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Nygren et al.

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(54) **BUILDING PANELS PROVIDED WITH A MECHANICAL LOCKING SYSTEM**

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(73) Assignee: **VALINGE INNOVATION AB**, Viken (SE)

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This patent is subject to a terminal disclaimer.

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E04F 15/02 (2006.01)
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(52) **U.S. Cl.**
CPC ***E04F 15/02038*** (2013.01); ***E04F 15/102*** (2013.01); ***E04F 15/107*** (2013.01);
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(58) **Field of Classification Search**
CPC E04F 13/0894; E04F 15/02038; E04F 2201/0547; E04F 2201/0541; E04F 2201/0523; E04F 2201/0511
See application file for complete search history.

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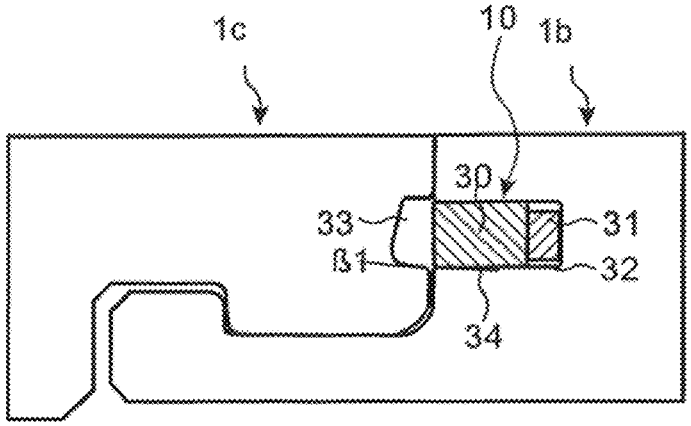
(57) **ABSTRACT**

Building panels, such as floorboards, provided with a mechanical locking system. The mechanical locking system includes a displacement groove at a first edge of a first floorboard and a tongue groove at a second edge of a second floorboard. A tongue is arranged in the displacement groove and is configured to cooperate, in a second position, with the tongue groove for vertical locking of the first and the second edge. The tongue includes, in a first position, an inner element and an outer element. The inner element is removable along the displacement groove, and is configured to cooperate with the outer element to obtain a displacement of the outer element towards the tongue groove and thereby obtain the second position. The inner element and the outer element vertically overlap each other.

26 Claims, 5 Drawing Sheets



Related U.S. Application Data

continuation of application No. 14/200,909, filed on Mar. 7, 2014, now Pat. No. 9,194,134.

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Fig. 1

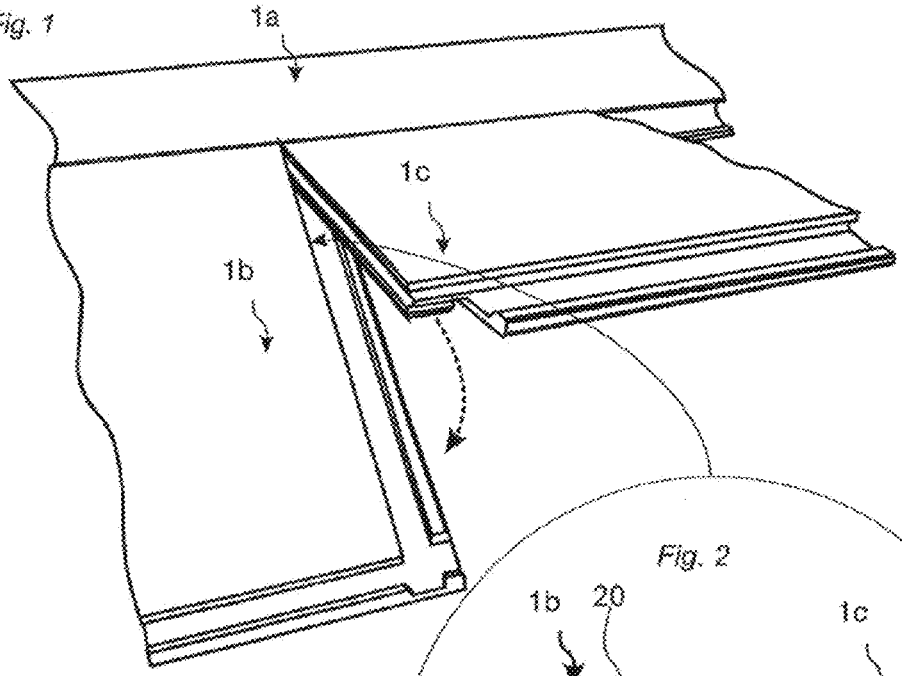


Fig. 2

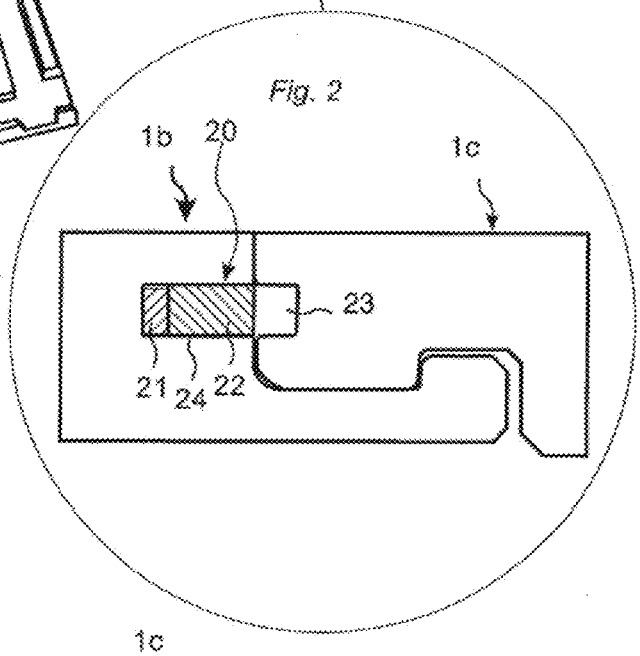
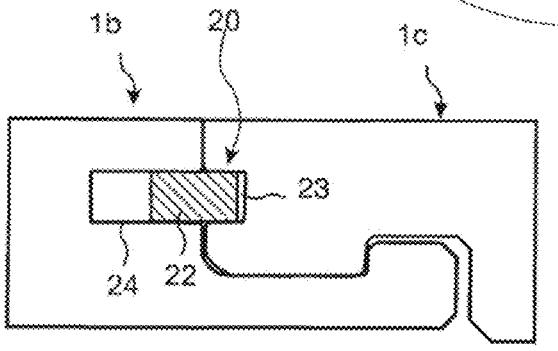


Fig. 3



KNOWN TECHNOLOGY

Fig. 4

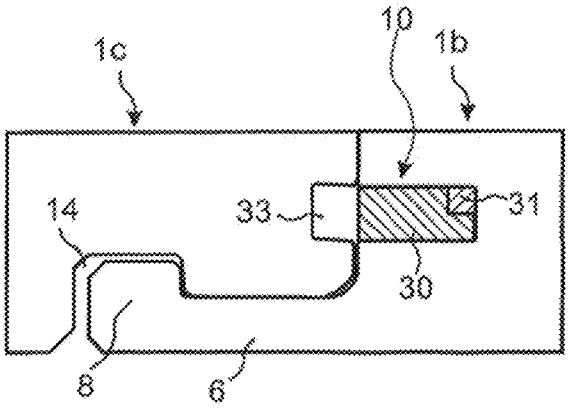


Fig. 5

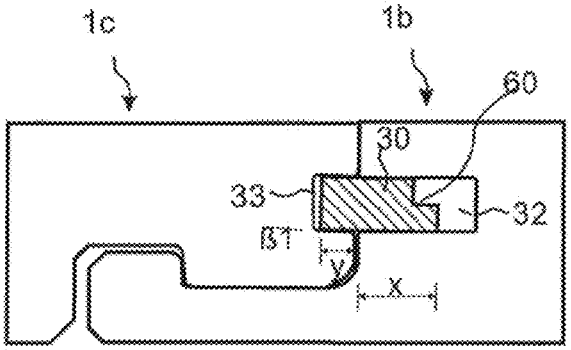


Fig. 6

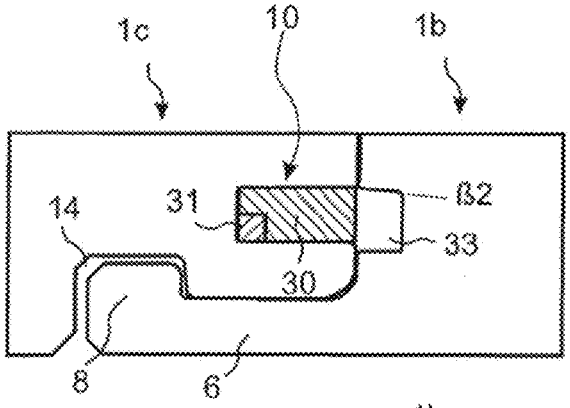


Fig. 7

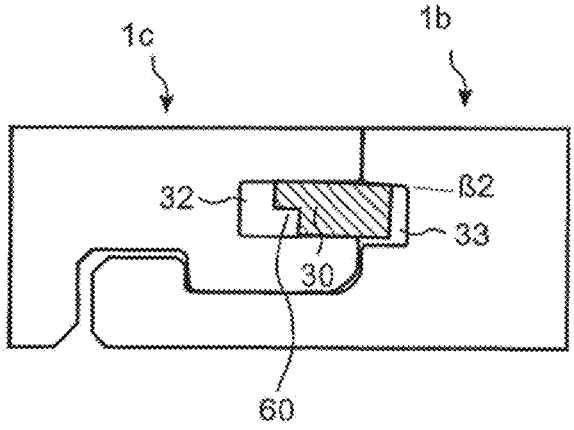


Fig. 8

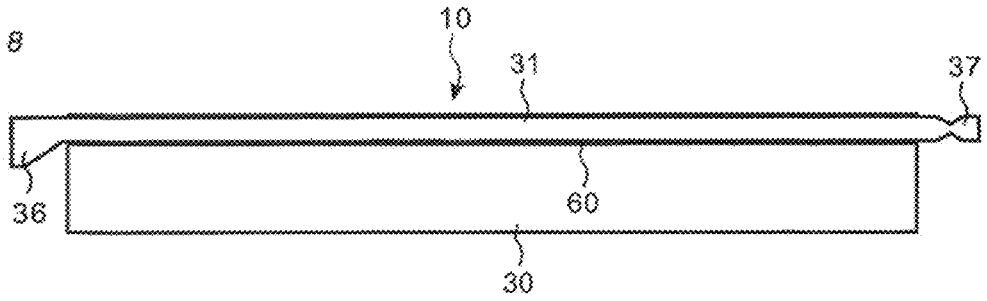


Fig. 9

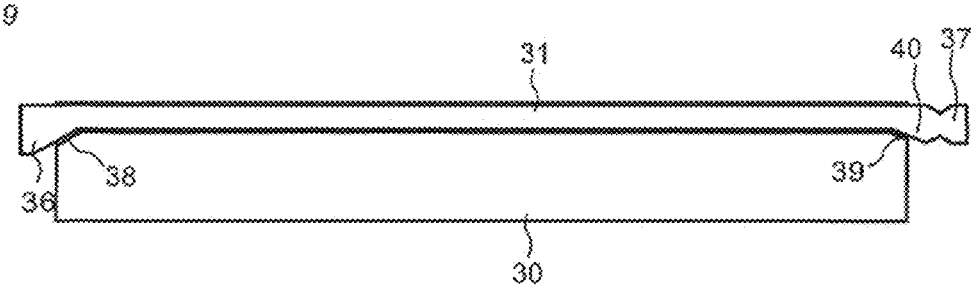


Fig. 10

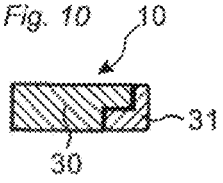


Fig. 11

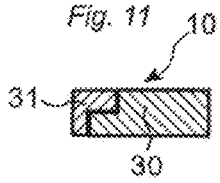


Fig. 12

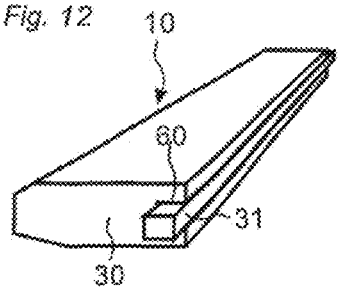


Fig. 13

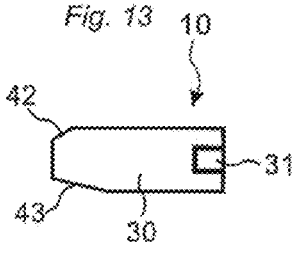


Fig. 14

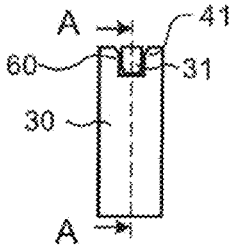


Fig. 15

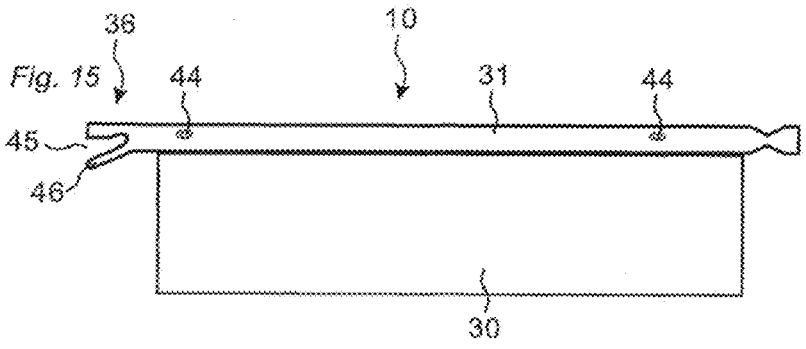


Fig. 16

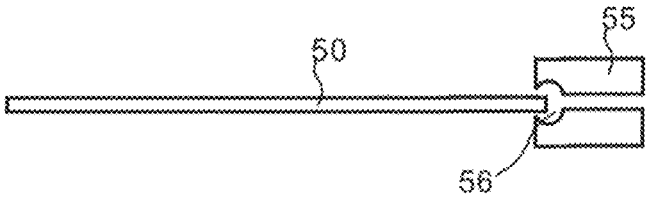


Fig. 17

Fig. 18

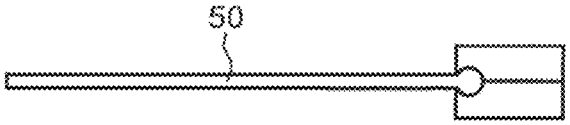


Fig. 19

Fig. 20

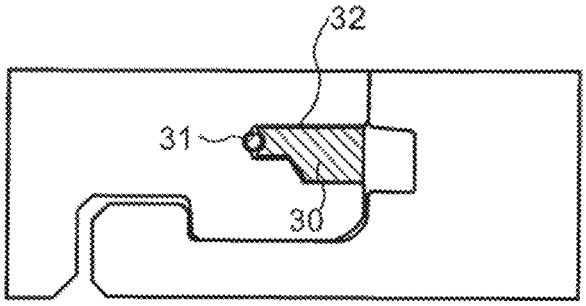


Fig. 21

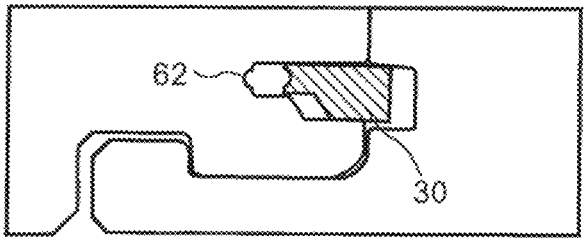


Fig. 22

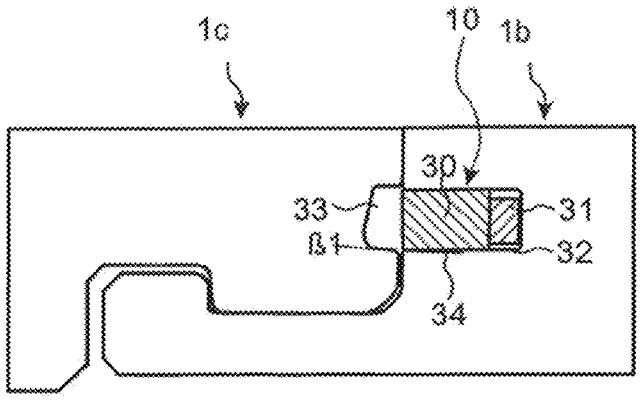


Fig. 23

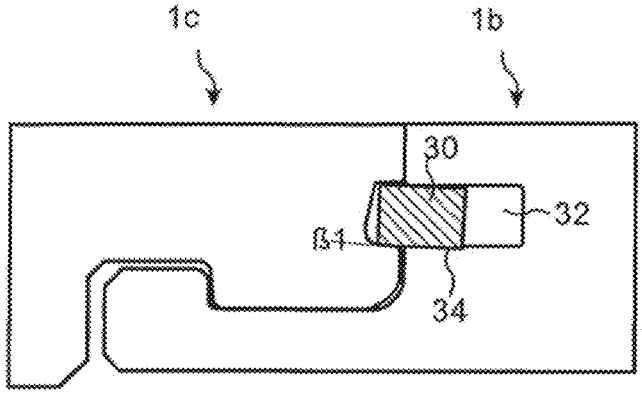


Fig. 24

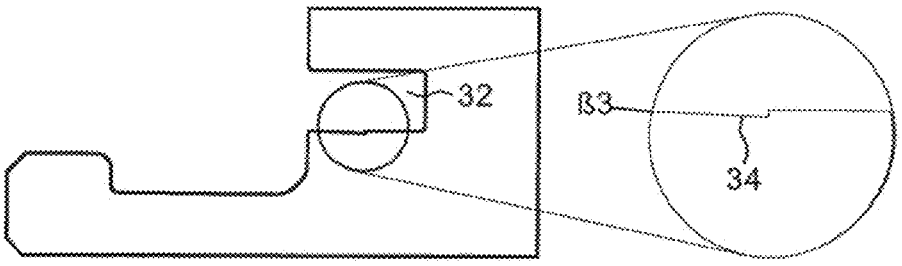
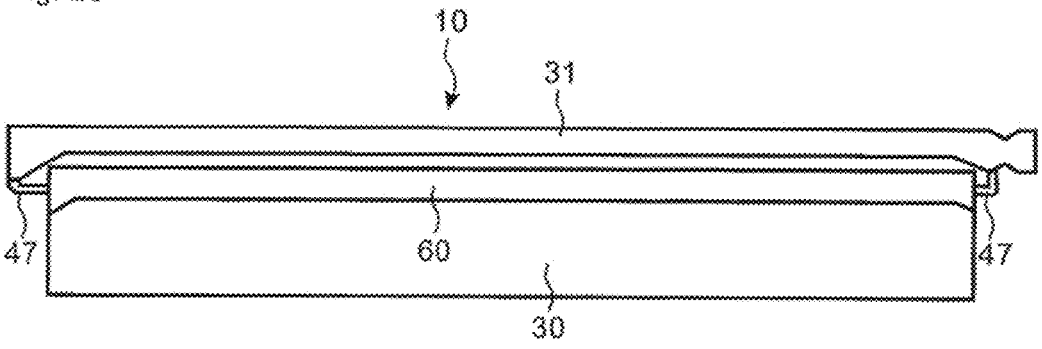


Fig. 25



BUILDING PANELS PROVIDED WITH A MECHANICAL LOCKING SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. application Ser. No. 14/881,614, filed on Oct. 13, 2015, which is a continuation of U.S. application Ser. No. 14/200,909, filed on Mar. 7, 2014, now U.S. Pat. No. 9,194,134, which claims the benefit of Provisional Application No. 61/774,749 filed on Mar. 8, 2013. The disclosure of each of U.S. application Ser. No. 14/881,614, U.S. application Ser. No. 14/200,909 and Provisional Application No. 61/774,749 is hereby incorporated by reference herein in its entirety.

TECHNICAL FIELD

The present disclosure relates to a building panel such as a floor panel, a wall panel, a ceiling panel, a furniture component or the like, which is provided with a mechanical locking system comprising a displaceable tongue.

TECHNICAL BACKGROUND

Building panels provided with a mechanical locking system comprising a displaceable tongue cooperating with a tongue groove for vertical locking is known and disclosed in, e.g., FR 2 975 717. The mechanical locking system in FR 2 975 717 has a displaceable tongue comprising an outer element which is pushed by a wedge part of a removable inner part of the tongue into a tongue groove, for vertical locking of adjacent edges of two floorboards. A drawback with this known system is that the locking strength is rather low.

The above description of various known aspects and drawback is the Applicant's characterization of such, and is not an admission that any of the above description is considered as prior art.

Although the description in the present disclosure relates to a floor panel, the description of techniques and problems thereof is applicable to other applications as well. For example, the description is also applicable to panels for other purposes, such as wall panels, ceiling panels, furniture panels and components, etc.

SUMMARY

It is an object of embodiments of the present disclosure to provide an improvement over the above described conventional techniques.

A further object of embodiments of the present disclosure is to provide building panels, such as floorboards, provided with a locking system that comprises a tongue that improves the vertical locking of the floorboards.

Another object of embodiments of the present disclosure is to provide a more efficient production method, which requires less complicated production equipment.

At least some of these and other objects and advantages that will be apparent from the present disclosure have been achieved by certain embodiments of the building panels described herein. The building panels, such as floorboards, are provided with a locking system that comprises a displacement groove at a first edge of a first floorboard and a tongue groove at a second edge of a second floorboard. A tongue is arranged in the displacement groove and is configured to cooperate, in a second position, with the tongue groove for vertical locking of the first edge and the second edge. The tongue comprises, in a first position, an inner element and an outer element. the inner element is removable along the displacement groove, and is configured to cooperate with the outer element to obtain a displacement of the outer element towards the tongue groove and thereby obtain the second position. The inner element and the outer element are preferably configured to vertically overlap each other in the first position to obtain an increased contact surface between a surface of the displacement groove and the outer element of the tongue in the second position. The inner element and the outer element are arranged such that the increased contact surface takes up a moment of force that arises on the tongue when a load is applied on the first or the second floorboard. The inner element in the first position may be arranged above or below the outer element. The inner element in the first position may also be arranged partly above partly behind the outer element, or may be arranged partly below the outer element and partly behind the outer element.

The entire outer element is in the first position preferably arranged within the displacement groove.

The outer element maybe provided with a guiding groove at either an inner and upper edge of the outer element or at an inner and lower edge of the outer element, wherein at least a part of the inner element in the first position is arranged in said guiding groove. The outer element may be provided with a guiding groove at an inner surface of the outer element, between an upper surface and lower surface of the outer element, wherein at least a part of the inner element is arranged in said guiding groove in the first position. The guiding groove facilitates the removal of the inner element by guiding the inner element in a controlled manner and provides a groove without obstructions and desired friction. The guiding groove preferably extends essentially along the whole longitudinal length of the outer element. This embodiment of the outer element provides for a simple production of the outer element for example by plastic profile extrusion and cutting of the profile in the desired length.

The inner element preferably comprises a first protruding part configured to cooperate with the guiding groove, to obtain said displacement of the outer element.

The first protruding part in the first position is preferably arranged outside of the outer element and/or in a recess of the outer element. When the inner element is removed by a displacement along the displacement groove and preferably in the guiding groove, the outer element is gradually pushed into the tongue groove to obtain the second position.

The first protruding part may be wedge shaped or of an essentially spherical shape. Such shapes facilitate the displacement of the inner element. The outer element may also be provided with guiding surfaces at the location of the first protruding part in the first position. The first protruding part is preferably elastic, to make it easier to displace the first protruding part over irregularities in the displacement groove. The first protruding part may comprise an elastic material and may be provided with a recess to increase the elasticity.

The inner element is preferably provided with a second protruding part, preferably configured such that the second protruding part is easy to grasp by an installer of the floorboards. The second protruding part may also be configured such that the inner element is secured in the correct position.

The cross section of the inner element may be L-shaped or rectangular or of an essentially circular shape.

The inner element may comprise plastic and may be produced by injection molding or extrusion. An extruded inner element of plastic may be provided with the first and or the second protruding part by heating and compressing a part of the extruded profile in a press tool.

The inner and outer element may be produced in one piece by injection molding of plastic and connected together by a connection configured to break when the inner element is displaced or when the tongue is inserted into the displacement groove.

The building panels may comprise a wood-based core, preferably made of at least one of MDF, HDF, OSB, WPC (Wood Powder Composite), and particleboard, or of plastic, such as vinyl or PVC.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure will by way of example be described in more detail with reference to the appended schematic drawings, which illustrate several embodiments.

FIGS. **1-3** show a known locking system with a tongue comprising an inner and an outer element.

FIGS. **4-7** show a tongue comprising a guiding groove at an inner edge, according to embodiments of the present disclosure.

FIGS. **8** and **9** each shows a tongue from a top view, according to embodiments of the present disclosure.

FIGS. **10** and **11** show cross-sections of a tongue comprising an L-shaped inner element, according to embodiments of the present disclosure.

FIGS. **12-15** show tongues comprising a guiding groove at an inner surface, according to embodiments of the present disclosure.

FIGS. **16-18** show a method for producing an inner element of a tongue, according to embodiments of the present disclosure.

FIG. **19** shows an embodiment of an inner element of a tongue, according to an embodiment of the present disclosure.

FIGS. **20** and **21** show a tongue with an inner element having a circular cross-section, according to an embodiment of the present disclosure.

FIGS. **22-24** show a displacement groove provided with recess, according to an embodiment of the present disclosure.

FIG. **25** shows a tongue from a top view, according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

FIGS. **1-3** show floorboards provided with a known locking system which comprises a tongue **20** having an inner element **21** and an outer element **22**. The tongue **20** is arranged in a displacement groove **24** at a first edge **1***b* of a first floorboard. FIG. **1** shows a position during assembling of the first floorboard. The first floorboard is arranged in a second row and is connected at a third edge to a fourth edge of a third floorboard in first row. A second floorboard is arranged in an angled position with a third edge adjacent the fourth edge of the third floorboard and a second edge **1***c* of the second floorboard is arranged adjacent the first edge **1***b* of the first floorboard.

FIG. **2** shows a cross-section of the first edge **1***b* and the second edge **1***c* after the second floorboard is angled down and connected to the third floorboard in the first row. The first edge **1***b* and the second edge **1***c* are in FIG. **2** locked together in the horizontal direction, and the inner element **21** and the outer element **22** of the tongue **20** are arranged in a first position. The first edge **1***b* and the second edge **1***c* are in the first position vertically un-locked. To lock the first edge **1***b* and the second edge **1***c* in the vertical direction, the inner element **21** is displaced and removed along the first edge **1***b*. The inner element **21** is provided with a protruding part. The protruding part pushes the outer element **22** of the tongue **20** into a tongue groove **23** at the second edge **1***c* of the second floorboard when the inner element **21** is displaced and removed.

FIG. **3** shows a cross-section of the first edge **1***b* and the second edge **1***c* in a second position. The inner element **21** of the tongue **20** is in the second position displaced and removed. The outer element **22** of the tongue **20** cooperates with the tongue groove **23** at the second edge **1***c* of the second floorboard for vertical locking of the first edge **1***b* and the second edge **1***c*.

An embodiment of the present disclosure is shown in FIG. **4** and FIG. **5**, with an inner and outer element **31**, **30** of the tongue **10** arranged in a displacement groove **32** at a first edge **1***b* of a first floorboard. FIGS. **4** and **5** illustrate the first position and the second position, respectively, of the inner and outer elements **31**, **30**. The outer element **30** of the tongue **10** extends below the inner element **31** of the tongue **10**, such that the inner element **31** vertically overlaps the outer element **30**. The inner element **31** is in this embodiment arranged in a guiding groove **60** at an inner and upper edge of the outer element **30**. The width x of a first contact surface between a lower surface of the outer element **30** of the tongue **10** and the displacement groove **32** is increased, as compared to the known locking system shown in FIG. **3**, in order to improve the strength of the locking system and minimize the offset in height between the first edge **1***b* and the second edge **1***c* when a load is applied, in the second position, on the first floorboard.

The second position in which the outer element **30** is pushed into the tongue groove **33** at the second edge **1***c* is shown in FIG. **5**. The outer element **30** is pushed into tongue groove **33** by a first protruding part **36** (see FIGS. **8** and **9**) arranged on the inner element **31**, when the inner element **31** is removed and displaced along the first edge **1***b*. A load applied on the first edge **1***b* will be taken up by a second contact surface, between an upper surface of the outer element **30** of the tongue **10** and the displacement groove **32**, and a third contact surface between a lower surface of the outer element **30** of the tongue and the tongue groove **33**. Since the second contact surface and the third contact surface are displaced, the load applied will result in a moment of force, which is taken up by the first contact surface. In order to increase the strength of the locking system, the width x of the first contact surface is preferably larger than the width y of the third contact surface, and preferably the width x is about twice ore more the width y. For the purpose of reducing the momentum that arises when a load is applied on the first edge **1***b*, the horizontal distance between the second and the third contact surfaces should be as small as possible, preferably less than about 1 mm and more preferably less than about 0.5 mm. This applies also to the embodiments described below.

The locking system additionally comprises in this embodiment a locking strip **6**, which protrudes horizontally from the first edge **1***b*. The locking strip **6** is provided with a locking element **8** which cooperates with a locking groove **14** provided at the second edge **1***c* for horizontal locking of the first edge **1***b* and the second edge **1***c*. A load applied on the second edge **1***c* is preferably taken up by a strip contact

surface between an upper surface of the locking strip **6** and a lower surface of the second edge **1***c*.

In order to push the first edge **1***b* and the second edge **1***c* vertically against each other, a lower surface of the tongue groove **33** at the third contact surface is preferably arranged with an angle β**1** in relation to the horizontal plane of the floorboards. The angle β**1** may be in the range of about 5° to about 20°, and preferably about 15°.

In the embodiment shown in FIGS. **6** and **7**, the tongue **10** is arranged in a displacement groove **32** at the second edge **1***c*. The inner element **31** of the tongue **10** is for this embodiment preferably arranged in a guiding groove **60** at an inner and lower edge of the outer element **30** of the tongue **10** to obtain an increased first contact surface between an upper surface of the outer element **30** of the tongue **10** and the displacement groove **32**. Also, in this embodiment the first contact surface takes up a momentum force resulting from a load applied at the first edge **1***b*, in a similar way as described for the embodiment shown in FIGS. **4** and **5**. In order to push the first edge **1***b* and the second edge **1***c* vertically against each other, an upper surface of the tongue groove is preferably arranged with an angle β**2** in relation to the horizontal plane of the floorboards. The angle β**2** may be in the range of about 5° to about 20°, and preferably about 15°.

FIGS. **8** and **9** show top view embodiments of an elongated tongue **10**, to be arranged in a displacement groove **32** at a first edge **1***b* of a first floorboard. The elongated tongue comprises an inner element **31**, and an outer element **30**. The inner element **31** is arranged in a guiding groove **60** at an inner edge of the outer element **30**. The inner element **31** is preferably a bar element of an elongated shape and is provided at a first short edge with a first protruding part in the form of a wedge shaped element **36**. The wedge shaped element is in a preferred embodiment guided by the guiding groove during the displacement of the inner element. The wedge shaped element **36** is configured to push the outer element **30** into a tongue groove **33** of an adjacent second edge **1***c* of a second floorboard when the inner element **31** is removed and displaced along the first edge **1***b*. The wedge shaped element **36** is, before the displacement, preferably arranged adjacent and at least partly outside a first short edge of the outer element **30** as shown in FIG. **8**. A second edge of the inner element **31** is preferably provided with a gripping part **37** that facilitates the displacement of the inner element **31**. FIG. **9** shows that the first short edge of the outer element **30** may be provided with first chamfer **38** that guides the wedge shaped element **36** into the guiding groove **60**. The gripping part **37** is, before displacement of the inner element **31**, preferably arranged adjacent a second short edge of the outer element **30** and preferably outside the second edge. As shown in FIG. **9** the inner element **31** may be provided with a second protruding part **40**, for a correct positioning of the inner element **31**, that before displacement of the inner element is preferably arranged in a notch or in a second chamfer **39** provided at the second short edge of the outer element **30**. The outer element **30** may have a uniform cross-section from the first short edge to the second short edge. A uniform cross-section makes it possible to produce the outer element **30** at low cost, by e.g., extrusion of plastic. Also the inner element **31** may have uniform cross-section with the exception of the protruding part (wedge shaped element) **36** at the first edge. For the purpose of obtaining a correct position of the inner element **31**, a preferred embodiment of the present disclosure comprises the first chamfer **38** and the second chamfer **39**, which cooperate with the first protruding part **36** and the second protruding part **40**, respectively.

FIGS. **10** and **11** show an embodiment of the tongue **10** comprising an L-shaped inner element **31** arranged in a corresponding guiding groove at an inner edge of the outer element **30**.

FIGS. **12-15** show an embodiment of the tongue **10** comprising inner element **31** arranged in a guiding groove **60** at an inner surface of the outer element **30**. FIG. **13** shows that outer edges **42**, **43** of the outer element **30** may be chamfered in order to guide the outer element **30** into the tongue groove **33**. FIG. **14** shows a cross section of the tongue **10** and that the guiding groove **60** may be provided with chamfered edges **41**. FIG. **15** shows a cross section of the tongue **10** in a plane indicated by AA in FIG. **14**. The inner element **31** in this embodiment is provided with friction elements **44** that avert that the inner element **31** from falling out before the floorboards are installed. The first protruding part **36** is provided with a recess **45** that makes its most protruding part **46** more resilient. The most protruding part **46** may be, during the displacement of the inner element **31**, compressed during, e.g., entrance of the inner element **21** into the guiding groove **60**, or at any irregularities in the displacement groove **32**. Also the other embodiments of the tongue **10** may be provided with a friction element **44** on the inner element **31** and/or on the outer element **30**, and/or a recess **45** in the first protruding part **36**.

A method for producing the first protruding part **36** and/or the second protruding part **40** of the inner element **31** is illustrated in FIGS. **16-18**. A plastic blank **50** of an elongated shape is displaced into a press tool comprising a first part **55** and a second part **56**. The first part **55** and the second part **56** are displaced against each other and a protruding part **35** at a first short edge of the plastic blank **50** is formed under heat and pressure. The process may be repeated for a second short edge of the plastic blank **50**. The method may also comprise the step of forming the second protruding part **35** simultaneously and essentially in the same manner as the first protruding part **35**. The produced first and/or second protruding part **35** may be of, for example, an essentially spherical shape or wedge shaped. FIG. **19** shows an inner element **31** that may be produced according to the method illustrated in FIGS. **16-18**. The inner element **31** preferably has an essentially circular cross-section and preferably comprises protruding parts **35** of an essentially spherical shape.

FIGS. **20** and **21** show that an inner element **31** with a circular cross section may be combined with a displacement groove **32** having an inner surface **62**, which is smaller than the opening of the displacement groove **32**. The inner surface **62** may be provided with a round shaped bottom that facilitates the displacement of the inner element **31**.

An upper or lower surface of the displacement groove **32** may be provided with a recess **34** having an angled surface at an angle β**3** to the horizontal plane. The angle β**3** may be in the range of about 3° to about 10°. An embodiment of the recess **34** is shown in FIGS. **22-24**. The recess **34** and the angled surface has the effect that the outer element **30** of the tongue **10** tilts and the outer element **30** is restrained from being displaced back into the displacement groove **32** after the outer element **30** is pushed into the tongue groove **33** by the inner element **31**. Such a recess **34** may be provided in locking systems comprising any type of the disclosed displaceable tongue.

A preferred embodiment of the tongue **10** is shown in FIG. **25**. The inner element **31** and the outer element **30** are produced in one piece by injection moulding of plastic. The

inner element **31** and the outer element **30** are connected together by a connection **47** configured to break when the inner element is displaced or when the tongue is inserted into the displacement groove.

The invention claimed is:

1. Panels including at least a first floorboard and a second floorboard provided with a mechanical locking system comprising:

a displacement groove at a first edge of the first floorboard and a tongue groove at a second edge of the second floorboard; and

a tongue arranged in the displacement groove and configured to cooperate, in a second position, with the tongue groove for vertical locking of the first edge and the second edge,

wherein the tongue comprises, in a first position, an inner element and an outer element, the inner element being removable along the displacement groove and configured to cooperate with the outer element to obtain a displacement of the outer element towards the tongue groove and thereby obtain the second position,

wherein said displacement groove includes a first inner surface, a second inner surface and a third inner surface, the second inner surface being located between and adjacent to the first and third inner surfaces, and the first, second and third inner surfaces all being angled relative to one another; and

wherein the displacement groove comprises a recess formed by the first and second inner surfaces and not including the third inner surface, the recess being configured such that the outer element, overlapping the first inner surface, is restrained by the second inner surface from being displaced back further into the displacement groove to overlap the third inner surface after the outer element is pushed into the tongue groove by the inner element.

2. Panels including at least a first floorboard and a second floorboard provided with a mechanical locking system comprising:

a displacement groove at a first edge of the first floorboard and a tongue groove at a second edge of the second floorboard; and

a tongue arranged in the displacement groove and configured to cooperate, in a second position, with the tongue groove for vertical locking of the first edge and the second edge,

wherein the tongue comprises, in a first position, an inner element and an outer element, the inner element being removable along the displacement groove and configured to cooperate with the outer element to obtain a displacement of the outer element towards the tongue groove and thereby obtain the second position,

wherein said displacement groove comprises a recess configured such that the outer element is restrained from being displaced back into the displacement groove after the outer element is pushed into the tongue groove by the inner element,

wherein said inner element and said outer element vertically overlap each other in the first position.

3. Panels as claimed in claim **1**, wherein the inner element, in the first position, is arranged above or below the outer element.

4. Panels as claimed in claim **1**, wherein the inner element, in the first position, is arranged partly above and partly behind the outer element, or is arranged partly below the outer element and partly behind the outer element.

5. Panels as claimed in claim **1**, wherein the outer element is provided with a guiding groove at either an inner and upper edge of the outer element or at an inner and lower edge of the outer element, and at least a part of the inner element in the first position is arranged in said guiding groove.

6. Panels as claimed in claim **1**, wherein the outer element is provided with a guiding groove at an inner surface of the outer element, between an upper surface and a lower surface of the outer element, and at least a part of the inner element is arranged in said guiding groove in the first position.

7. Panels as claimed in claim **5**, wherein the guiding groove extends essentially along the whole longitudinal length of the outer element.

8. Panels as claimed in claim **5**, wherein the inner element comprises a first protruding part configured to cooperate with the guiding groove, to obtain said displacement of the outer element.

9. Panels as claimed in claim **8**, wherein the first protruding part in the first position is arranged outside of the outer element.

10. Panels as claimed in claim **8**, wherein the first protruding part is one of wedge shaped and essentially spherical shaped.

11. Panels as claimed in claim **1**, wherein a cross section of the inner element is one of an L-shape, rectangular shape, and an essentially circular shape.

12. Panels as claimed in claim **1**, wherein the entire outer element is arranged within the displacement groove in the first position.

13. Panels as claimed in claim **1**, wherein the panels comprise a wood-based core made of at least one of MDF, HDF, OSB, WPC (Wood Powder Composite), and particleboard.

14. Panels as claimed in claim **1**, wherein the panels comprise a plastic core.

15. Panels as claimed in claim **1**, wherein the first second and third inner surfaces of the displacement groove are at an upper or lower surface of the displacement groove.

16. Panels as claimed in claim **1**, wherein the first inner surface of the displacement groove is oriented at an angle $\beta 3$ to the horizontal plane.

17. Panels as claimed in claim **16**, wherein the angle $\beta 3$ is in the range of about 3° to about 10°.

18. Panels as claimed in claim **8**, wherein the first protruding part in the first position is arranged at least partly in a recess of the outer element.

19. Panels as claimed in claim **18**, wherein the first protruding part is one of wedge shaped and essentially spherical shaped.

20. Panels as claimed in claim **1**, wherein the outer element includes two opposed long edges, and a first short edge and second short edge which oppose each other, and the outer element has a uniform cross-section from the first short edge to the second short edge.

21. Panels as claimed in claim **1**, wherein two corners of the substantially rectangular shape which face the inner element each has a chamfer.

22. Panels as claimed in claim **1**, wherein the inner element includes two opposed long edges, a first short edge and second short edge which oppose each other, and a protruding part at the first short edge, wherein the inner element has a uniform cross-section with the exception of the protruding part at the first short edge.

23. Panels as claimed in claim **1**, wherein said inner element and said outer element vertically overlap each other in the first position.

24. Panels as claimed in claim **1**, wherein the outer element has a substantially rectangular shape in plan view as seen from above the first floorboard.

25. Panels as claimed in claim **1**, wherein the first inner surface and the third inner surface form an angle within a range of 3° to 10°.

26. Panels as claimed in claim **1**, wherein the first inner surface defines a positive angle relative to the third inner surface, and the second inner surface defines a negative angle relative to the third inner surface.

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