner part (IP) comprises a cavity (23);

a locking protrusion (19), located above the strip body (7), that locks the strip part to the first edge vertically against a holding protrusion (18) formed at the first edge; and

polymer material and is formed by injection moulding.

Item 11. The building panels according to item 10, wherein the inner part (IP) comprises several cavities (23) .

Item 12. The building panels according to item 10 or 11, wherein the outer part (OP) comprises a cavity (23).

Item 13. The building panels according to any one of the preceding items 10 - 12, wherein the cavity (23) comprises a wall (40) with a wall thickness, which is smaller than the width (W) of the cavity.

Item 14. The building panels according to any one of the preceding items 10-13, wherein the length (L) of the strip part (6) varies along its width (W).

Item 15. The building panels according to any one of the preceding items 10-14, wherein the fixing element (16) comprises a flexible locking part (41) that locks against a wall of the fixing groove (15).

Item 16. The building panels according to any one of the preceding items 10-15, wherein the building panels are floor panels.

Item 17. A strip part (6), configured to lock panels (1,1') horizontally and to be fixed to a panel edge, comprising a strip body (7) with an inner part (IP) configured to be fixed under the panel edge (1) and an outer part (OP) configured to extend outside the panel edge **characterised** in

that the inner part (IP) comprises a fixing element (16) configured to lock the strip part (6) to the panel edge in a horizontal direction,

that the outer part (OP) comprises a locking protrusion (19), located above the strip body (7) and configured to lock the strip part to the panel edge vertically and a locking element (8) configured to lock the panels in a horizontal direction,

that the inner part (IP) comprises a cavity (23) formed in the strip body (7) and located between the fixing element (16) and the locking protrusion (19).

Item 18. The strip part according to item 17, wherein the fixing element (16) comprises a flexible locking part (41) that prevents the strip part to be released from the panel edge by angling.

Item 19. The strip part according to item 17 or 18, wherein the flexible locking part (41) comprises a flexible protrusion (44) extending along the fixing element (16).

Claims

1. A strip part (6), configured to lock panels (1,1') in a horizontal direction and to be fixed to a panel edge (1) of one of the panels, and comprising a strip body (7) with an inner part (IP) configured to be fixed under the panel edge (1) and an outer part (OP) configured to extend outside the panel edge,
wherein the inner part (IP) comprises a fixing element (16) configured to lock the strip part (6) to the panel edge in a horizontal direction,
wherein the outer part (OP) comprises a locking protrusion (19), located above the strip body (7) and configured to lock the strip part to the panel edge vertically, and a locking element (8) configured to lock the panels in the horizontal direction, and
wherein the inner part (IP) comprises a cavity (23) formed in the strip body (7) and located between the fixing element (16) and the locking protrusion (19).

2. The strip part according to claim 1, wherein the fixing element (16) comprises a flexible locking part (41) configured to prevent the strip part to be released from the panel edge by angling.

3. The strip part according to claim 1 or 2, wherein the fixing element (16) comprises a flexible locking part (41) that locks against a wall of a fixing groove (15).

4. The strip part according to claim 2 or 3, wherein the flexible locking part (41) comprises a flexible protrusion (44) extending along the fixing element (16).

5. The strip part according to any of the preceding claims, wherein the strip part has a length direction and a width direction, and wherein a length (L) of the strip part (6) in the length direction varies along the width direction (W).

6. The strip part according to any of the preceding claims, wherein the strip part is configured to be attached to the panel edge (1) with an essentially horizontal snapping action in the horizontal direction.

7. The strip part according to any of the preceding claims, wherein the locking protrusion (19) is configured to lock the strip part to the panel edge vertically against a holding protrusion (18) formed at the panel edge.

8. The strip part according to any of the preceding claims, wherein the locking protrusion (19) extends essentially horizontally towards the fixing element (16).

9. The strip part according to any of the preceding claims, wherein the locking protrusion (19) is formed as two parts that are spaced from each other by said

cavity (23) .

10. The strip part according to any of the preceding claims, wherein the locking element (8) is connected to an outer part of the strip body (7).

11. The strip part according to any of the preceding claims, wherein a thickness of the strip body (7) varies along a width direction of the strip part.

12. The strip part according to any of the preceding claims, wherein a thickness of the locking protrusion (19) varies along a width direction of the strip part.

13. The strip part according to any of the preceding claims, wherein the strip part comprises polymer material and is formed by injection moulding.

Fig. 1a

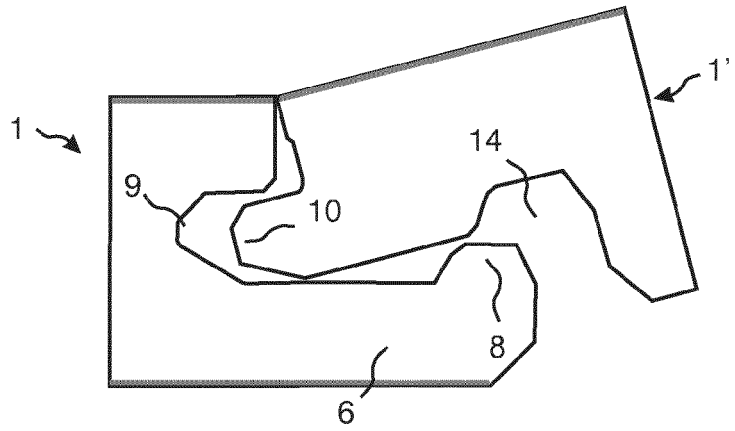


Fig. 1b

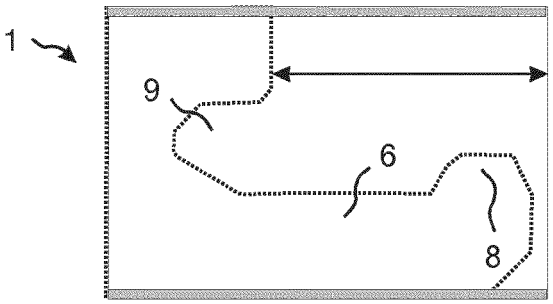


Fig. 1c

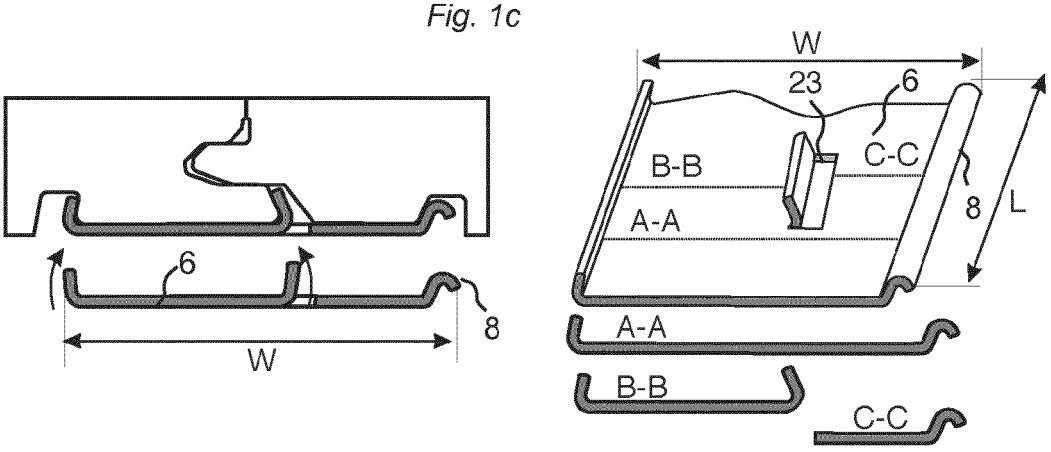
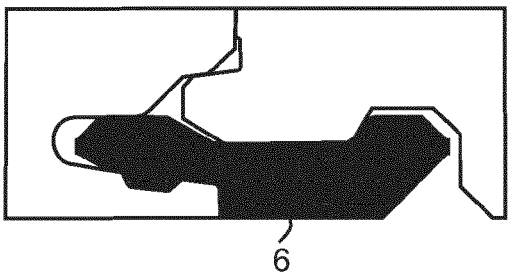


Fig. 1d



KNOWN TECHNOLOGY

Fig. 2a

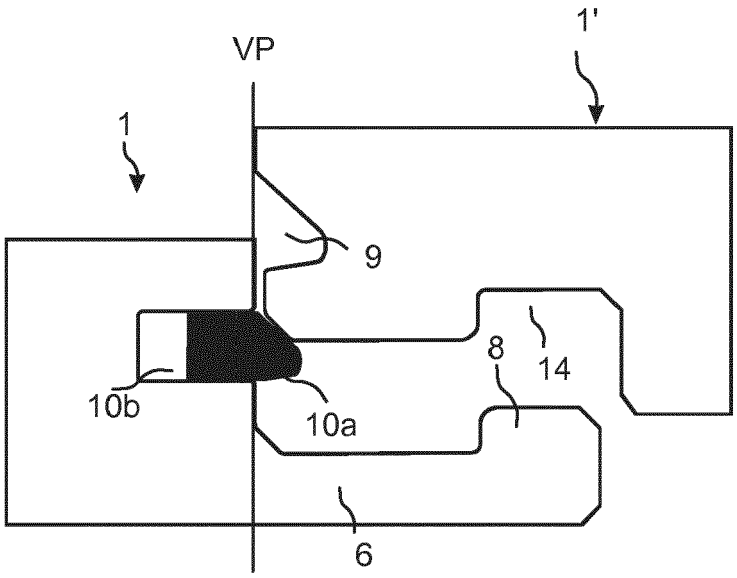


Fig. 2b

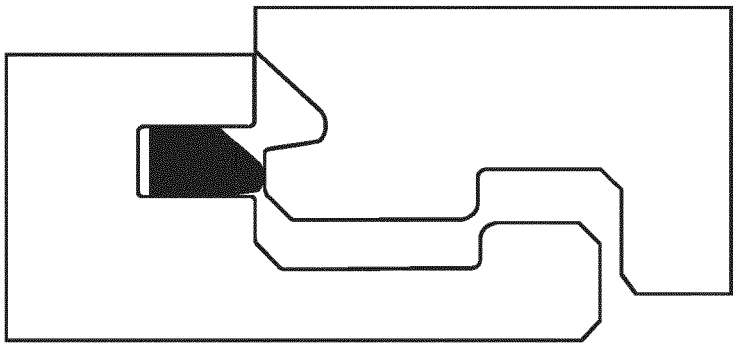
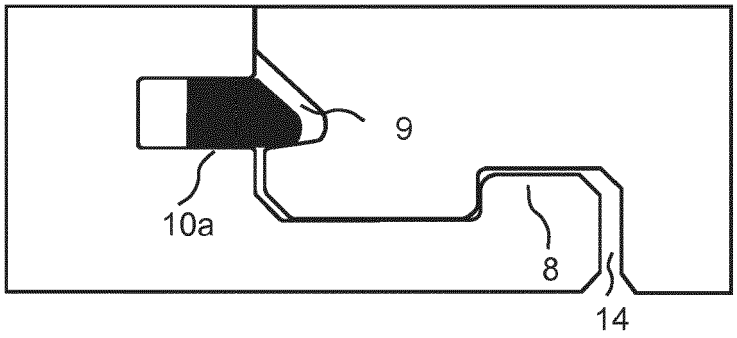


Fig. 2c



KNOWN TECHNOLOGY

Fig. 3a

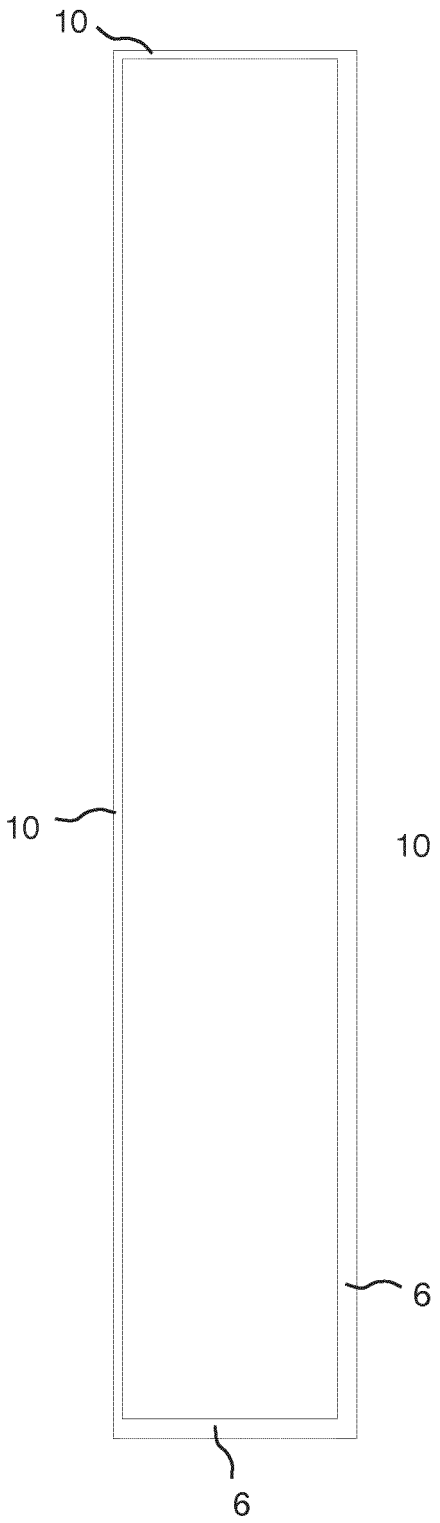
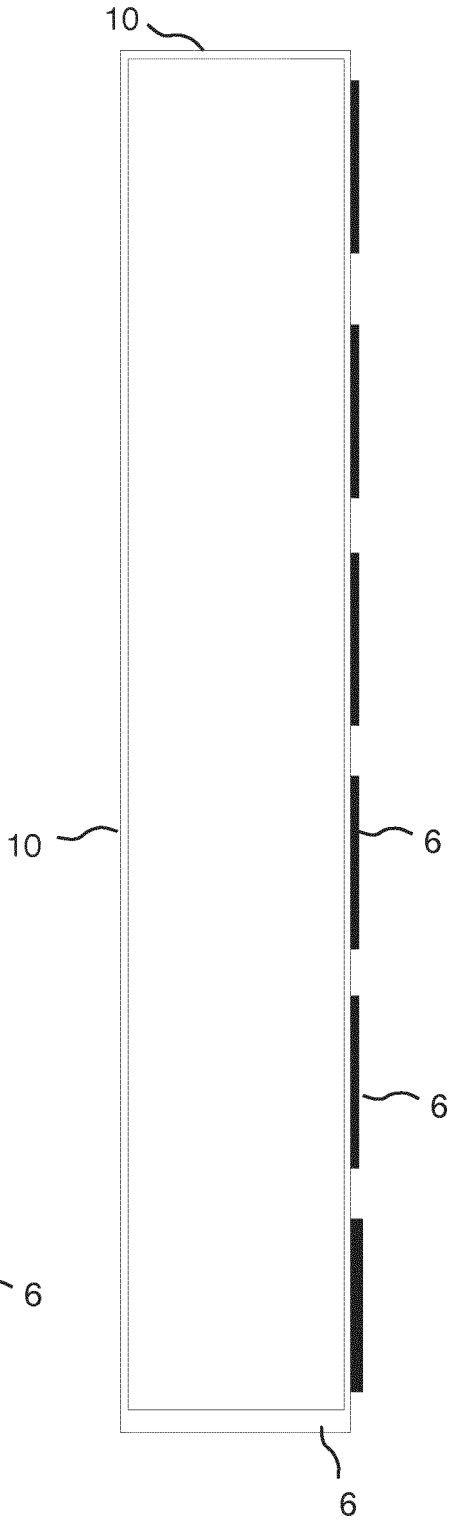


Fig. 3b



KNOWN TECHNOLOGY

Fig. 4a

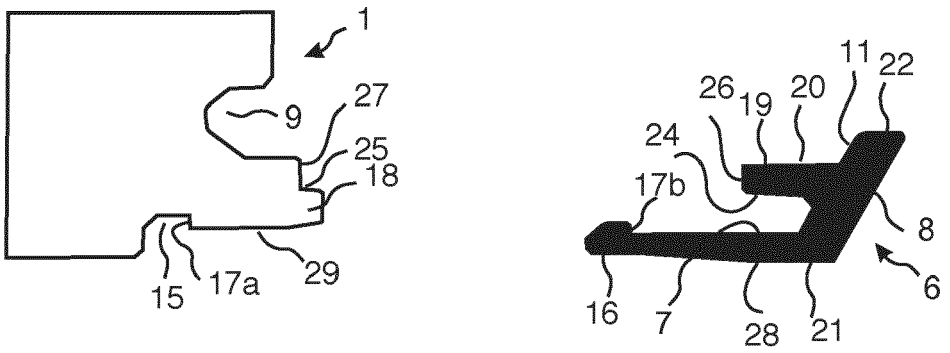


Fig. 4b

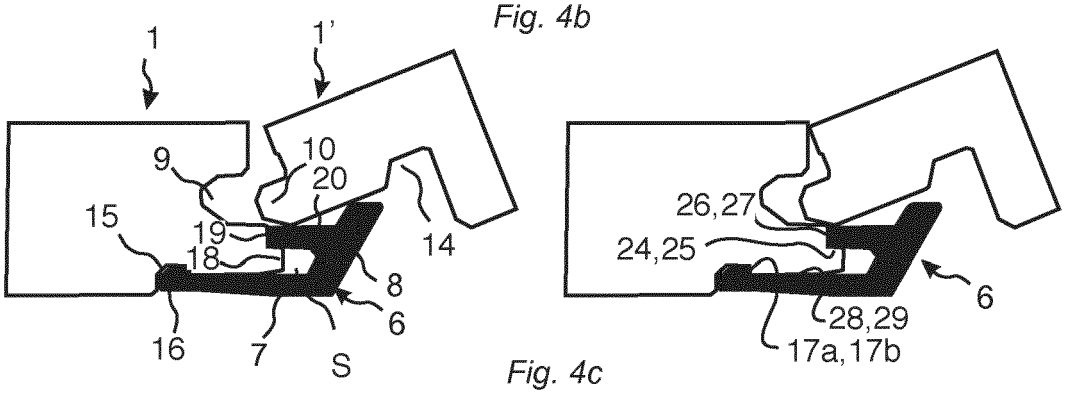


Fig. 4c

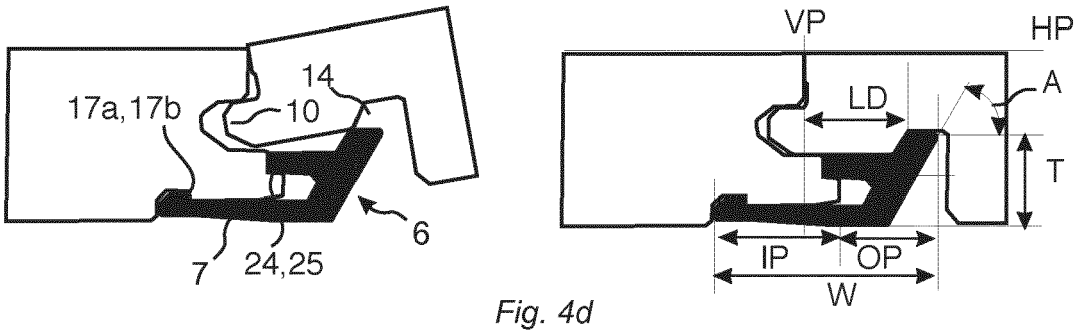


Fig. 4d

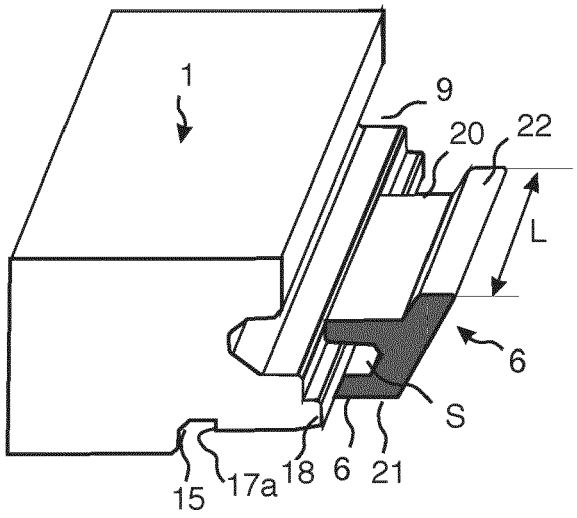


Fig. 5a

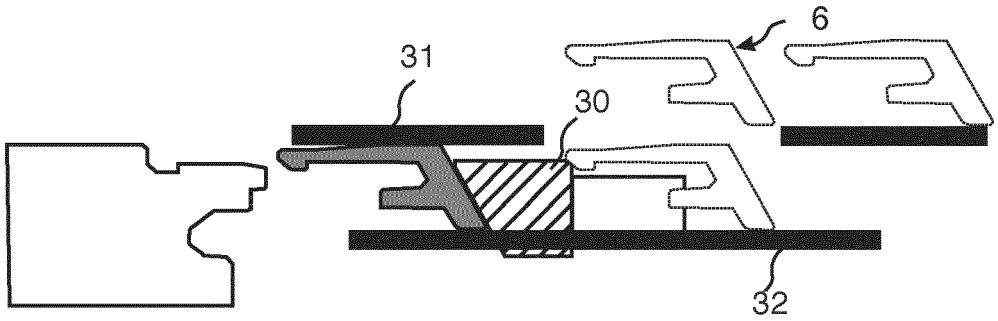


Fig. 5b

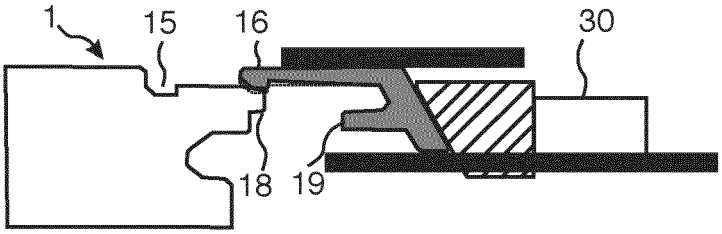


Fig. 5c

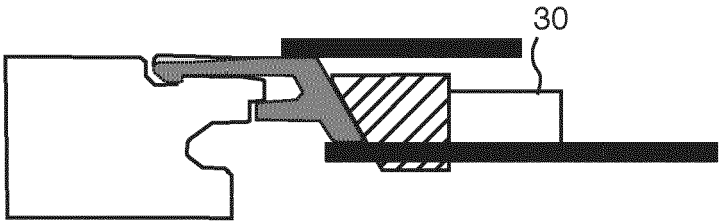


Fig. 5d

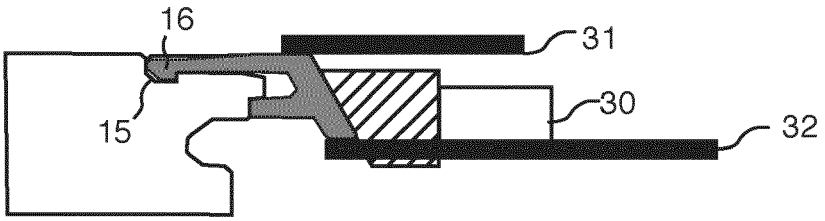


Fig. 5e

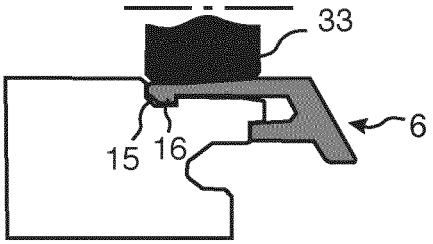


Fig. 5f

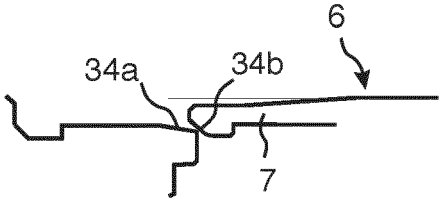


Fig. 6a

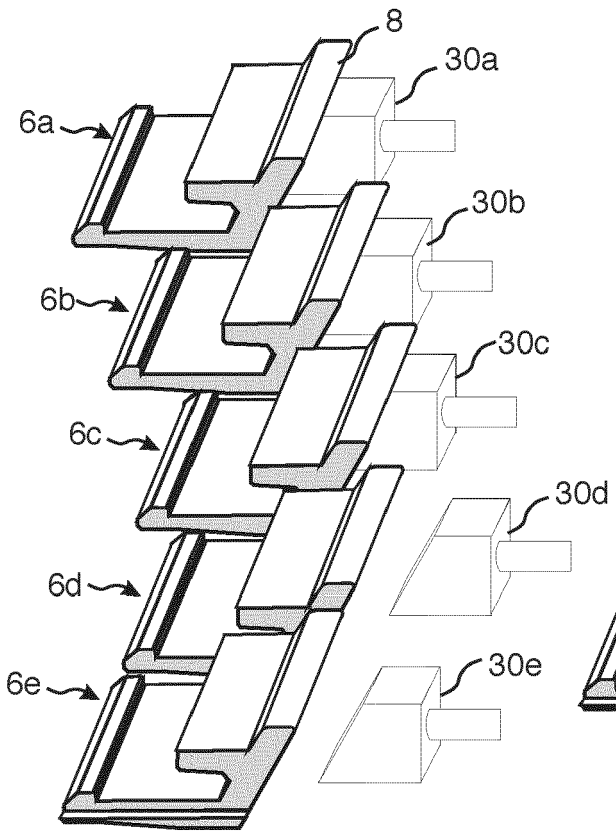


Fig. 6b

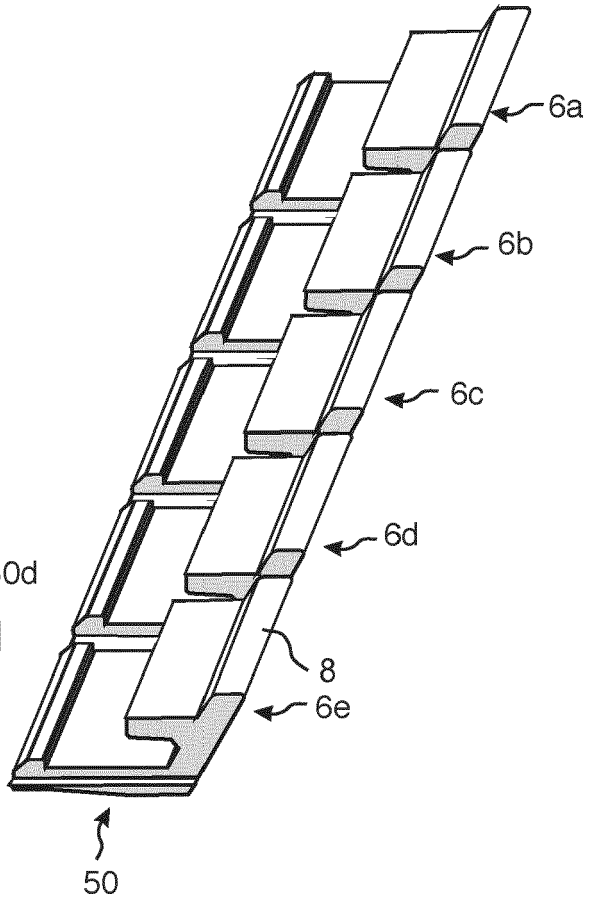


Fig. 7a

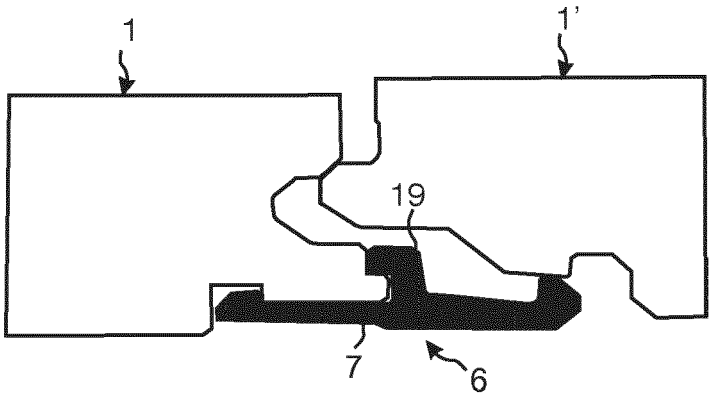


Fig. 7b

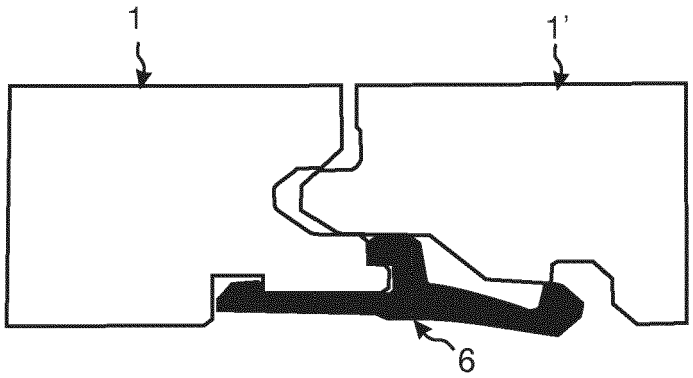


Fig. 7c

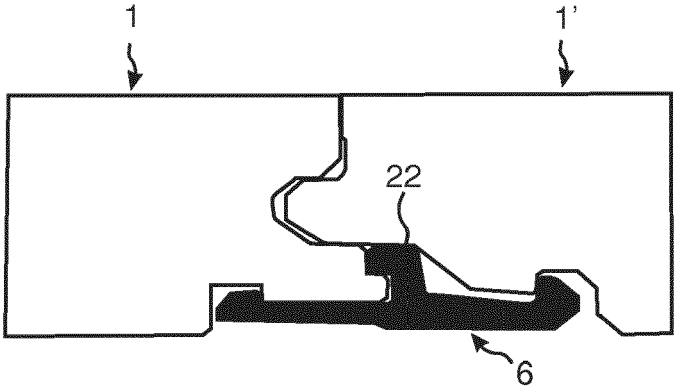


Fig. 7d

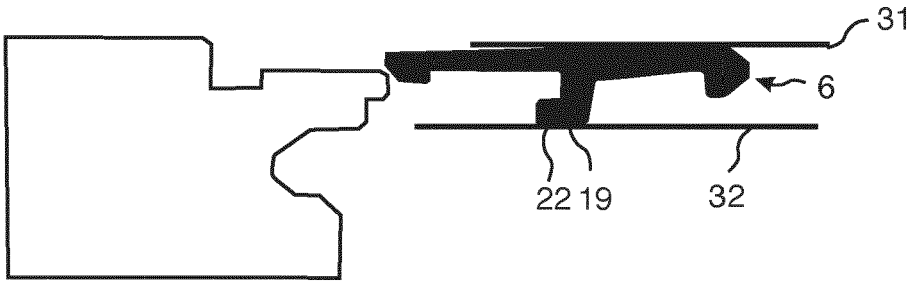


Fig. 8a

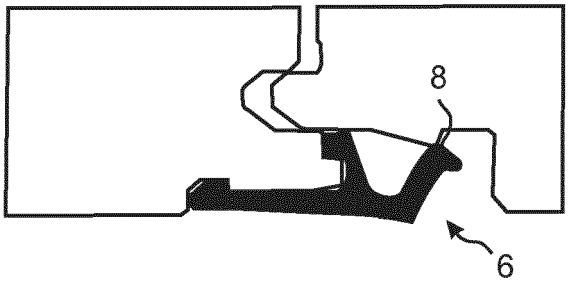


Fig. 8b

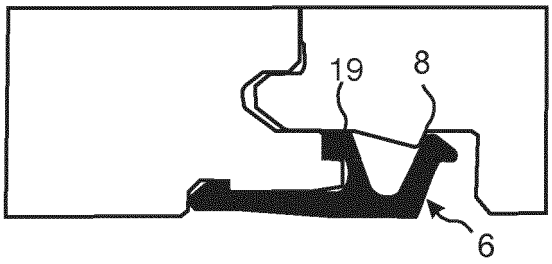


Fig. 8c

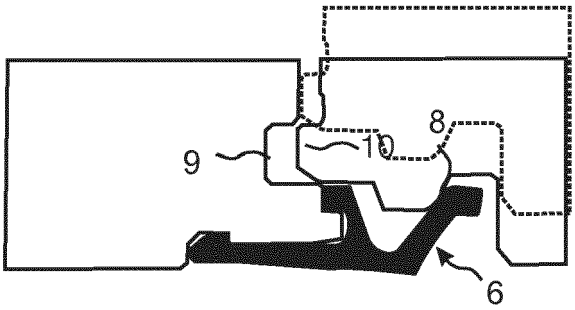


Fig. 8d

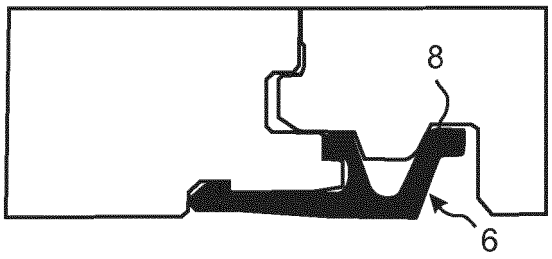


Fig. 8e

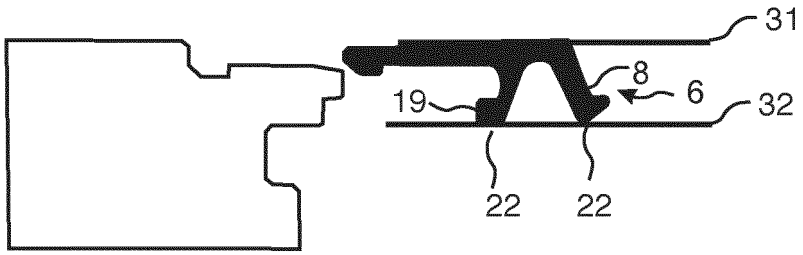


Fig. 9a

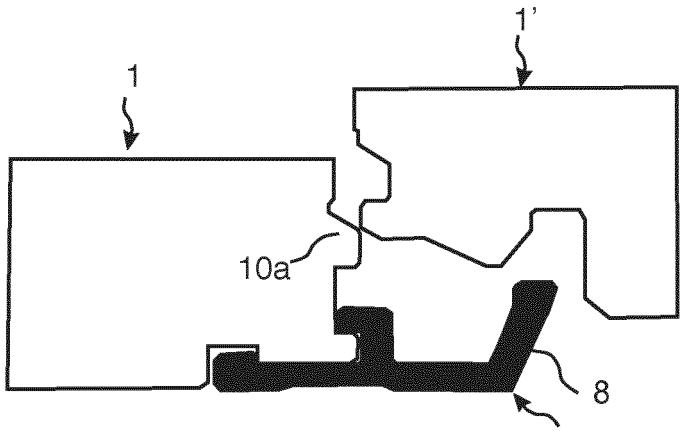


Fig. 9b

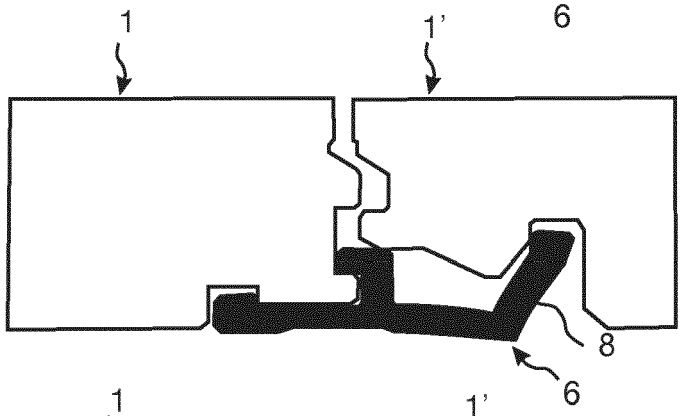


Fig. 9c

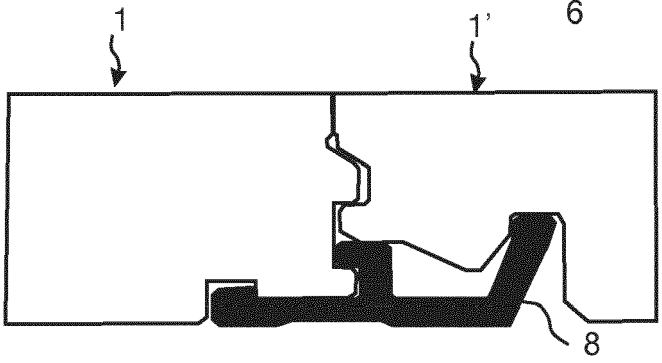
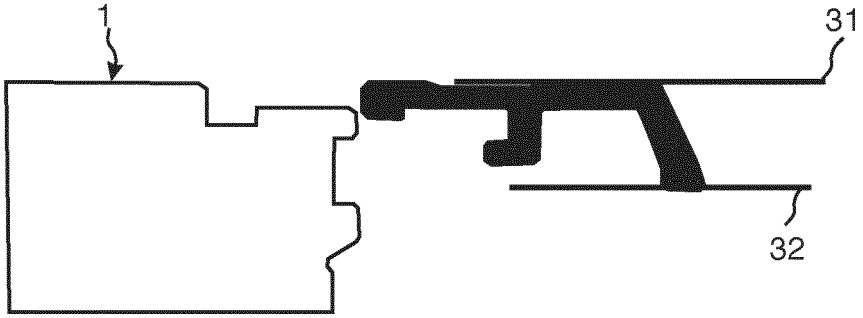


Fig. 9d



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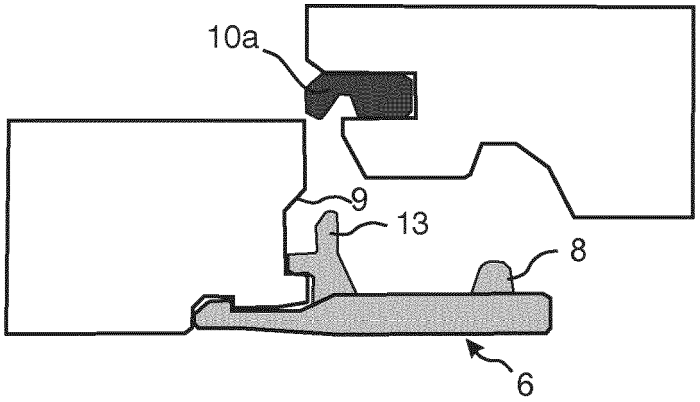
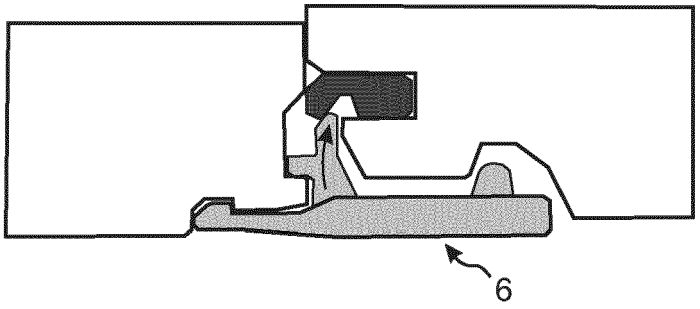


Fig. 10b



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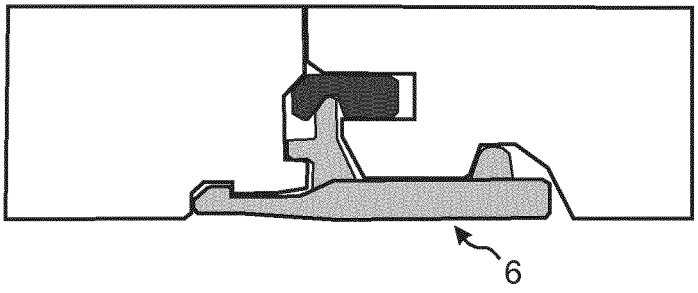


Fig. 10d

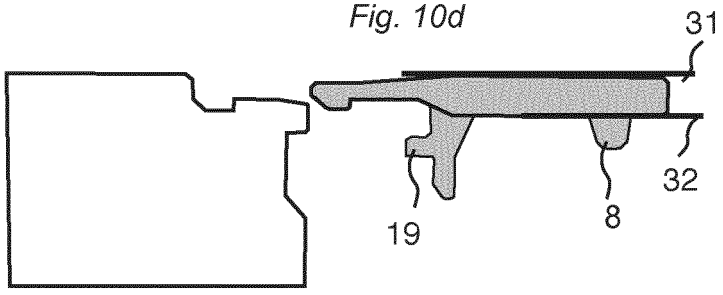
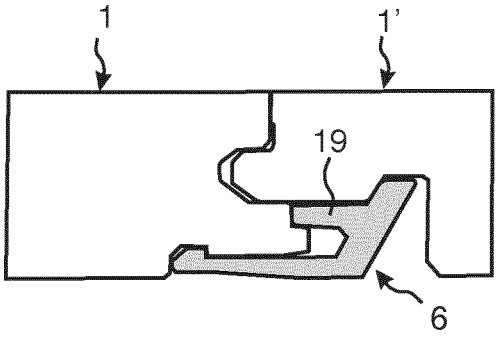


Fig. 11a



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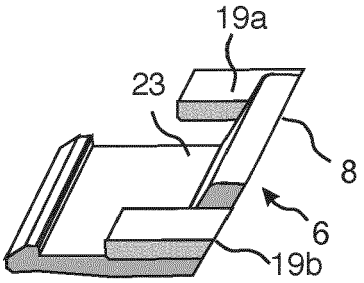

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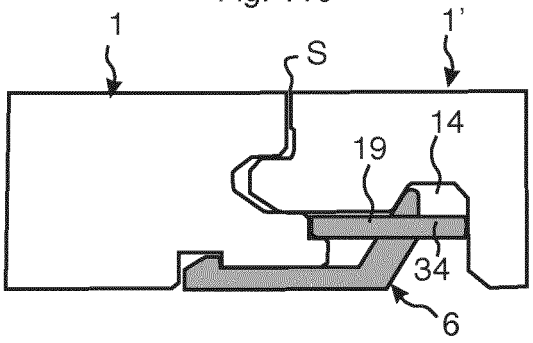

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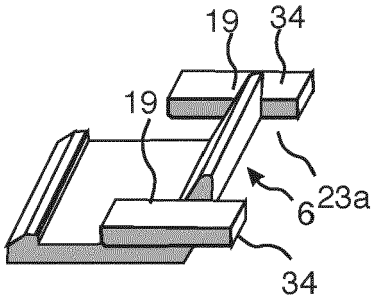

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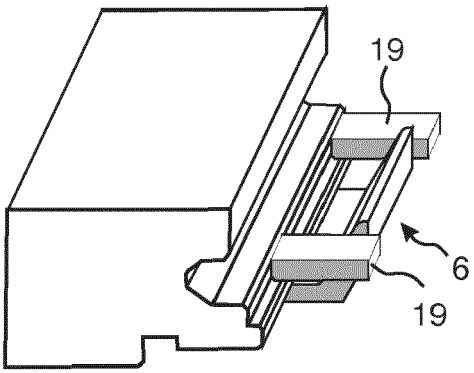
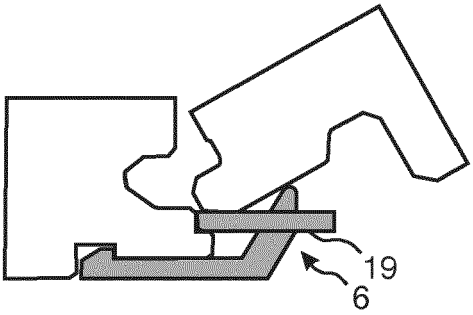


Fig. 11f



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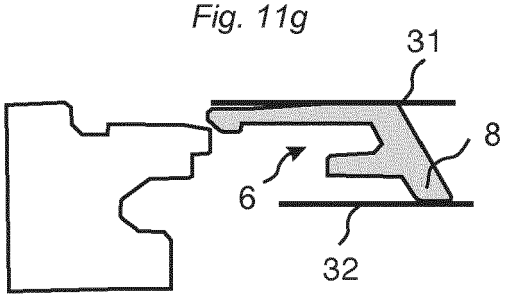

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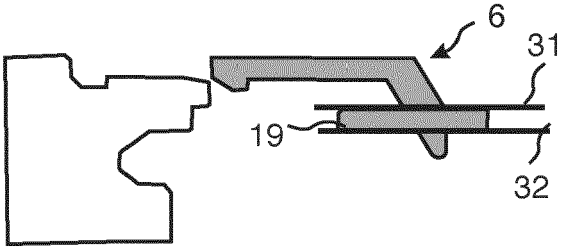


Fig. 12a

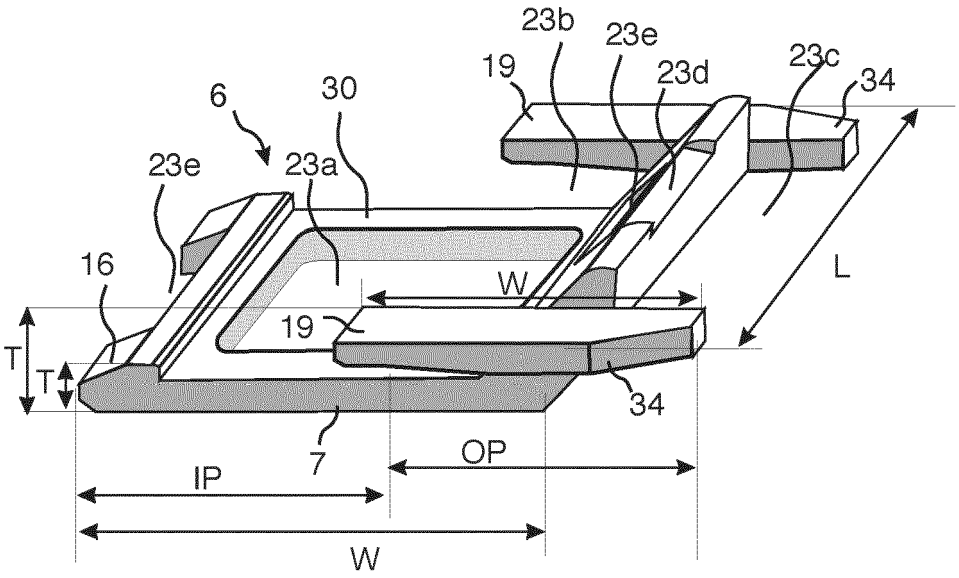
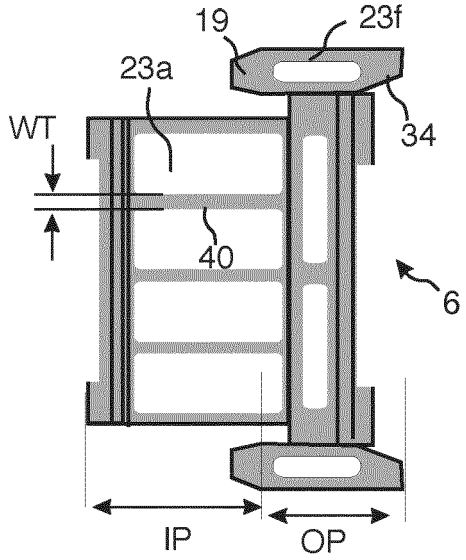


Fig. 12b



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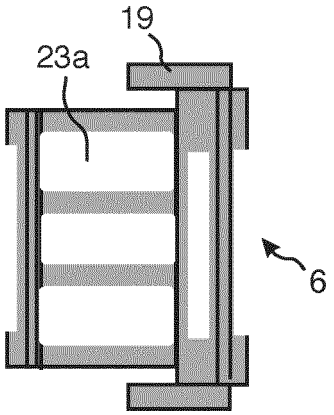

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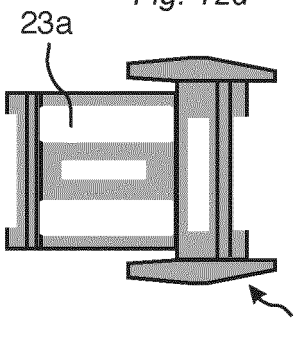

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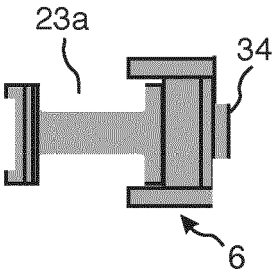


Fig. 12f

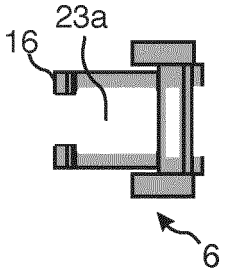


Fig. 13a

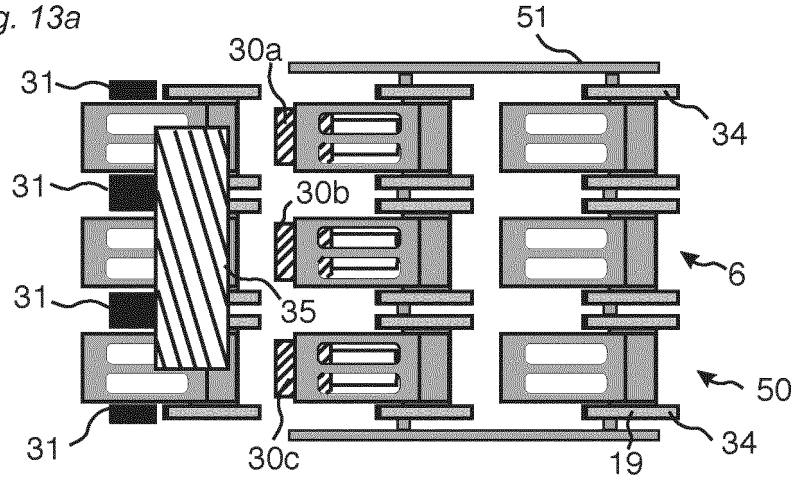


Fig. 13b

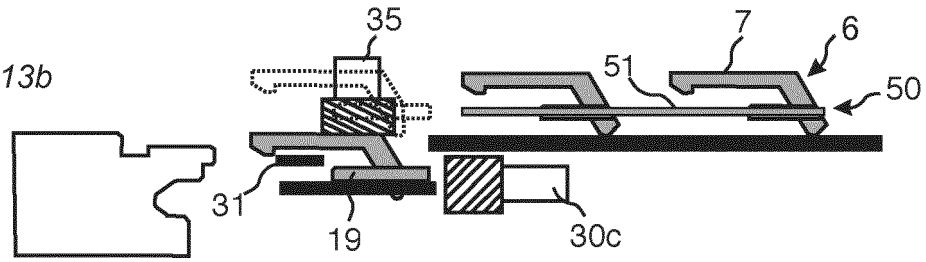


Fig. 13c

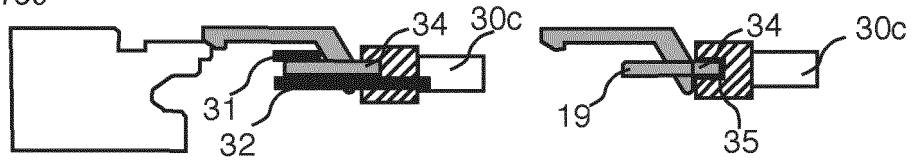


Fig. 13d

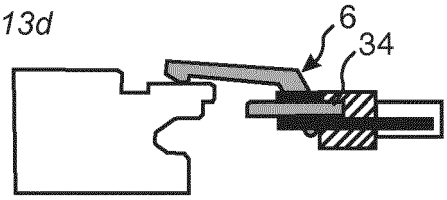


Fig. 13e

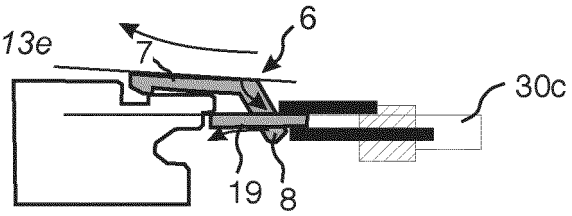


Fig. 13f

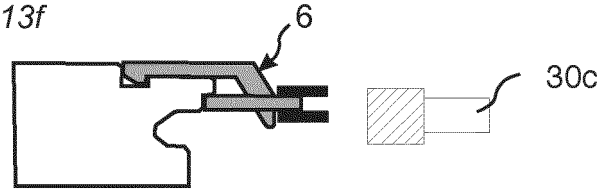


Fig. 14a

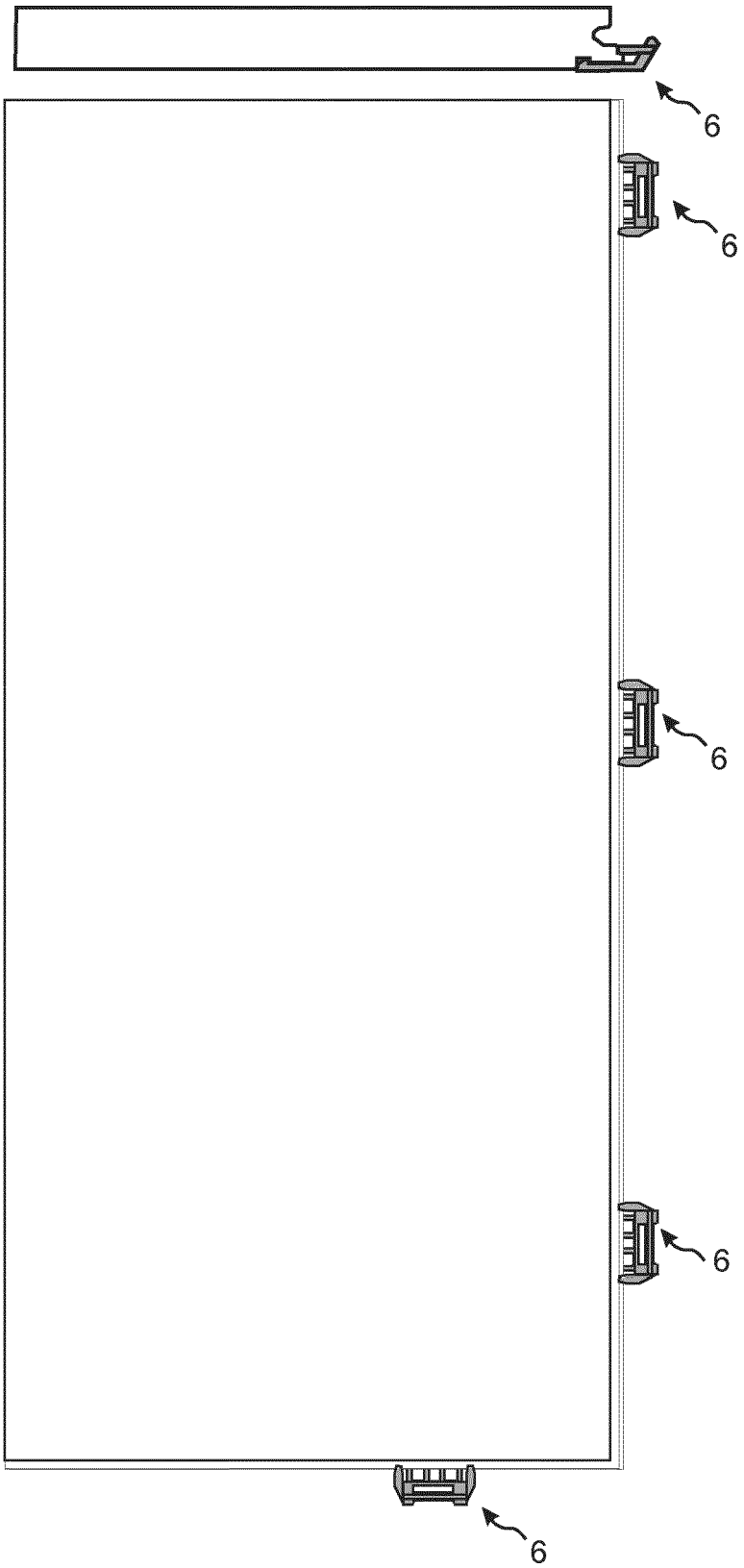


Fig. 14b

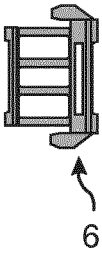
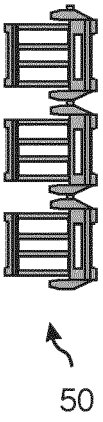


Fig. 14c



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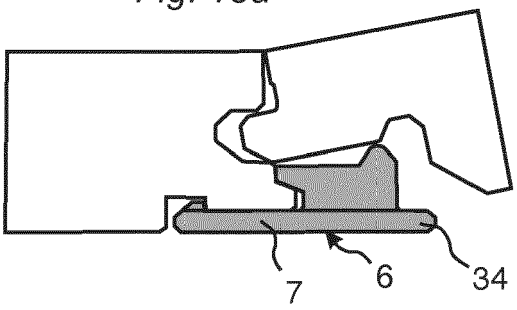


Fig. 15b

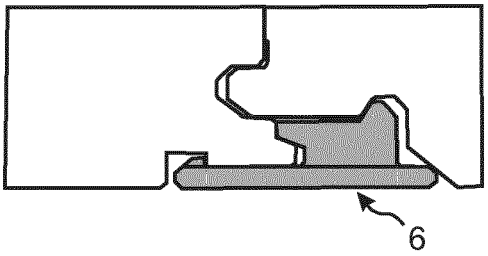


Fig. 15c

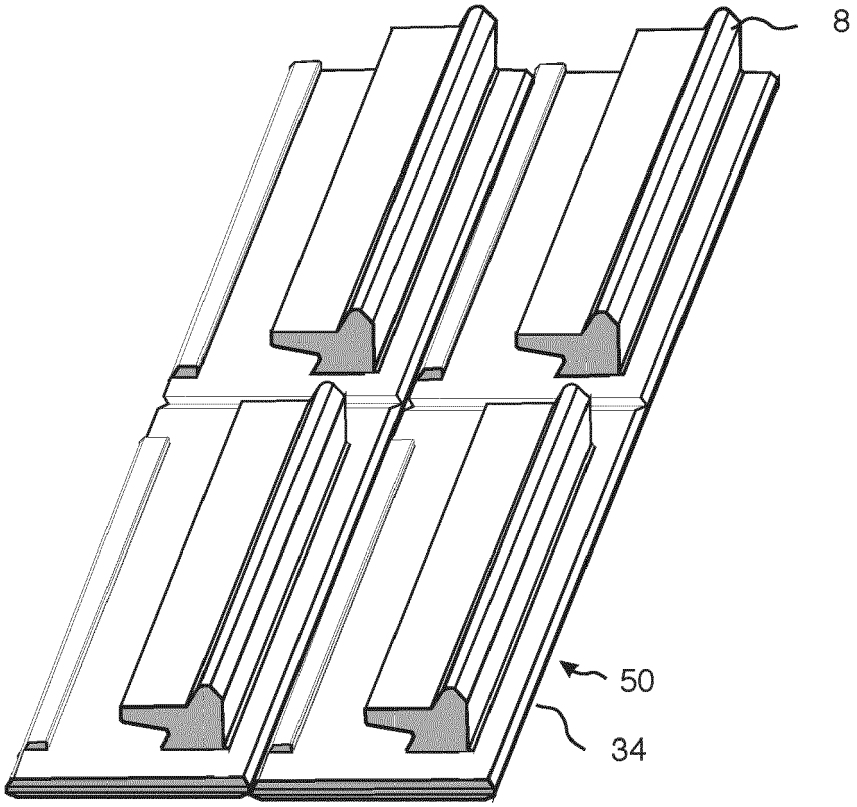


Fig. 15d

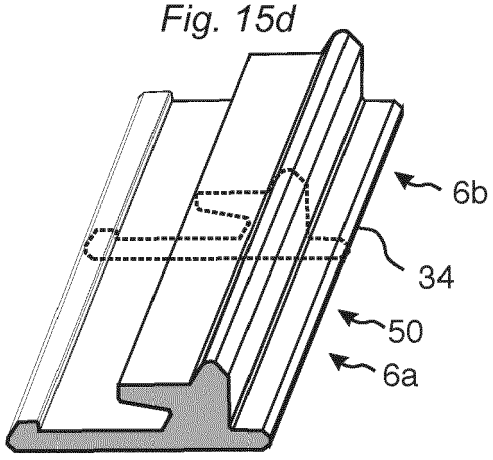


Fig. 16a

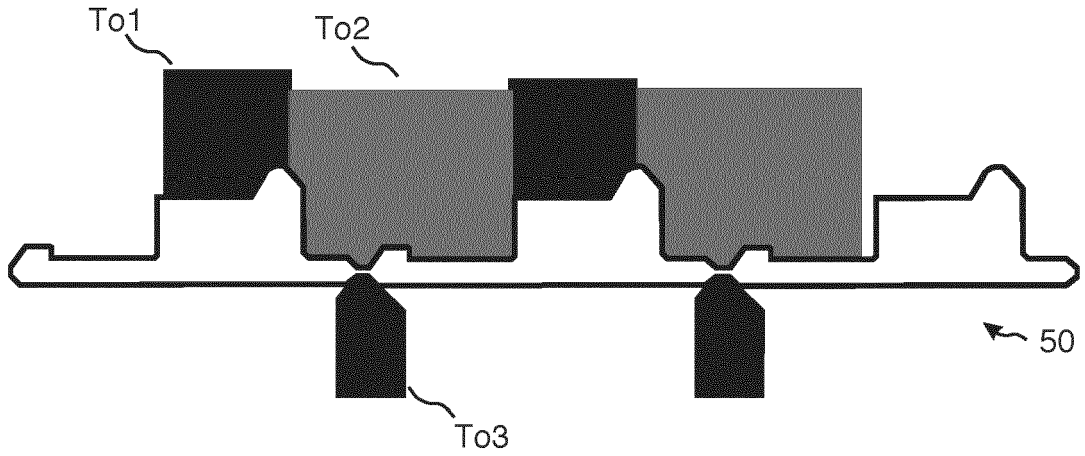


Fig. 16b

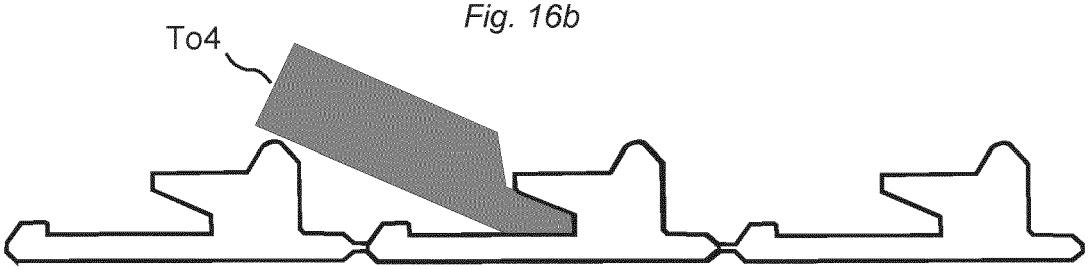


Fig. 16c

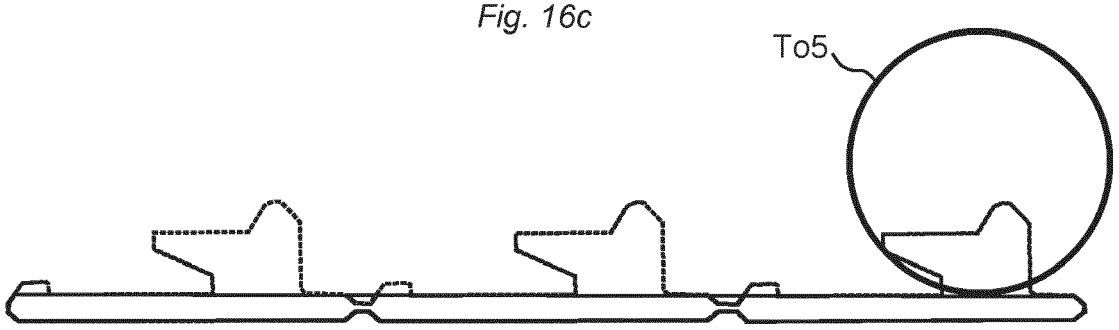


Fig. 16d

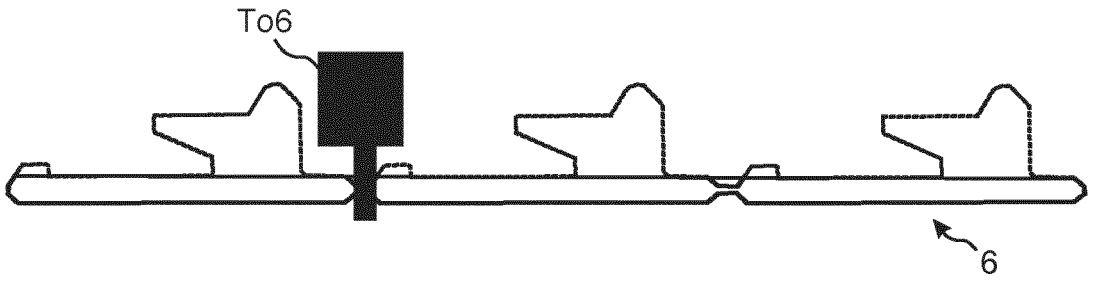


Fig. 17

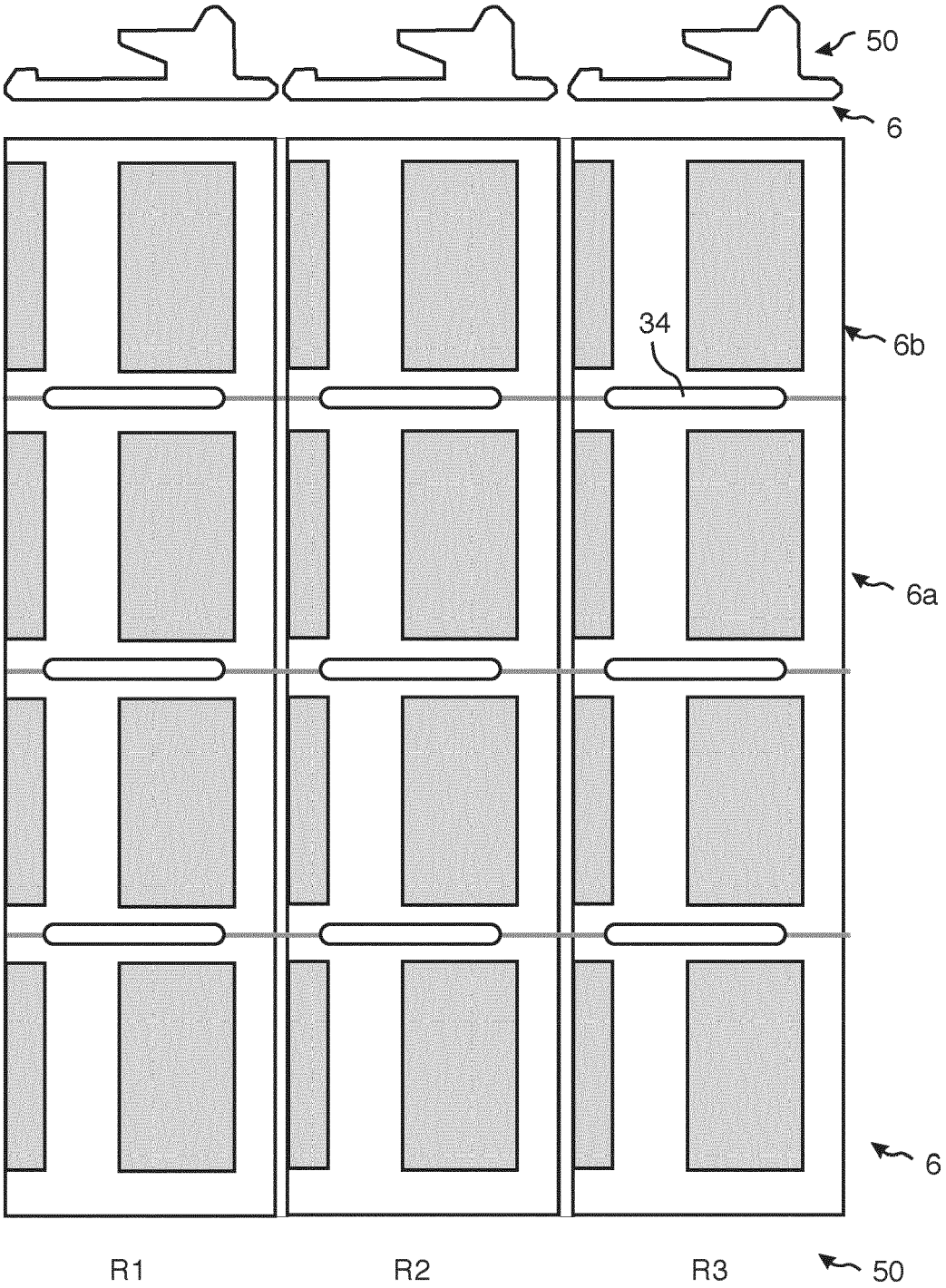


Fig. 18a

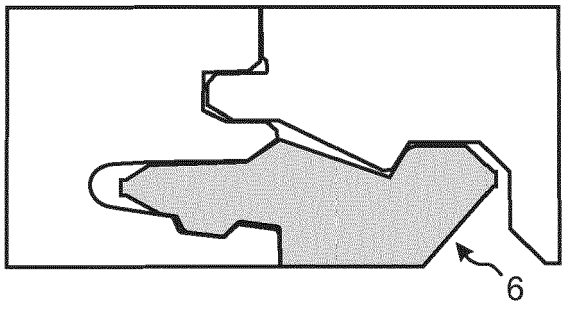


Fig. 18b

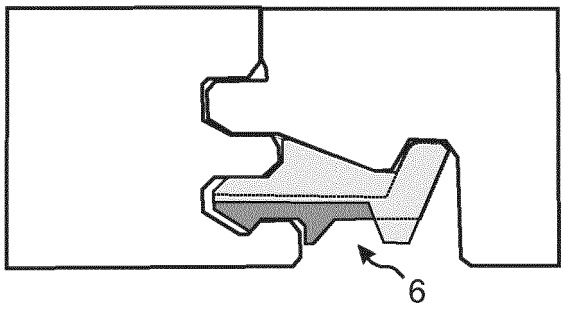


Fig. 18c

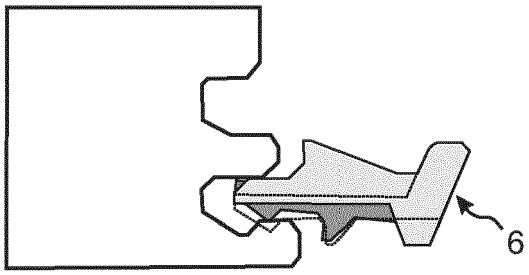


Fig. 18d

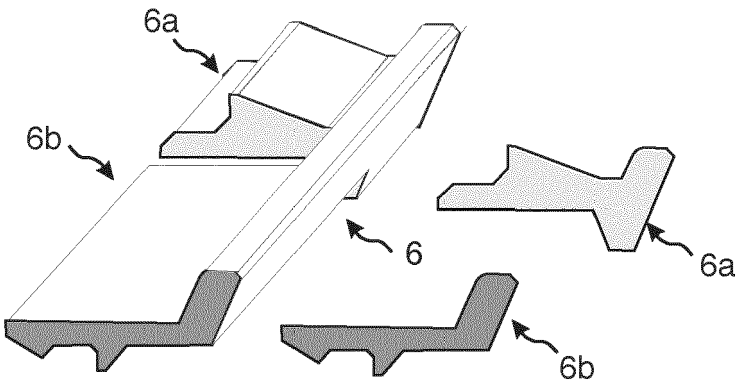


Fig. 19a

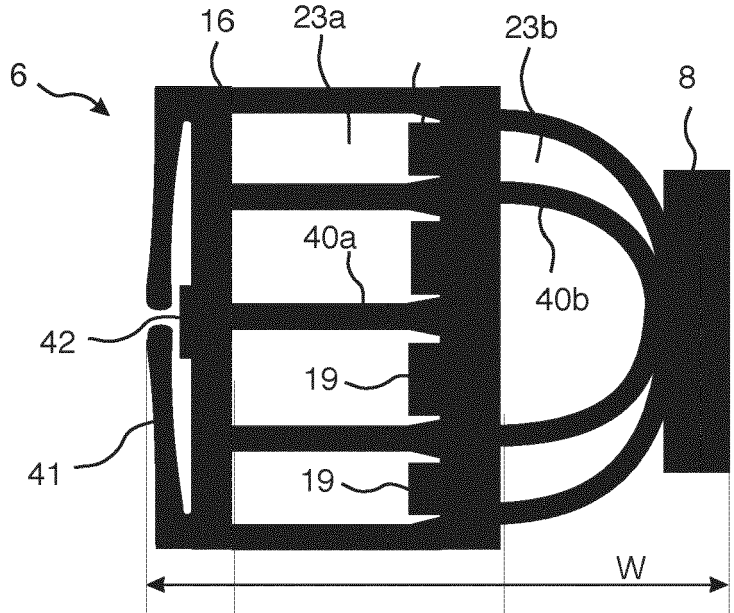
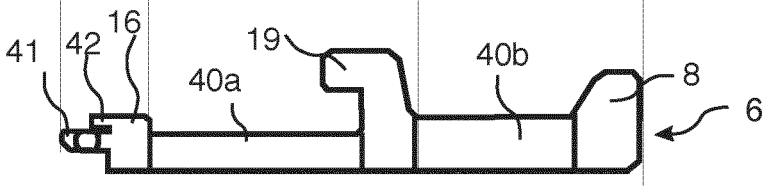


Fig. 19b



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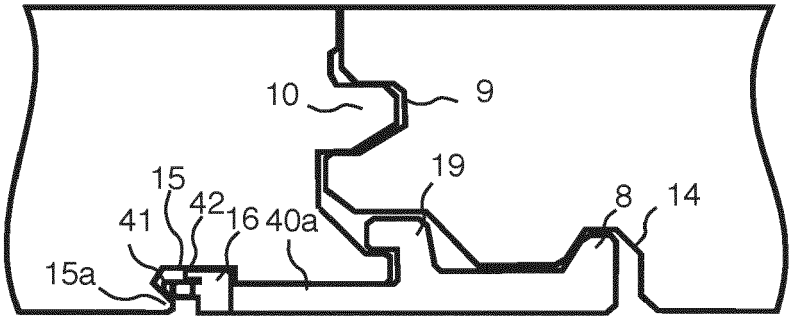


Fig. 19d

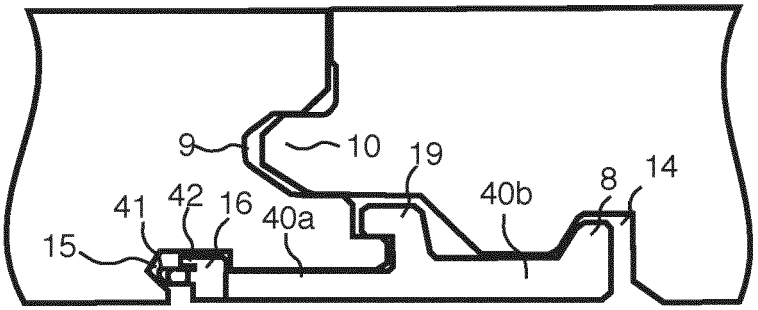
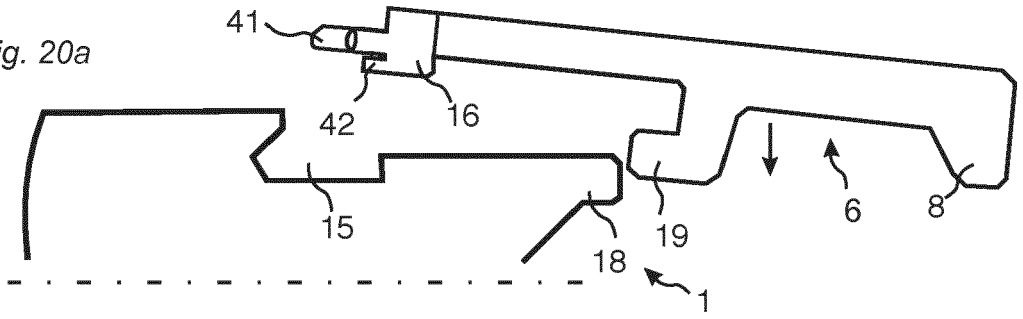


Fig. 20a



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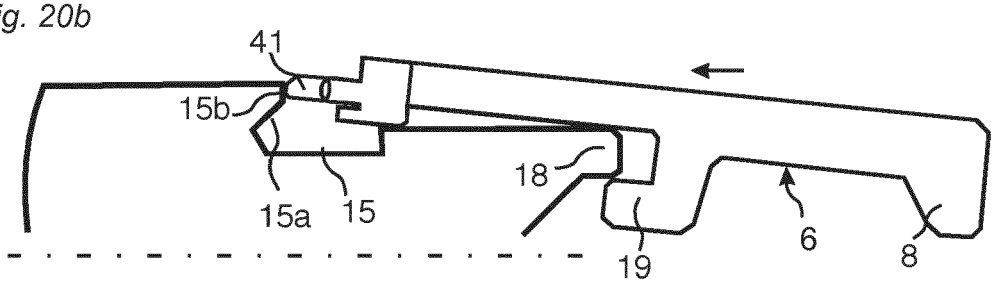


Fig. 20c

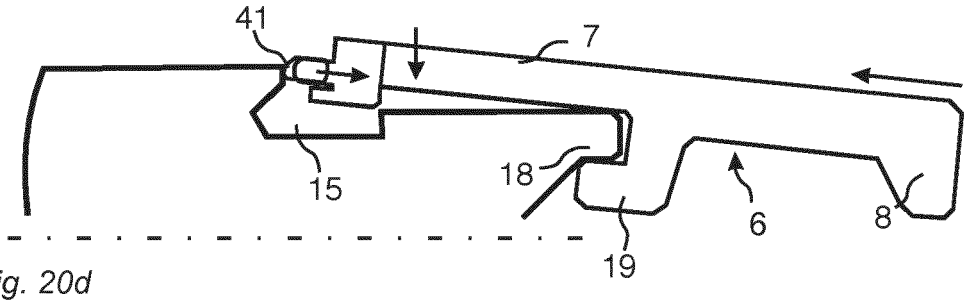


Fig. 20d

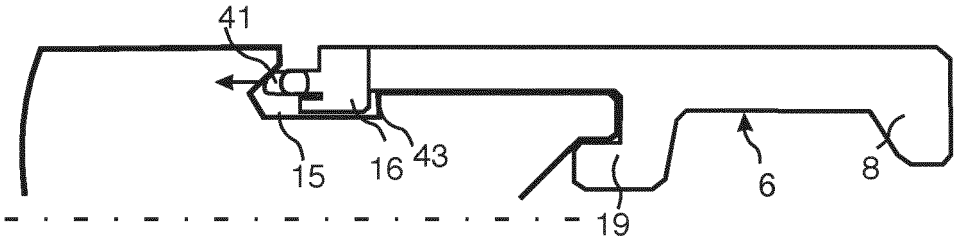


Fig. 20e

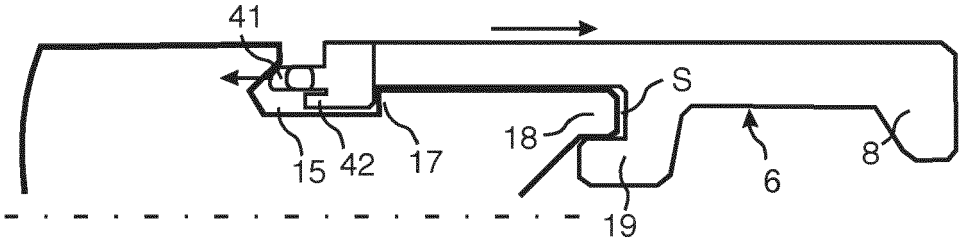
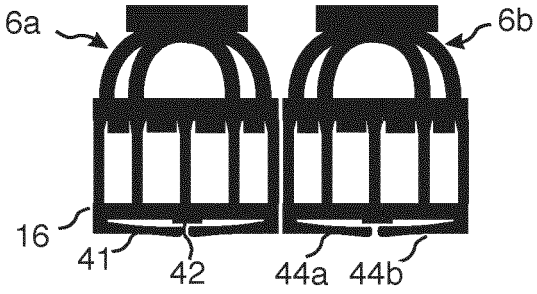


Fig. 21a



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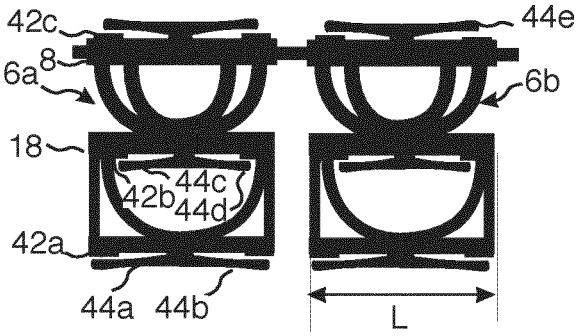

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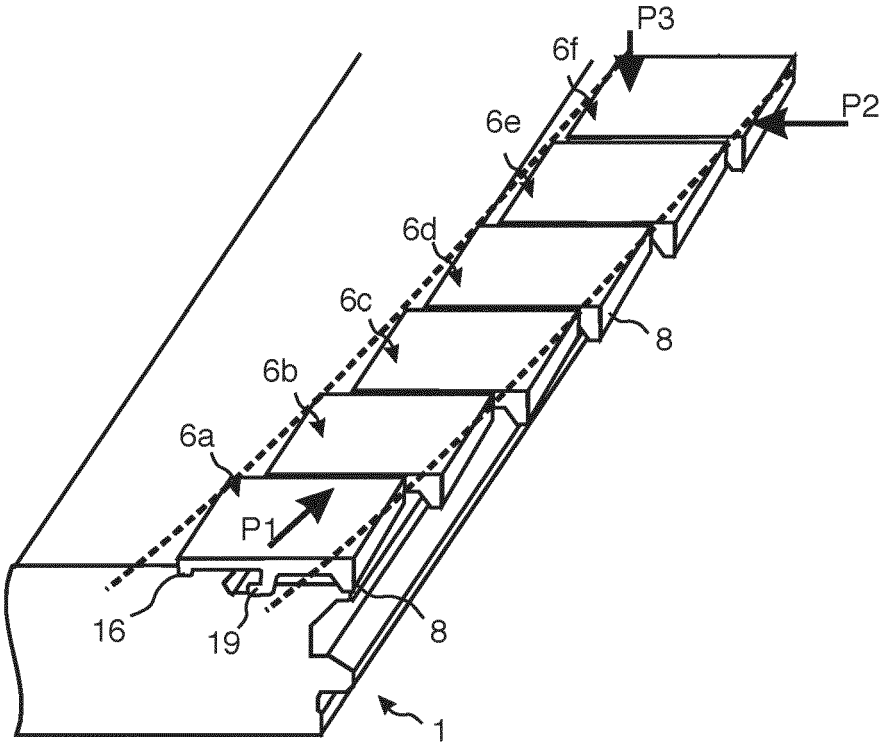
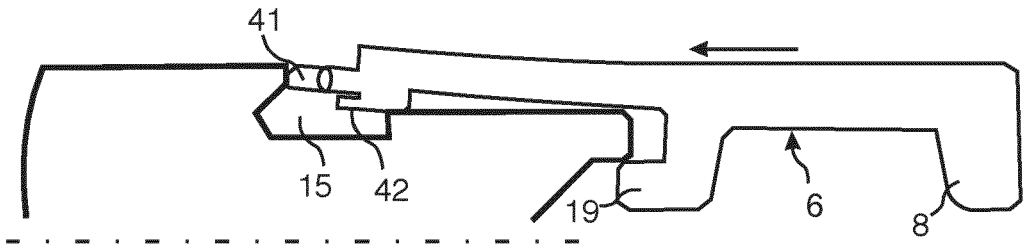


Fig. 21d



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EUROPEAN SEARCH REPORT

Application Number
EP 18 19 7441

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 120 515 A1 (TRIAX N V [BE]) 1 August 2001 (2001-08-01) * figures 3,4,5a *	1,3,4, 6-8,10	INV. E04F15/02 E04F15/04
A	US 2011/016815 A1 (YANG FENG-LING [TW]) 27 January 2011 (2011-01-27) * figures 1,2a *	1-13	
A	US 5 860 267 A (PERVAN TONY [SE]) 19 January 1999 (1999-01-19) * the whole document *	1-13	

TECHNICAL FIELDS SEARCHED (IPC)

E04F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 February 2019	Bourgoin, J

CATEGORY OF CITED DOCUMENTS

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15-02-2019

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