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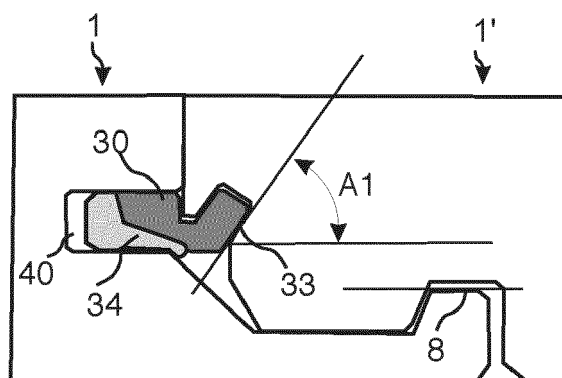
This application was filed on 31.10.2019 as a divisional application to the application mentioned under INID code 62.

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

(57) There is disclosed building panels provided with a locking system for vertical locking of a first (1) and a second (1') building panel by a vertical displacement of the building panels relative each other. A displaceable tongue (30) is inserted into a sidewardly open displacement groove (40) provided at an edge of the first building panel, wherein the displaceable tongue is configured to cooperate with a tongue groove provided at an adjacent edge of the second building panel for locking the edge

and the adjacent edge vertically. The displaceable tongue comprises a pulling extension at its outer part configured to cooperate with a pulling protrusion formed at the adjacent edge such that the displaceable tongue is pulled out from the displacement groove and into the tongue groove when the edges of the building panels are displaced vertically relative to each other. Moreover, the displaceable tongue comprises a locking hook (34).

Fig. 5d



Description

TECHNICAL FIELD

[0001] The invention generally relates to the field of mechanical locking systems for floor panels and building panels and production methods to insert a tongue into a groove.

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 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 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 panels formed as rectangular floor panels with long and short 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. The invention is preferably used on the short edges. It should be emphasised that the invention may be used in any floor panel and it may be combined with all types of known locking system formed on the long edges, where the floor panels are intended to be joined using a mechanical locking system connecting the panels in the horizontal and vertical directions on at least two adjacent sides.

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 floorings are 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 is 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 plan. 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.

By "locking systems" are meant co acting connecting elements, which connect the floor panels vertically and/or horizontally.

RELATED ART AND PROBLEMS THEREOF

[0009] For mechanical joining of long edges as well as short edges in the vertical and in the first 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 may need to be used to overcome the friction between the long edges and to bend the strip during the snapping action.

[0010] 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.

[0011] Recently new and very efficient locking systems have been introduced with a separate flexible or displaceable integrated tongue on the short edge that allows installation with only an angling action, generally referred to as "vertical folding". Such a system is described in WO 2006/043893 (Valinge Innovation AB).

[0012] Several versions are used on the market. One of the most used versions is shown in figures 1a-1d. A flexible tongue 30 is during locking displaced in a horizontally extending displacement groove 40 and into a tongue groove 20 of an adjacent panel. The displaceable tongue locks the edges vertically and a strip 6 with a locking element that cooperates with a locking groove 14 locks the panels horizontally. The locking is a combination of vertical displacement and turning similar to a scissor action. The tongue is gradually displaced inwardly during locking from one inner edge to an outer edge as shown in figure 1d such that the tongue is bent in the length direction. Such systems are referred to as vertical snap systems and they provide an automatically locking during the folding action.

[0013] Although such systems are very efficient, there is still a room for improvements.

[0014] High locking force can only be accomplished with high snapping resistance when the tongue is pressed inwardly and bent in the length direction. This creates separation forces that tend to push the panels apart during folding. The locking may lose its strength if the flexibility and pressing force of the tongue decreases over time.

[0015] The flexibility must be considerable and allow that a flexible tongue is displaced in two directions about 1-2 mm. The material, which is used to produce such tongues, is rather expensive and glass fibres are generally used to reinforce the flexible tongue.

[0016] It would be a major advantage if snapping could be eliminated in a system that locks automatically during folding.

SUMMARY OF THE INVENTION

[0017] An overall objective of embodiment of the present invention is to provide a locking system for primarily rectangular floor panels with long and short edges installed in parallel rows, which allows that the short edges may be locked to each other automatically without a snap action that creates a locking resistance and separation forces of the short edges during folding.

[0018] A specific objective is to provide a locking system with a separate displaceable tongue that may be bent in length direction with a lower separation force and that comprises means that prevent the tongue to slide back into the groove after locking.

[0019] The above objects of embodiment of the invention may be achieved wholly or partly by locking systems and floor panels according to the disclosure. Embodi-

ments of the invention are evident from the from the description and drawings.

An aspect of the invention is building panels provided with a locking system for vertical locking of a first and a second building panel by a vertical displacement of the panels relative each other. A displaceable tongue is attached into a sidewardly open displacement groove provided at an edge of the first panel. Said tongue cooperates with a tongue groove provided at an adjacent edge of the second panel for locking the edges vertically. A strip protrudes below the displacement groove and outwardly beyond the upper part of the edge or below the tongue groove and outwardly beyond the upper part of the adjacent edge. The displaceable tongue comprises a pulling extension at its outer part configured to cooperate with a pulling protrusion formed at an edge of the adjacent panel such that the displaceable tongue is pulled out from the displacement groove and into the tongue groove when the edges of the panels are displaced vertically against each other.

[0020] Said pulling protrusion may be part of the tongue groove.

[0021] The pulling extension may be inclined in relation to a main horizontal plane of the panels.

[0022] The pulling protrusion may be inclined in relation to a main horizontal plane of the panels.

[0023] The displaceable tongue may be provided with a locking hook that prevents the tongue to slide back into the displacement groove after locking.

[0024] The locking hook may lock against an outer part of the displacement groove.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] 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-e illustrate a short edge locking system according to the invention.

Figs 3a-3c illustrate a short edge locking system according to preferred embodiments of the invention.

Figs 4a-c illustrate preferred embodiments of short edge locking systems with a separate strip.

Figs 5a-e illustrate a locking system according to an embodiment of the invention with a locking hook that prevents unlocking.

Figs 6a-d illustrate a tongue according to an embod-

iment of the invention with increased flexibility related to bending in length direction.

Figs 7a-d illustrate a method according to an embodiment of the invention to insert a tongue into a groove.

Figs 8a-c illustrate an embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0026] 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.

[0027] All embodiments may be used separately or in combinations. Angles, dimensions, rounded parts, spaces between surfaces etc. are only examples that may be adjusted within the basic principles of the invention.

[0028] Figures 2a-2e show a first preferred embodiment of a short edge locking system provided with a flexible and displaceable tongue 30 in an edge of a first panel 1 inserted in a horizontally extending displacement groove 40. The displaceable tongue 30 has a pulling extension 31 comprising a tongue pulling surface 32 and tongue locking surface 33. The second adjacent panel 1' has a pulling protrusion 21 with a groove pulling surface 22 that is also a part of a tongue groove 20 comprising a groove locking surface 23. The pulling surfaces 22, 32 cooperate during the vertical displacement and pull the displaceable tongue 30 into a tongue groove 20. The pulling extension 31 comprises a tongue locking surface 33 that locks against a groove locking surface 23 and prevents vertical displacement of the edges in a first vertical direction. A locking strip 6 and a lower part 39 of the adjacent panel locks the edges in a second vertical direction. A locking element 8 and a locking groove 14 locks the edges horizontally together with the upper edges. The vertical connection may be used without the horizontal locking as shown by figure 2e. Short edges may be locked horizontally by for example friction between long edges.

[0029] The tongue may be attached into a displacement groove 40 formed on the panel comprising the strip 6, the strip panel, or on the panel comprising the locking groove, the groove panel, as shown in figures 3a-3c. The pulling protrusion 21 may extend upwardly or downwardly and the displacement groove may be inclined against the horizontal plane HP.

[0030] Figures 4a-4c show that the strip 6 may be formed as a separate material. The pulling protrusion 21 may be flexible and this may eliminate production tolerances and facilitate the displacement of the tongue 30 into the tongue groove 20 during folding.

[0031] Figures 5a-5e show that the displaceable tongue 30 may comprise a locking hook 34 that may serve as a friction connection to prevent the tongue 30

from falling out from the groove 40 but also to prevent the tongue from sliding back after locking. The locking angle A1 is preferably about 45 degrees or higher. A higher angle facilitates displacement into the tongue groove 20 but also backward displacement. This may be prevented by a hook connection 34 that preferably locks against an upper or lower part of the displacement groove 40. The hook connection is pressed into the groove by a hammer that inserts the tongue 30 into the groove 40 during production. The hook 34 slides against a bevel formed at the displacement groove 40 as shown in figure 5c. The upper part of the locking element 8 is preferably located vertically below the tongue locking surface 33 as shown in figure 5d. This gives a stronger locking. The locking system may have a geometry that allows locking and unlocking with angling.

[0032] Figures 6a-6c show that the displaceable tongue 30 turns and bends in the length direction during folding when an inner short edge of the tongue, as shown in figure 6b is in locked position and an outer short edge of the tongue 30 is in unlocked position as shown in figure 6d. The locking function may be improved if cavities 35 are formed on the displaceable tongue 30. Locking may also be improved if the locking surface 32 at an edge has a lower angle than at an inner part as shown in figures 6b and 6c. The cavities 35 may be formed at tongue section where the locking hooks 34 are formed. The displaceable tongue 30 comprises preferably a polymer material and is preferably formed by injection moulding.

[0033] Figures 7a-7d show that the locking hook 34 may comprise a hook part 34a that is used to press the hook connection upwards by inserting rails 36 during the insertion of the tongue 30 into the displacement groove 40.

[0034] Figures 8a-8c show that the locking hook 34 may be used to prevent unlocking in any locking system where a tongue is displaced in a groove from an inner position to an outer position. The shown locking system comprises pushing protrusions 38 located in pushing cavities 37. The pushing protrusions slide against the locking element 8 and push the tongue 30 into a tongue groove 20. The locking element 8 is preferably located vertically below the cooperating locking surfaces 23, 33 of the tongue 30 and the tongue groove 20.

Embodiments

[0035]

Item 1. Building panels provided with a locking system for vertical locking of a first (1) and a second (1') building panel by a vertical displacement of said building panels (1, 1') relative each other, a displaceable tongue (30) is attached into a sidewardly open displacement groove (40) provided at an edge of the first building panel, said tongue cooperates with a tongue groove (20) provided at an adjacent edge of the second building panel (1') for locking the edge

and the adjacent edge vertically, a strip (6) protrudes:

below the displacement groove and outwardly beyond the upper part of the edge; or below the tongue groove and outwardly beyond the upper part of the adjacent edge,

characterised in that

the displaceable tongue (30) comprises a pulling extension (31) at its outer part configured to cooperate with a pulling protrusion (21) formed at the adjacent edge such that the displaceable tongue (30) is pulled out from the displacement groove (40) and into the tongue groove (20) when the edges of said building panels are displaced vertically against each other.

Item 2. Building panels according to item 1, wherein a part of said pulling protrusion (21) is a part of the tongue groove (20).

Item 3. Building panels according to item 1 or 2, wherein the pulling extension (31) and the pulling protrusion (21) are inclined in relation to a main horizontal plane (HP) of the panels.

Item 4. Building panels according to any one of the items 1 - 3, wherein the displaceable tongue (30) comprises a locking hook (34) that prevents the tongue to slide back into the displacement groove (40) after locking.

Item 5. Building panels according to item 4, wherein the locking hook (34) locks against an outer part of the displacement groove (40).

Item 6. Building panels according to any one of the items 1-5, wherein said building panels are floor panels.

Claims

1. Building panels provided with a locking system for vertical locking of a first (1) and a second (1') building panel by a vertical displacement of said building panels (1, 1') relative each other, a displaceable tongue (30) being inserted into a sidewardly open displacement groove (40) provided at an edge of the first building panel, wherein said displaceable tongue is configured to cooperate with a tongue groove (20) provided at an adjacent edge of the second building panel (1') for locking the edge and the adjacent edge vertically, wherein a strip (6) protrudes:

below the displacement groove and outwardly beyond the upper part of the edge; or below the tongue groove and outwardly beyond

the upper part of the adjacent edge,

wherein the displaceable tongue (30) comprises a pulling extension (31) at its outer part configured to cooperate with a pulling protrusion (21) formed at the adjacent edge such that the displaceable tongue (30) is pulled out from the displacement groove (40) and into the tongue groove (20) when the edges of said building panels are displaced vertically relative to each other, and wherein the displaceable tongue (30) comprises a locking hook (34).

2. Building panels according to claim 1, wherein a part of said pulling protrusion (21) is a part of the tongue groove (20).
3. Building panels according to claim 1 or 2, wherein the pulling extension (31) and the pulling protrusion (21) are inclined in relation to a main horizontal plane (HP) of the panels.
4. Building panels according to any of the preceding claims, wherein the locking hook (34) is configured to prevent the displaceable tongue from sliding back into the displacement groove (40) after locking.
5. Building panels as according to claim 4, wherein the locking hook (34) is configured to lock against an outer part of the sidewardly open displacement groove (40).
6. Building panels according to any of the preceding claims, wherein the locking hook (34) is configured to lock against an upper or lower part of the displacement groove (40).
7. Building panels according to any of the preceding claims, wherein the locking hook (34) is configured to serve as a friction connection for preventing the displaceable tongue (30) from falling out from the displacement groove (40) after locking of the building panels.
8. Building panels according to any of the preceding claims, wherein the locking hook (34) is configured to slide against a bevel formed at the displacement groove (40).
9. Building panels according to any of the preceding claims, wherein cavities (35) are formed on the displaceable tongue (30).
10. Building panels according to claim 9, wherein the cavities (35) are formed at a tongue section where locking hooks (34) of the displaceable tongue (30) are formed.

11. Building panels according to any of the preceding claims, wherein the displaceable tongue (30) is a separate displaceable tongue.
12. Building panels according to any of the preceding claims, wherein the displaceable tongue is formed by injection moulding. 5
13. Building panels according to any of the preceding claims, wherein the locking hook (34) comprises a hook part (34a) that is configured to press the locking hook upwards by inserting rails during insertion of the displaceable tongue (30) into the displaceable groove (40) . 10
14. Building panels according to any of the preceding claims, wherein an upper part of the locking element (8) is located vertically below a tongue-locking surface (33) of the pulling extension (31) in a locked state of the building panels. 15 20
15. Building panels according to any of the preceding claims, wherein said building panels are floor panels.

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Fig. 1a

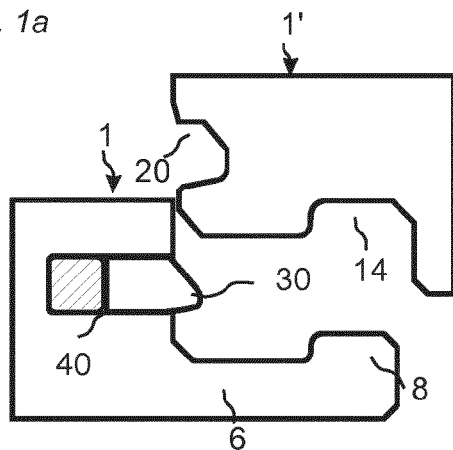


Fig. 1b

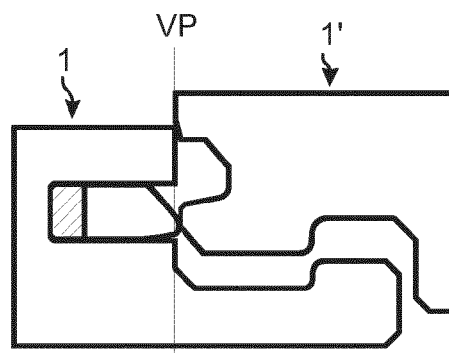


Fig. 1c

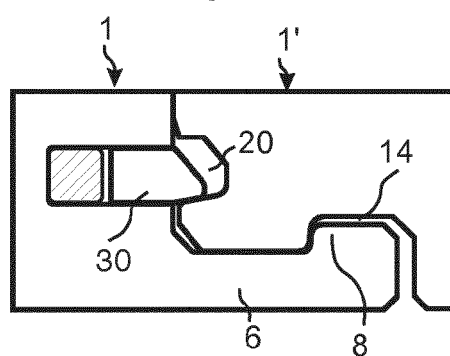
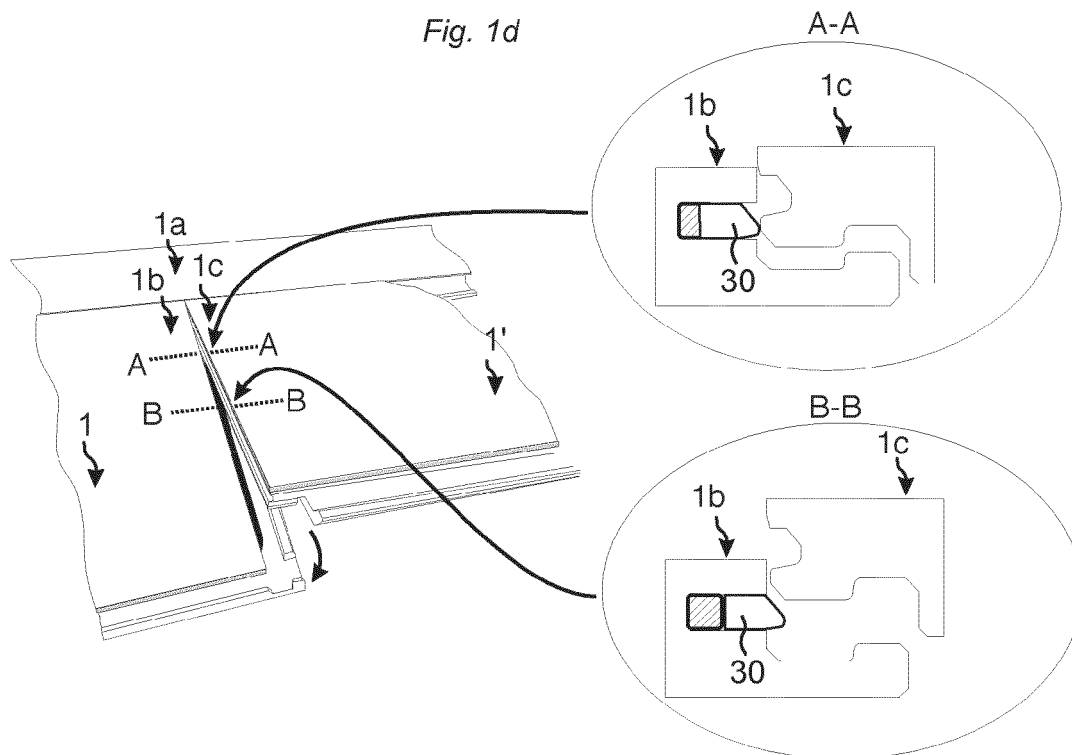


Fig. 1d



KNOWN TECHNOLOGY

Fig. 2a

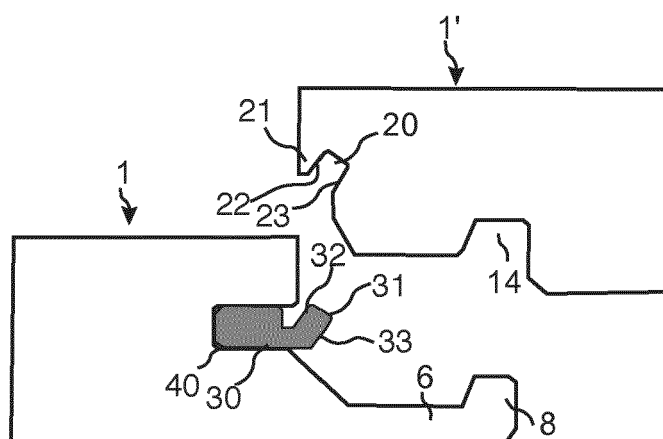


Fig. 2b

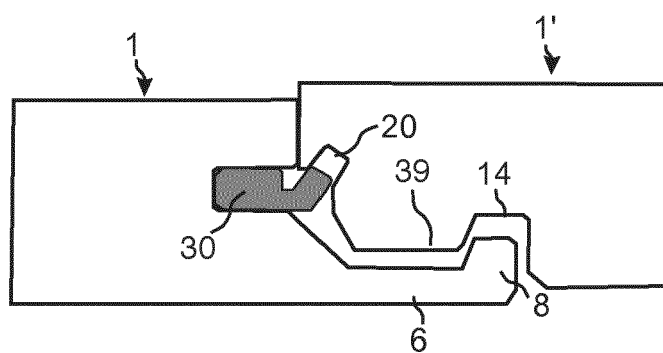


Fig. 2c

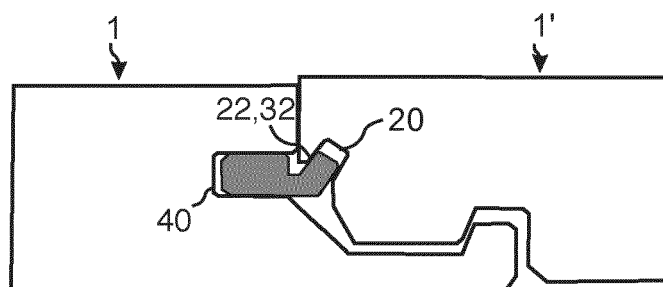


Fig. 2d

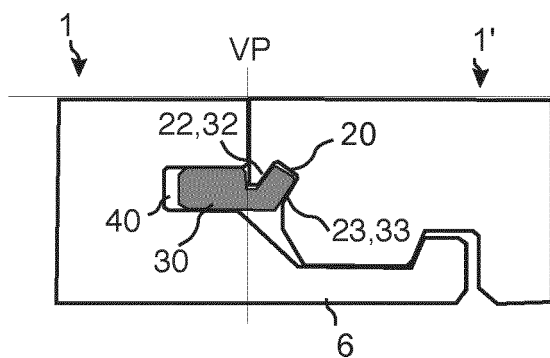


Fig. 2e

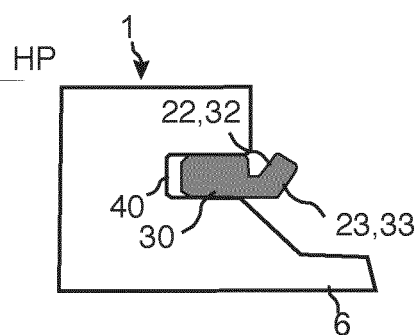


Fig. 3a

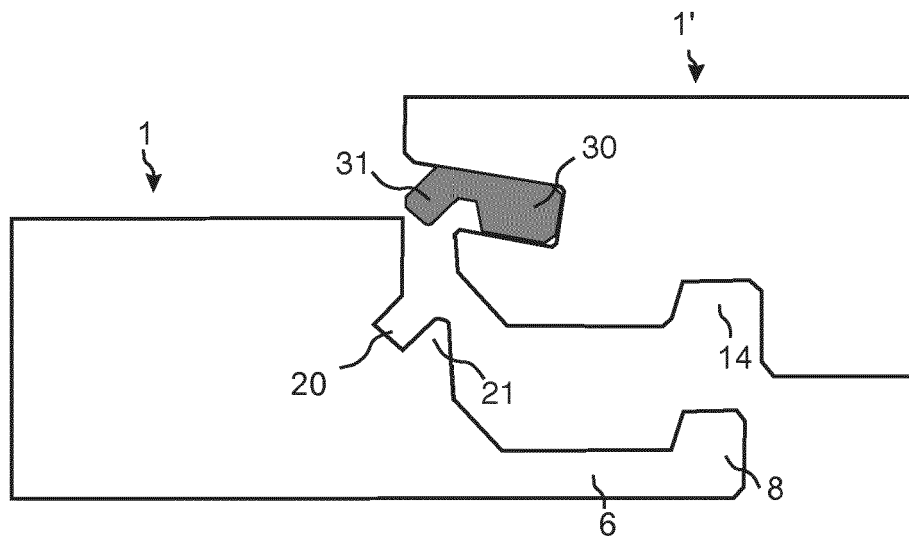


Fig. 3b

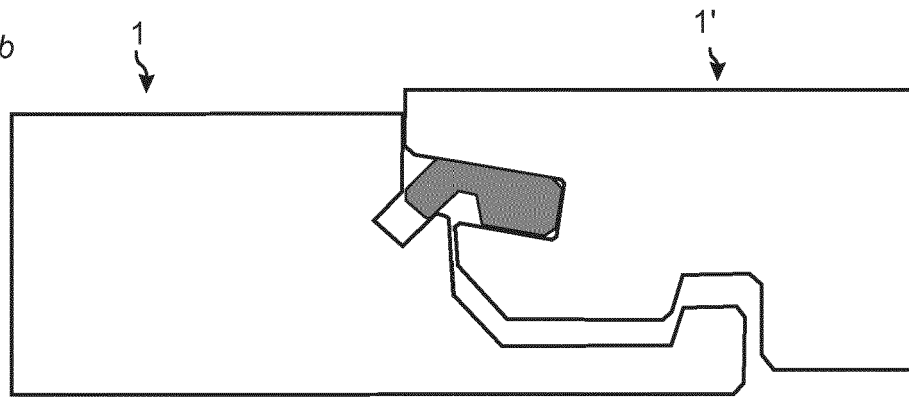


Fig. 3c

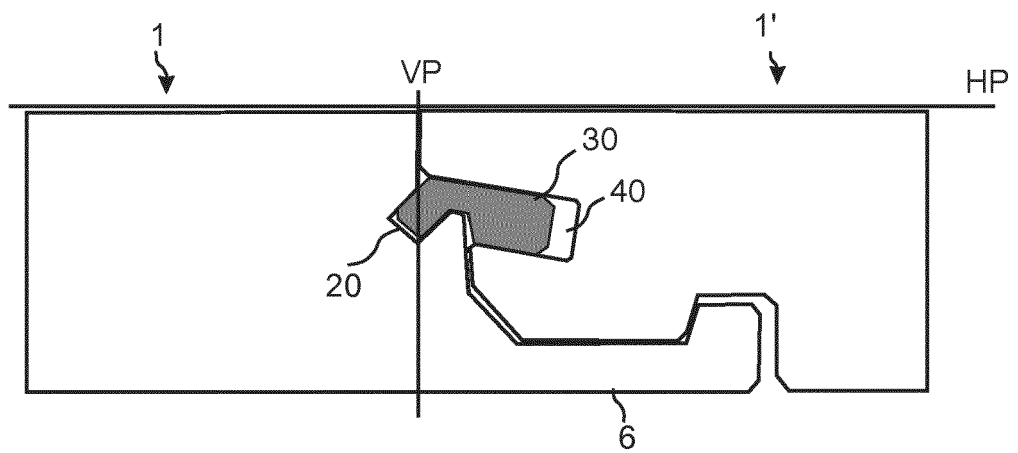


Fig. 4a

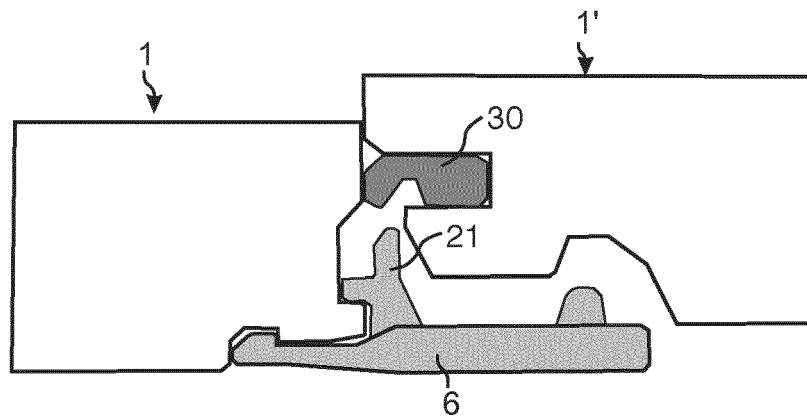


Fig. 4b

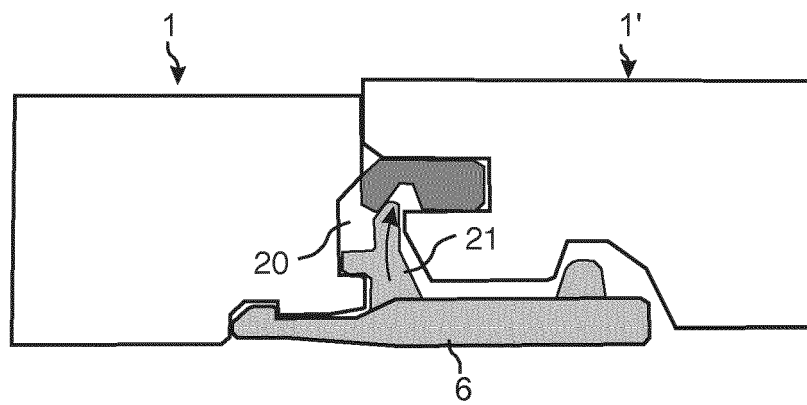


Fig. 4c

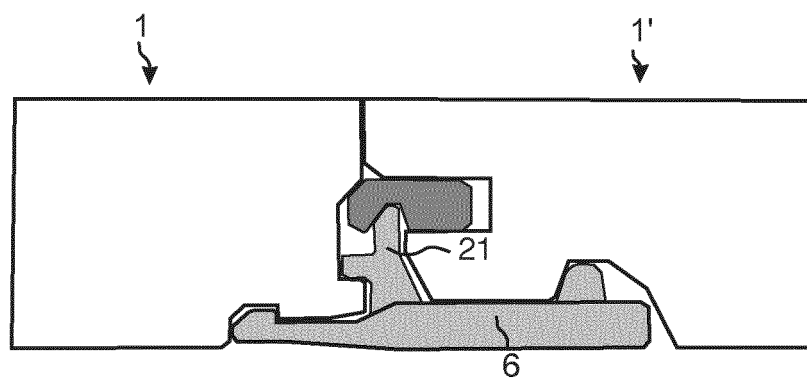


Fig. 5a

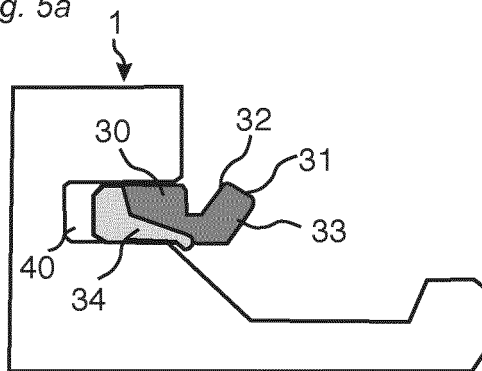


Fig. 5b

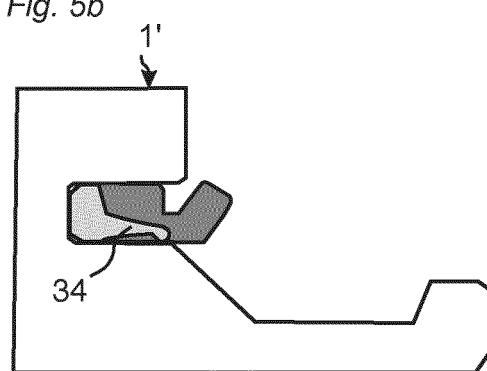


Fig. 5c

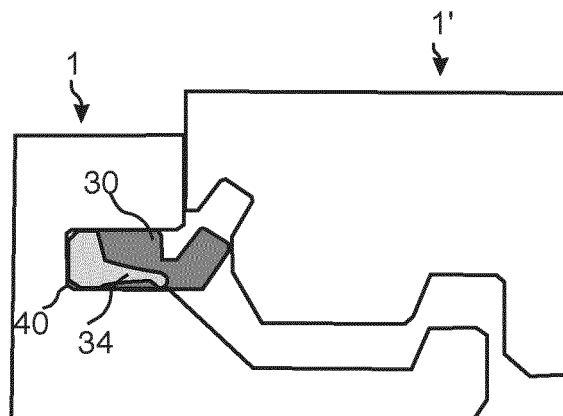


Fig. 5d

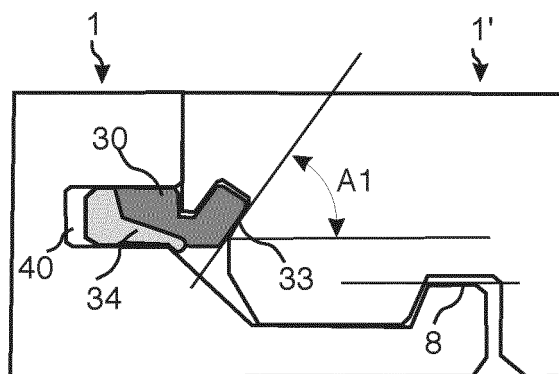
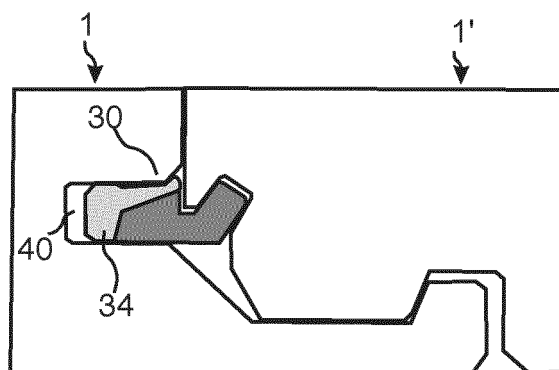


Fig. 5e



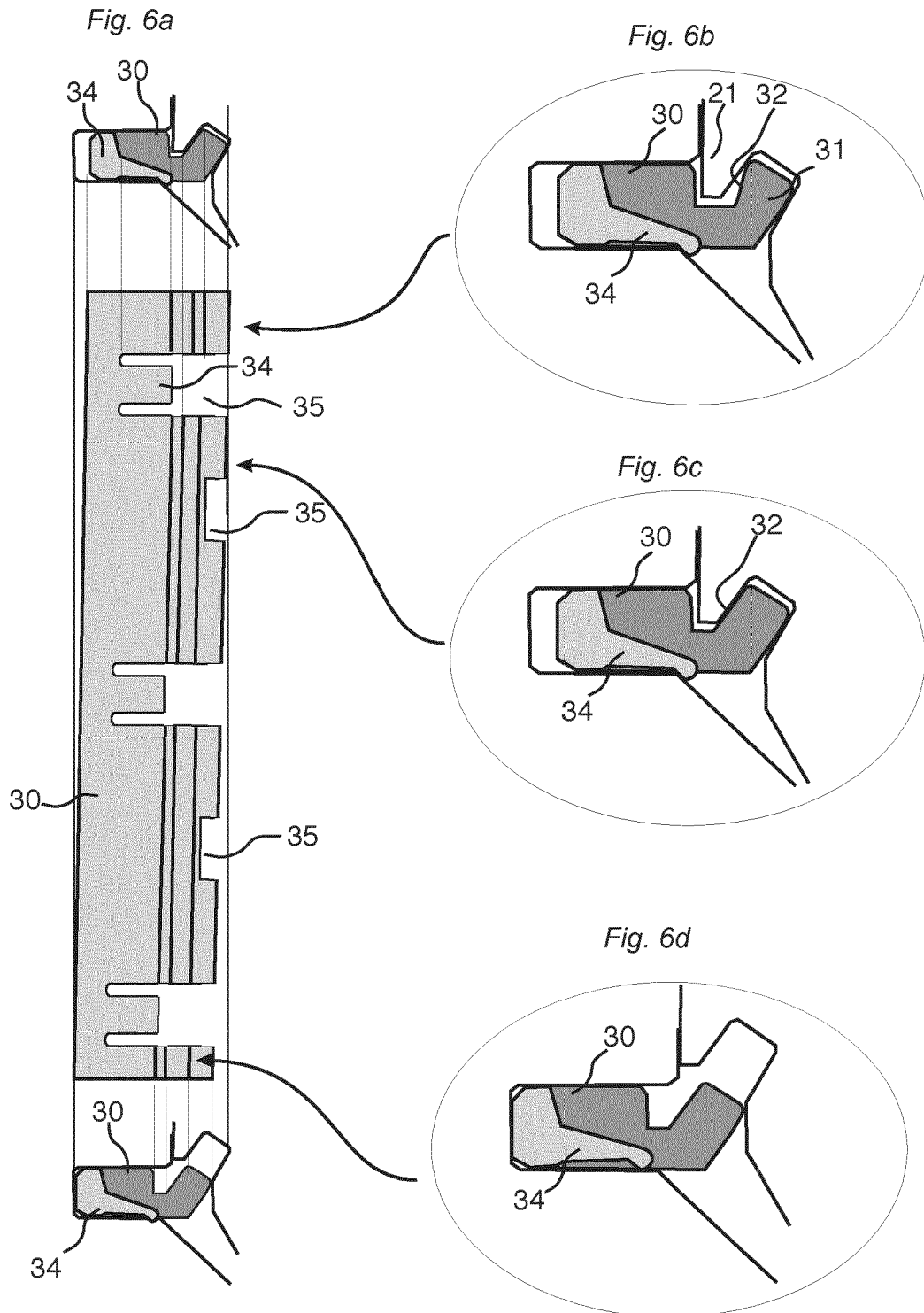


Fig. 7a

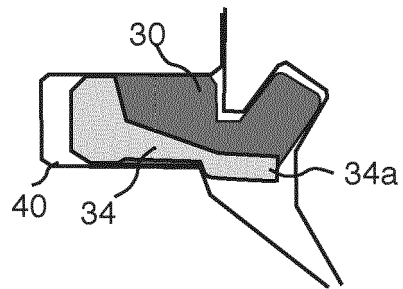


Fig. 7b

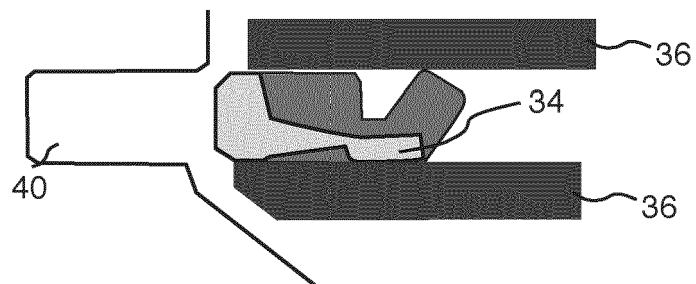


Fig. 7c

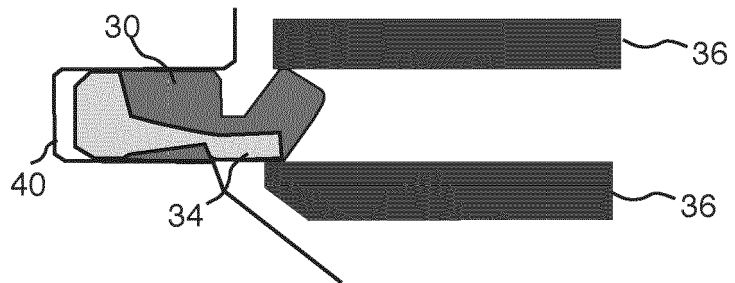


Fig. 7d

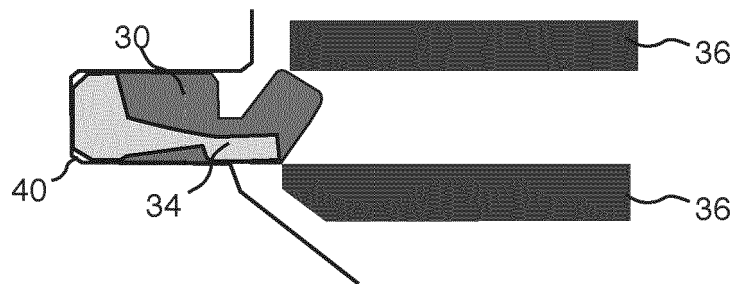


Fig. 8a

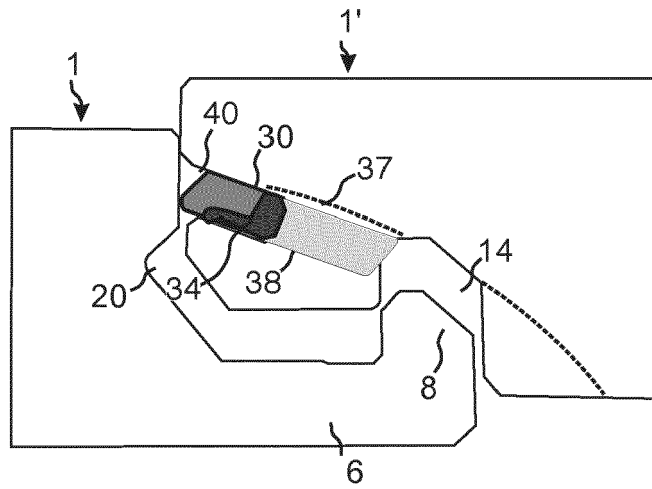


Fig. 8b

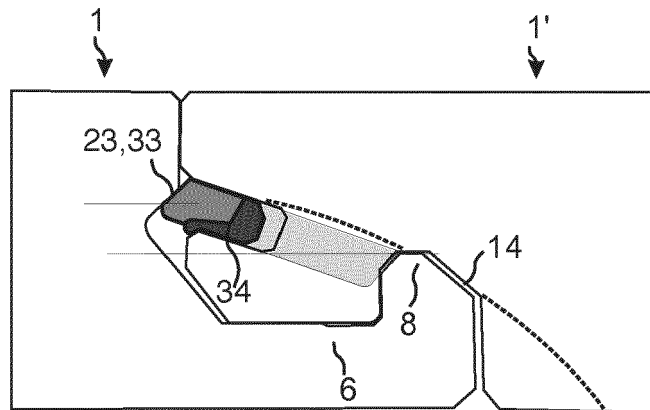
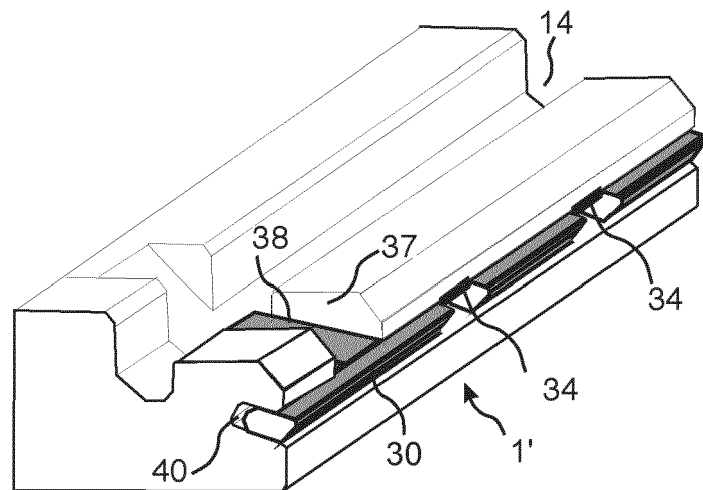


Fig. 8c





EUROPEAN SEARCH REPORT

Application Number
EP 19 20 6640

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	WO 2006/043893 A1 (VAELINGE INNOVATION AB [SE]; PERVAN DARKO [SE] ET AL.) 27 April 2006 (2006-04-27) * the whole document * -----	1-15	INV. E04F15/02 E04F15/04
			TECHNICAL FIELDS SEARCHED (IPC)
			E04F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 February 2020	Examiner Bourgoin, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 20 6640

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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