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- **Nilsson, Thomas**
281 31, Hässleholm (SE)
- **Wilkins, Jan**
263 39, Höganäs (SE)

(71) Applicant: **Saint-Gobain Ecophon AB**
260 61 Hyllinge (SE)

(74) Representative: **Bratt, Jan Henrik**
Awapatent AB
Järnvägsgatan 10 A
P.O. Box 1066
S-251 10 Helsingborg (SE)

(72) Inventors:
 • **Skeppås, Jonas**
254 51, Helsingborg (SE)

(54) **A ceiling tile unit and a method for forming a ceiling tile unit**

(57) The present invention relates to a ceiling tile unit (10) comprising a tile body made of mineral fibre material, a surface layer and a guide. The tile body has a front side, a rear side and at least one side edge, and the surface layer is arranged on said front side of said tile body. A groove is provided in said rear side of said tile

body dividing said tile body into a first tile body section and a second tile body section. Said guide is adapted to form a fold guidance for inclination of said first tile body section in relation to said second tile body section by folding about an axis parallel to the longitudinal direction of said groove. The invention further relates to a method for forming a ceiling tile unit (10).

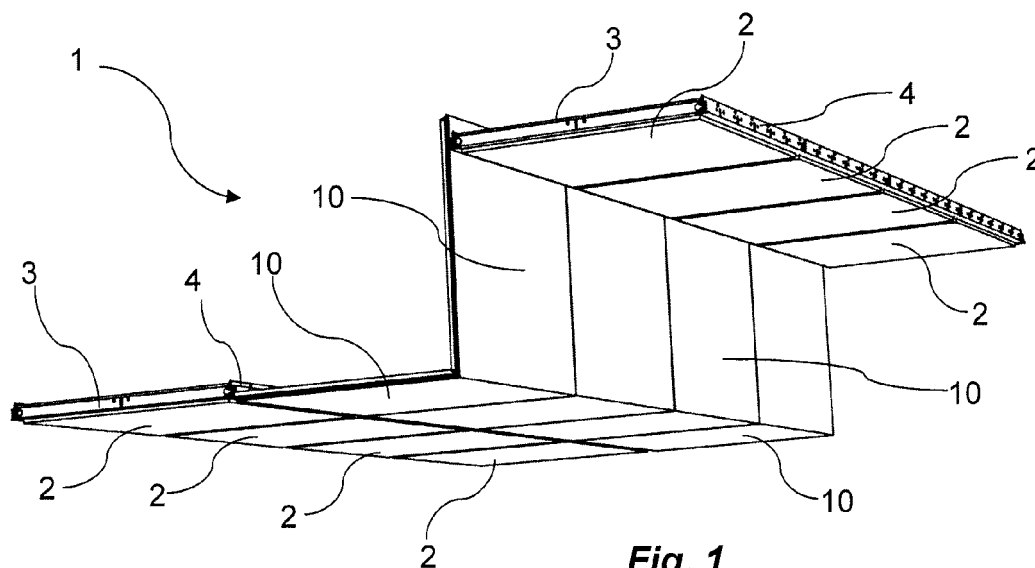


Fig. 1

Description

Field of the invention

[0001] The present invention relates to a ceiling tile unit and a method for forming such a ceiling tile unit. The ceiling tile unit comprises a groove and a guide adapted to form a fold guidance for inclination of a first tile body section in relation to a second tile body section.

Technical background

[0002] Suspended ceilings can be installed in many different types of buildings for various reasons, for example to absorb sound, to reflect light, to lower the ceiling height or to conceal installations such as cable arrangements, ventilation equipment, lighting installations and other devices arranged in the space between the suspended ceiling and the ceiling structure of a building.

[0003] Suspended ceilings often comprise tiles and a supporting structure. The supporting structure normally comprises supporting profiles, which are arranged in a grid defining compartments for individual tiles or groups of tiles. The tiles may have sound-absorbing and/or sound-insulation properties in order to improve the acoustic environment of the room. In order to obtain a relatively lightweight ceiling with satisfactory sound absorption, the tiles, for instance, may be made of a compressed fibre material such as mineral wool. The tiles may also be made of gypsum.

[0004] Sometime it is desirable to create a smooth transition between different levels of the suspended ceiling, for example to accommodate various installations such as ventilation equipment in the ceiling void, or to achieve a special effect of the suspended ceiling. It may also be desirable to create a smooth transition between a wall and the suspended ceiling or to create a special curvature of the suspended ceiling.

[0005] In order to hide for example a ventilation tube, plasterboards and a filler material may be used to visually cover the ventilation tube. This task is time-consuming and the result may not match the visual impression of the rest of the suspended ceiling.

[0006] Alternatively, there is provided ceiling tiles being pre-formed to a specific curvature for this purpose. These tiles, especially tiles made of a mineral fibre material, are pressed to a specific shape and curvature. These tiles may have a cross-sectional shape corresponding to a segment of a circle, or be essentially S-shaped or L-shaped in cross-section. Common for these tiles is that they have a large radius of curvature and a large portion of the tile is curved, which may not be desirable from an architectural or aesthetical point of view. Further, compared to the cost of a conventional ceiling tile, a pre-formed curved ceiling tile is considerably more expensive.

[0007] Since the tiles are formed and pressed to the desired shape during manufacture, they are also space

requiring during transport and distribution.

[0008] As an alternative, there is provided ceiling tiles having a glass wool core being bendable to a desired shape when mounting the tile to the support structure. Similar to ceiling tiles of the type described above, these ceiling tiles are only bendable to a large radius of curvature. In addition, these ceiling tiles must be attached to the support profile by clips. In order to maintain the desired shape of the profile, a clip must be fixed at every 100-300 mm depending of the radius of curvature, which is a time-consuming task.

Summary of the invention

[0009] It is an object of the present invention to provide a ceiling tile unit and a method for forming such a ceiling tile unit which facilitate forming of an inclined tile unit. A further object is to provide a ceiling tile unit which enables forming of small radius of curvature and which enables efficient transportation and distribution of the tile unit.

[0010] This and other objects and advantages that will be apparent from the description have been achieved by a ceiling tile unit comprising a tile body made of mineral fibre material, a surface layer and a guide. The tile body has a front side, a rear side and at least one side edge. The surface layer is arranged on said front side of said tile body. A groove is provided in said rear side of said tile body dividing said tile body into a first tile body section and a second tile body section. The guide is adapted to form a fold guidance for inclination of said first tile body section in relation to said second tile body section by folding about an axis parallel to the longitudinal extension said groove.

[0011] With a ceiling tile unit is meant a set comprising the tile body, the surface layer and the guide. The guide may be provided separately from the tile body, or may be provided together with the tile body.

[0012] An advantage of the present invention is that the tile unit can be delivered and transported in a flat state. Thereby, the tile unit requires no extra space during transportation compared to a conventional flat tile. Since the tile unit may be transported in a flat state, the risk for damages caused by the transport is reduced. Not until the tile unit is to be mounted in a specific room the first tile body section is inclined about the axis in relation to the second tile body.

[0013] The guide is adapted to guide the position and direction of the folding between the first and second tile body portions and to relieve the forces affecting the surface layer when inclining the second tile body portion in relation to the first tile body portion. Furthermore, the guide strengthens the transition between the first and second tile body sections and improves the impact resistance of the transition.

[0014] Since the groove may be arranged at any position on the tile body, the tile unit offers great flexibility. By varying the position and shape of the groove, a ceiling tile unit having a shape and inclination adjusted to ac-

commodate a specific detail of a room may be formed. The architect, for example, is free to create a specific shape of the tile unit without having to select between a limited numbers of pre-formed tiles. The flexibility includes varying the angle of inclination, the position of the groove, the number and relative positions of the inclinations, the radius of curvature etc.

[0015] Another advantage compared to a pre-formed ceiling tile having a large radius of curvature is that a horizontal portion of the suspended ceiling may extend from any position along the extension of the first tile body portion. It is not necessary that the horizontal portion of the suspended ceiling starts at the end of the first tile body portion. Thereby, the level of the horizontal portion of the suspended ceiling is variable.

[0016] A further advantage is that it is possible to obtain a small radius of curvature when forming the inclination between the first and second tile body sections. The transition between the first and second tile body sections may be restricted to a small area. It is thus possible to obtain a distinct transition between the first and second tile body sections.

[0017] It is to be understood that the groove may be formed in connection with the manufacturing of the tile body, or may be formed just before mounting the tile unit. If the groove is formed on the building site, adjustments to the specific room are possible by varying the number of grooves and the position of the groove or grooves.

[0018] Mounting a ceiling tile unit according to the present invention is easy and fast compared to the prior art solutions. When the groove and guide are provided, the tile unit is ready to be mounted and no additional step is required.

[0019] An inclined tile unit according to the present invention requires no clips in order to maintain its shape and inclination. Once inclined and suspended by a supporting structure, the tile unit will maintain its shape. Thereby, the time-consuming task of attaching clips at certain distance from each other along the edge of the tile unit is avoided. The tile unit is comparably more stable and the risk that the tile unit becomes damaged by an object making contact with the tile unit is reduced. Since no clips are required, the tile unit is easily demountable.

[0020] Compared to a pre-formed ceiling tile, a ceiling tile unit according the present invention is less expensive since it is formed from a conventional ceiling tile body.

[0021] The guide may comprise a crease formed in said surface layer. The crease such as a crease line reduces the risk that the surface layer cracks or splits when the first tile body section is inclined in relation to the second tile body section. Thereby, folding the first tile body in relation to the second tile body is facilitated and the visual impression of the folding is improved. Further, the crease forms a distinct transition between the first and second tile body sections. The crease may be formed by means of a knife or by means of a tool compressing a portion of the surface layer. The crease may be formed just before mounting the tile unit, thereby allowing flexi-

bility. Alternatively, the crease may be formed in connection to the manufacturing of the tile body.

[0022] The guide may comprise a guide body of a compressible material, the guide body being adapted to be arranged in the groove. The guide body of the compressible material forms guidance for folding and a smooth transition between the first and second tile body sections. Further, the guide body protects and strengthens the surface layer in the transition between the first and second tile body sections.

[0023] The guide may comprise a profile insertable in said groove. The profile reduces the risk that the surface layer cracks or splits when the first tile body section is inclined in relation to the second tile body section. Furthermore, the profile improves the strength and rigidity of the folded portion of the tile unit. The risk is reduced that the tile unit is damaged if an object hits the folded portion.

[0024] Additionally, by varying the cross-sectional shape of the profile, different radius of curvature and shapes of the transition between the first and second tile body sections are obtainable.

[0025] It is to be understood that the profile may be provided in the same package as the tile body or may be provided separately. Nevertheless, the profile, the tile body and the surface layer form a ceiling tile unit irrespectively if they are provided in the same package or not.

[0026] The profile may be used in combination with a crease. Depending of the desired radius of curvature and properties of surface layer, it may be advantageous to form a crease line and insert a profile in the groove.

[0027] The profile may at least be partially enclosed by the tile body when inserted in said groove and when the first tile body section is inclined in relation to the second tile body section. Thereby, the profile cannot be separated from the tile unit when being mounted.

[0028] The profile may form part of a supporting grid for supporting said tile body. Thereby, the tile unit is supported by the profile also used to form the guide. Consequently, it is possible to suspend the profile to the soffit or as a part of the supporting grid and then arrange the tile unit about the profile.

[0029] The surface layer may comprise a layer of paint. The front surface of the ceiling tile body adapted to be faced towards the interior of a room is usually coated by a layer of paint. Further, the surface layer may be air-permeable.

[0030] The groove may have a depth corresponding to the thickness of the tile body. Thereby, folding of the first tile body in relation to the second tile body is further facilitated since the material of the tile body is removed in this portion.

[0031] The ceiling tile unit may further comprise an angle bar for locking the first tile body section in relation to the second tile body section in an inclined position. The angle bar secures the tile unit in its inclined position. The angle bar may also be used to attach two adjacent tile units to each other.

[0032] As an alternative, the profile may comprise protrusions forming the angle bar.

[0033] The ceiling tile unit may further comprise an additional groove provided in said rear side of said tile body, said groove and said additional groove dividing said tile body into said first tile body section, said second tile body section and a third tile body section, and wherein an additional guide may adapted to form a fold guidance for inclination of said third tile body section in relation to said first tile body section by folding about an axis being parallel to said additional groove. Thereby, a Z-shaped tile unit may be formed, or part of box may be formed. Forming more than one groove and guide allows further adaptation to the architecture of a specific room.

[0034] The groove may have a square cross section and may have a width corresponding to a thickness of the tile body. When the first tile body section is inclined in relation to the second tile body section, the surface layer covers a side edge of the second tile body section.

[0035] According to a second aspect of the invention, a suspended ceiling comprising at least one ceiling tile unit of the above described type is provided. The suspended ceiling incorporates all the advantages of the inventive ceiling tile unit, which previously has been discussed. Thereby, the previous discussion is applicable also for the inventive suspended ceiling.

[0036] According to a third aspect of the invention, a method for forming a ceiling tile unit is provided. The method comprises:

providing a ceiling tile unit comprising a tile body made of mineral fibre material and a surface layer, said tile body having a front side, a rear side and at least one side edge, and said surface layer being arranged on said front side of said tile body, forming a groove in said rear side of said tile body dividing said tile body into a first tile body section and a second tile body section, providing a guide adapted to form a fold guidance for inclination of said first tile body section in relation to said second tile body section by folding about an axis parallel to the longitudinal extension of said groove.

[0037] The method incorporates all the advantages of the inventive ceiling tile unit, which previously has been discussed. Thereby, the previous discussion is applicable also for the inventive method. In addition to the advantages already discussed, the method is advantageous since the step of forming the groove may be performed both in connection with the manufacturing of the tile body or just before the tile unit is to be mounted in a building, thereby offering flexibility and adjustment possibilities. The guide may be provided as a part of the tile body or may be provided as a separate part which is to be arranged in the tile body before the first tile body section is to be inclined in relation to the second tile body section.

[0038] The method may further comprise inclining said first tile body section in relation to said second tile body section about said axis. The step of inclining the first tile body section in relation to the second tile body section may be performed separately from the forming of tile unit. During distribution, the tile unit is in its flat and unfolded state, but when mounting the tile unit, the tile unit is inclined.

[0039] Generally, all terms used in the claims are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the [element, device, component, means, etc]" are to be interpreted openly as referring to at least one instance of said element, device, component, means, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated.

Brief description of the drawings

[0040] The above, as well as additional objects, features and advantages of the present invention, will be better understood through the following illustrative and non-limiting detailed description of embodiments of the present invention, with reference to the appended drawings, where the same reference numerals will be used for similar elements, wherein:

Fig 1 shows a schematic perspective view of a suspended ceiling in two different levels.

Fig 2a shows a schematic side view of a ceiling tile unit according to a first embodiment of the present invention.

Fig 2b shows a schematic perspective view of the ceiling tile unit in fig 2a.

Fig 2c shows a schematic perspective view of the ceiling tile unit in figs 2a-b when the tile unit is inclined.

Fig 3a shows a schematic side view of a ceiling tile unit according to a second embodiment of the present invention.

Fig 3b shows a schematic perspective view of the ceiling tile unit in fig 3a.

Fig 3c shows a schematic perspective view of the ceiling tile unit in figs 3a-b when the tile unit is inclined.

Fig 4a shows a schematic perspective view of a ceiling tile unit according to a third embodiment of the invention.

Fig 4b shows a schematic perspective view of the ceiling tile unit in fig 4a when the tile unit is inclined.

Fig 4c shows a schematic perspective view of the ceiling tile unit in fig 4a including an alternative embodiment of the profile.

Fig 4d shows a schematic perspective view of the ceiling tile unit in fig 4a including an alternative embodiment of the profile.

Fig 5a shows a schematic perspective view of a ceiling tile unit according to a fourth embodiment of the invention.

Fig 5b shows a schematic perspective view of the ceiling tile unit in fig 5a when the tile unit is inclined. Fig 6a shows a schematic perspective view of a ceiling tile unit according to a fifth embodiment of the invention.

Fig 6b shows a schematic perspective view of the ceiling tile unit in fig 6a when the tile unit is inclined. Fig 7 shows a schematic perspective view of a ceiling tile unit being inclined twice.

Fig 8a shows schematic perspective view of a ceiling tile unit for forming part of a box.

Fig 8b shows a schematic perspective view of the ceiling tile unit in fig 8a when being inclined.

Fig 9a shows a schematic perspective view of a ceiling tile unit according to another aspect of the present invention.

Fig 9b shows the ceiling tile unit in fig 9a when the surface layer has been folded.

Fig 10 shows an alternative embodiment of the ceiling tile unit.

Fig 11 a shows a further alternative embodiment of the ceiling tile unit.

Fig 11b shows the ceiling tile unit in fig 11 a when inclined.

Detailed description

[0041] A suspended ceiling 1 comprising ceiling tile units 10 according to the present invention will now be described with reference to fig 1. The suspended ceiling 1 comprises at least one ceiling tile unit 2, 10 and a supporting grid supporting the ceiling tile units 2, 10 comprising at least one profile 3, 4. In the shown embodiment, the supporting grid is formed of main profiles 4 and transverse profiles 3. The shown suspended ceiling comprises ceiling tiles of two types, conventional ceiling tile units 2 and ceiling tile units 10 according to the present invention. As the ceiling tile units 10 according to the present invention are inclined, the suspended ceiling 1 forms two horizontal levels being connected by the ceiling tile units 10 according to the present invention. The ceiling tile units 10 comprise in the shown embodiment both a horizontally extending section and a vertically extending portion.

[0042] Common for embodiments is that the ceiling tile unit 10 may be a sound absorber having sound absorbing properties and/or a sound insulation element having sound insulation properties.

[0043] A ceiling tile unit 10 according to the present invention will now be described in more detail with reference to figs 1-9. With reference to fig 2a-2c, a first embodiment of a ceiling tile unit 10 will be described. The tile unit 10 comprises a tile body 11 and a surface layer 12. The tile body 11 has a rear side 15, a front side 16 and four side edges 17, 18, 19, 20. The front side 16 is

adapted to be facing the interior of the room when the tile unit 10 is mounted. The rear side 15 is adapted to be facing the soffit or ceiling structure of the building when the tile unit 10 is mounted. Even if a rectangular tile body is shown, the tile body may have any other shape such as circular, elliptic, irregular shaped etc.

[0044] Common for all embodiments is that the tile body 11 comprises a mineral fibre material. The mineral fibre material may be a compressed mineral fibre material, or more specifically a man-made mineral fibre material. The mineral fibre material may be mineral wool. More specifically, the mineral fibre material may be glass wool. In addition to mineral fibres, the material may comprise for example binders.

[0045] The surface layer 12 is arranged on the front side 16 of the tile body 11. The surface layer 12 may for example be a layer of paint.

[0046] A groove 13 is formed in the rear side 15 of the tile body 11. The groove 13 has a linear extension and is extending between two side edges, 18, 20 of the tile body 11. The position of the groove 13 may be varied. In this embodiment, the groove 13 is essentially V-shaped in cross-section. The groove 13 divides the tile body 11 into a first tile body section 11a and a second tile body section 11 b. By varying the position of the groove 13, the relative size between the first and second tile body sections 11 a, 11 b may be varied. It is not necessary for the invention that the first and second tile body sections 11 a, 11 b have an equal size and/or shape.

[0047] Preferably, the groove 13 has a linear extension.

[0048] A guide 14 is provided in the surface layer 12. The guide 14 is adapted to form a fold guidance for inclination of the first tile body section 11 a in relation to the second tile body section 11 b by folding about an axis A being parallel to the longitudinal extension of the groove 13. In this embodiment the guide 14 is provided in form of a crease 22. The crease or crease line 22 provides an indication or a weakening of the surface layer 12 about which the first tile body section 11 a may be inclined in relation to the second tile body section 11 b. The crease 22 forms a distinct transition between the first and section tile body sections 11a, 11b. The crease 22 is arranged in the surface layer 12. Preferably, the crease 22 is arranged in a side of the surface layer 12 facing the tile body 11.

[0049] In figs 2a-b, the tile unit 10 is shown in its flat shape, i.e. when the first tile body section 11 a has an extension in the same plane as the second tile body section 11 b. In fig 2c, the tile unit 10 has been inclined. The first tile body section 11a has been inclined in relation to the second tile body section 11 b about the axis A parallel to the longitudinal extension of the groove 13. In this embodiment, the first tile body section 11a is extending upwards from the second tile body section 11 b. The angle of inclination may be varied. The angle of inclination may be varied by varying the cross-sectional shape of the groove.

[0050] A second embodiment of the present invention will now be described with reference to figs 3a-c. The tile unit 10 comprises a tile body 11, a surface layer 12, a groove 13 and a guide 14 as previously has been described with reference to figs 2a-c. The tile unit 10 shown in figs 3a-c only differs from the tile unit 10 shown in figs 2a-c regarding the cross-sectional shape of the groove 13. As previously described, the groove 13 is formed in the rear side 15 of the tile body 11 and has a linear extension extending between two side edges 8, 20 of the tile body 11. In this embodiment, the groove 13 is in form of a slit having a small widthwise extension. The guide 14 is provided in the surface layer 12 in form of a crease 22. The guide 14 is adapted to form a fold guidance for inclination of the first tile body section 11a in relation to the second tile body section 11 b by folding about the axis A being parallel to the longitudinal extension of the groove 13.

[0051] In figs 3a-b, the tile unit 10 is shown in its flat shape, i.e. when the first tile body section 11 a has an extension in the same plane as the second tile body section 11 b. In fig 3c, the tile unit 10 has been inclined. The first tile body section 11a has been inclined in relation to the second tile body section 11 b about the axis A parallel to the longitudinal extension of the groove 13. In this embodiment, the first tile body section 11 a is extending downwardly from the second tile body section 11 b. The angle of inclination may be varied.

[0052] A third embodiment of the present invention will now be described with reference to figs 4a-c. The tile unit 10 comprises a tile body 11, a surface layer 12 and a groove 13 as previously has been described with reference to figs 2a-c. The tile unit 10 shown in figs 4a-b differs from the tile unit 10 previously described with regard to the cross-sectional shape of the groove 13 and the form of the guide 14. As previously described, the groove 13 is formed in the rear side 15 of the tile body 11 and has a linear extension extending between two side edges 18, 20 of the tile body 11. In this embodiment, the groove 13 has a V-shaped cross-section which narrow end transforms into a semi-circular shape in cross-section.

[0053] In this embodiment, the guide 14 is in form of a profile 21. The profile is arranged in the groove 13 and is extending in a direction being parallel to the longitudinal direction of the groove 13. The profile 21 has a circular cross-section. Preferably, the radius of the profile 21 is smaller than the radius of the semi-circular end section of the groove 13. The length of the profile 21 may equal the length of the groove 13. Alternatively, the length of the profile 21 may exceed the length of the groove 13. In this case, one profile 21 may extend across more than one tile unit 10, and thereby forms a guide 14 for more than one tile unit 10. The profile 21 may also be used to attach tile units 10 to each other in order to form a row as shown in fig 1.

[0054] The guide 14, in form of the profile 21, is adapted to form a fold guidance for inclination of the first tile body section 11 a in relation to the second tile body sec-

tion 11 b by folding about the axis A being parallel to the longitudinal extension of the groove 13. In this embodiment, the first tile body section 11 a is inclined in relation to the second tile body section 11 b by folding about the profile 21.

[0055] In fig 4a, the tile unit 10 is shown in its flat shape, i.e. when the first tile body section 11 a has an extension in the same plane as the second tile body section 11 b. In fig 4b, the tile unit 10 has been inclined. The first tile body section 11 a has been inclined in relation to the second tile body section 11 b by folding about the profile 21. In this embodiment, the first tile body section 11 a is extending upwardly from the second tile body section 11 b. The angle of inclination may be varied, for example by varying the dimensions of the groove 13.

[0056] The cross-section and dimensions of the profile 21 may be varied in order to vary the radius of curvature of the transition between the first and second tile body sections 11 a, 11 b. The larger radius of the profile 21, the larger radius of curvature of the transition.

[0057] When the first tile body section 11a has been inclined in relation to the second tile body portion 11 b, the profile 21 is at least partially enclosed by the tile body 11.

[0058] In fig 4b, an angle bar 30 is arranged in grooves 31 arranged in the side edge 18 of the tile body 11. The angle bar 30 locks the tile unit 10 in its inclined position, i.e. the angle bar 30 locks the first tile body section 11 a in a specific angle in relation to the second tile body section 11 b. The angle bar 30 may also be used to attach the tile unit 10 to an adjacent tile unit for forming a row of tile units as shown in fig 1. Even if the angle bar 30 is shown in connection with the embodiment shown in fig 4b, it is to be understood that the angle bar 30 may be used in connection to any other embodiment of the inventive tile unit.

[0059] In fig 4c, an alternative embodiment of the profile 21 is shown. In all other aspects, the tile unit 10 corresponds to the tile unit 10 shown in figs 4a-b. The profile 21 comprises in this embodiment protrusions 32 which protrude from the profile 21. The protrusions 32 are inserted into grooves 31 arranged in the first and second tile body sections 11 a, 11 b. The protrusions form an angle bar 30. The protrusions 32 have the same function as the angle bar described in connection to fig 4b, i.e. to lock the first tile body section 11 a in a specific angle in relation to the second tile body section 11 b. Even if this embodiment of the profile 21 is shown in connection to the embodiment shown in fig 4c, it may be used in connection to any other embodiment of the tile unit 10.

[0060] When inclining a ceiling tile unit 10 including the profile 21 described above, the first tile body section 11a is inclined in relation to the second tile body section 11 b before the profile 21 is arranged in the groove 13. Thereafter, the profile 21 is arranged in the grooves 13, 31 by inserting the profile from the side edge of the tile body when the angle between the first and second tile body sections 11 a, 11 b corresponds to the angle between

the protrusions 32 of the profile 21. If the profile 21 comprises protrusions 32 at both ends (as shown in fig 4c), the groove 31 is extending from one side edge of the tile body to the opposite side edge.

[0061] In the embodiment shown in fig 4d, the tile unit 10 may be suspended to an overlying structure by means of the profile 21. In this embodiment, the profile 21 is enclosed by the tile body 11 when the tile unit 10 is in its inclined position. The tile unit 10 may therefore be supported by the profile 21 when the tile unit 10 is maintained in its inclined position by the fact that it is supported by profiles 3, 4 forming a part of the supporting grid. The profile 21 comprises in this embodiment protrusions 23 adapted to be attached to hangers. The profile 21 may also comprise protrusions (not shown) adapted to engage with the tile body 11. When mounting the tile units 10, a plurality of profiles 21 are attached to the hangers. Alternatively, a profile 21 extending across more than one tile unit 10 is attached to the hangers. The tile units 10 are then folded about the profile/profiles 21 already being suspended. Alternatively, the tile unit 20 is inclined about the profile 21 before being mounted, and the profile 21 is then connected to the hangers.

[0062] Even if the profile 21 described above is described in connection to the embodiment shown in fig 4d, it is to be understood that the profile adapted to be suspended to the hangers may be used in connection with any other embodiment of the inventive tile unit.

[0063] A fourth embodiment will now be described with reference to figs 5a-b. The tile unit 10 comprises a tile body 11, a surface layer 12, a groove 13 and a guide 14 in form of a profile 21 as previously has been described with reference to figs 4a-c. The tile unit 10 shown in figs 5a-b differs from the tile unit 10 shown in figs 4a-c with regard to the cross-sectional shape of the groove 13 and the shape of the profile 21. As previously described, the groove 13 is formed in the rear side 15 of the tile body 11 and has a linear extension extending between two side edges 18, 20 of the tile body 11. In this embodiment, the groove 13 has a V-shaped cross-section which narrow end transforms into a rectangular cross-section.

[0064] In this embodiment, the guide 14 is in form of a profile 21. The profile 21 is arranged in the groove 13 and is extending in a direction being parallel to the longitudinal direction of the groove 13. The profile 21 has a rectangular cross-section. Preferably, the size of the profile 21 is smaller than the size of the rectangular end section of the groove 13. The length of the profile 21 may equal the length of the groove 13. Alternatively, the length of the profile 21 may exceed the length of the groove 13. In this case, one profile 21 may extend across more than one tile unit 10, and thereby forms a guide 14 for more than one tile unit 10. The profile 21 may also be used to attach tile units 10 to each other in order to form a row as shown in fig 1.

[0065] The guide 14, in form of the profile 21, is adapted to form a fold guidance for inclination of the first tile body section 11 a in relation to the second tile body section 11 b by folding about the axis A being parallel to the longitudinal extension of the groove 13. In this embodiment, the first tile body section 11 a is inclined in relation to the second tile body section 11 b by folding about the profile 21.

[0066] In fig 5a, the tile unit 10 is shown in its flat shape, i.e. when the first tile body section 11a has an extension in the same plane as the second tile body section 11b. In fig 5a, the tile unit 10 has been inclined. The first tile body section 11 a has been inclined in relation to the second tile body section 11 b by folding about the profile 21. In this embodiment, the first tile body section 11 a is extending upwardly from the second tile body section 11 b. The angle of inclination may be varied, for example by varying the shape and position of the groove 13.

[0067] The cross-section and dimensions of the profile 21 may be varied in order to vary the transition between the first and second tile body sections 11 a, 11 b. Depending on the properties of the surface layer 12, it may be advantageous to combine the profile 21 with a crease 22.

[0068] When the first tile body section 11a has been inclined in relation to the second tile body portion 11 b, the profile 21 is at least partially enclosed by the tile body 11, thus allowing the tile unit 10 to be suspended by means of the profile 21.

[0069] A fifth embodiment of the present invention will now be described with reference to figs 6a-b. As previously has been described, for example with reference to figs 2a-c, the tile unit 10 comprises a tile body 11, a surface layer 12, a groove 13 and a guide 14. The tile unit 10 shown in figs 6a-b differs from the tile unit 10 shown in figs 2a-c with regard to the cross-sectional shape of the groove 13. As previously described, the groove 13 is formed in the rear side 15 of the tile body 11 and has a linear extension extending between two side edges 18, 20 of the tile body 11. In this embodiment, the groove 13 has a rectangular cross section. Further, in this embodiment the depth of groove 13 equals the thickness of the tile body 11.

[0070] The guide 14 is provided in the surface layer 12 in form of a crease 22. The crease or crease line 22 is arranged in a side of the surface layer 12 facing the tile body 11. The crease 22 in the groove 13 adjacent the tile body 11. The guide 14 in form of the crease 22 is adapted to form a fold guidance for inclination of the first tile body section 11a in relation to the second tile body section 11 b by folding about the axis A being parallel to the longitudinal extension of the groove 13.

[0071] In fig 6a, the tile unit 10 is shown in its flat shape, i.e. when the first tile body section 11 a has an extension in the same plane as the second tile body section 11 b. In fig 6b, the tile unit 10 has been inclined. The first tile body section 11 a has been inclined in relation to the second tile body section 11 b by folding about the crease 22. In this embodiment, the first tile body section 11 a is extending in a direction being essentially perpendicular to the extension of the second tile body section 11 b.

Thereby, a side edge 24 of the second tile body section 11 b formed by the groove 13 is covered by the surface layer 12.

[0072] In one embodiment (not shown), the groove has a rectangular cross-section as described above, but the width of the groove 13 is twice the height of tile body 11. A first guide is provided in the surface layer 12 in the groove 13 adjacent the first tile body section 11 a in form of a first crease. A second guide is provided in the surface layer 12 in the groove 13 adjacent the second tile body section 11 b in form of a second crease. Thereby, the first tile body section 11 a may be folded about the first crease. The second tile body section 11 b may be folded about the second crease. The first and second tile body sections 11a, 11b may be inclined towards each other such that they extend in the same direction. Thus, a ceiling tile unit 10 having a thickness twice the original thickness of the tile body is formed. A side edge of the first and second tile body sections 11 a, 11 b is covered by the surface layer 12 in the inclined state of the tile unit 10.

[0073] A ceiling tile unit 10 being inclined twice will now be described with reference to fig 7. As previously described, the tile unit 10 comprises a tile body 11 and a surface layer 12. A first groove 13a and a second groove 13b are provided in the rear side of the tile body 11. The first groove 13a divides the tile body 11 into a first tile body section 11a and second tile body section 11 b. The second groove 13b divides the tile body 11 into the first tile body section 11 a and a third tile body section 11 c. A first guide 14a is adapted to form a fold guidance for inclination of the first tile body section 11a in relation to the second tile body section 11b. In the embodiment shown in fig 7, the first guide 14a is in form of a crease 22a. A second guide 14b is adapted to form a fold guidance for inclination of the third tile body section 11 c in relation to the first tile body section 11 a. In the embodiment shown in fig 7, the second guide 14b is in form of a crease 22b. Alternatively, the first and/or second guide 14a, 14b may instead comprise a profile insertable in the groove 13a, 13b. A combination is also possible, wherein the first guide 14a comprises a profile and the second guide 14b comprises a crease 22b, or vice versa.

[0074] Fig 7 shows the tile unit 10 when the first tile body section 11 a has been inclined in relation to the second tile body section 11 b, and the third tile body section 11c has been inclined in relation to the first tile body section 11 a. Thereby, a ceiling tile unit 10 having two tile body sections 11 b, 11c extending in a horizontal direction and one tile body section 11a extending in an inclined direction is provided.

[0075] A further embodiment of the present invention will now be described with reference to figs 8a-b. In fig 8a, a ceiling tile unit 10 adapted to form a box is shown. In fig 8a, a portion of the tile unit disclosing the grooves is shown in more detail, but in fig 8b the complete tile unit 10 is shown. The tile unit 10 is formed from a rectangular tile body 11 from which a rectangular portion has been cut off. Consequently, an L-shaped tile unit 10 is provided.

The tile unit 10 comprises a rear side 15, a front side 16 and six side edges. A surface layer 12 is arranged on the front side 16.

[0076] A first groove 13a and a second groove 13b are provided in the rear side 15 of the tile body 11. The first groove 13a extends from one of the side edges to the corner where two other side edges meet. The second groove 13b extends from another side edge to the corner where two side edges meet. The grooves 13a, 13b may have any cross-sectional shape as previously described. The first groove 13a divides the tile body 11 into a first tile body section 11 a and a second tile body section 11 b. The second groove 13b divides the tile body 11 into the second tile body section 11 b and a third tile body section 11c.

[0077] A first guide 14a is adapted to form a fold guidance for inclination of the first tile body section 11 a in relation to the second tile body section 11 b. A second guide 14b is adapted to form a fold guidance for inclination of the third tile body section 11 c in relation to the second tile body section 11 b. The first and second guides 14a, 14b comprise a crease and/or a profile. In order to improve the strength of the transition, it may be advantageous to provide a profile insertable in the grooves 13a, 13b.

[0078] In order to form a part of a box, which is shown in fig 8b, the first and third tile body sections 11a, 11c are inclined in relation to the second tile body section 11 b. Preferably, the tile body sections 11 a-c are locked in this position by means of an angle bar 30. The remaining two side edges not being connected are attached to each other by using for example an adhesive and a filler material. Thereby, a part of a box 10 having three sides is formed. The structure may be used to conceal for example a ventilation duct.

[0079] Even if a part of a box is described above, it is contemplated that other three-dimensional structures may be formed as well.

[0080] When forming the inventive ceiling tile unit 10 described above with reference to figs 1-8, a groove 13 is formed in the rear side of the tile body 11 dividing the tile unit 10 into a first tile body section 11a and a second tile body section 11 b. The groove 13 may be formed during manufacturing of the ceiling tile unit 10 or in connection with the mounting of the suspended ceiling 1. A guide is provided, adapted to form the fold guidance for inclination of the first tile body section 11 a in relation to the second tile body section 11 b by folding about the axis parallel to the groove 13. The guide 14b may be provided during manufacturing or when mounting the suspended ceiling 1. For example, if the guide comprises a crease 22, the crease 22 may be formed during manufacturing of the tile unit 10 or when mounting the suspended ceiling 1. If the guide 14 comprises a profile 21, the profile 21 may be arranged in the groove 13 in connection with the manufacturing of the tile unit 10, or may be placed in the groove 13 just before mounting the suspended ceiling 1. Preferably, the first tile body section 11

a is inclined in relation to the second tile body section 11 b when the tile unit 10 is to be mounted as a suspended ceiling 1 and not during manufacturing of the tile unit 10.

[0081] Another aspect of the present invention will now be described with reference to figs 9a-b. In fig 9a, a tile unit 10' comprising a tile body 11 and a surface layer 12 is shown. The tile unit 10' may be a ceiling tile unit. The tile body 11 comprises a rear side 15, a front side 16 and four side edges 17, 18, 19, 20. The tile body 11 may be made of compressed fibre material, such as mineral fibre, or more specifically such as glass wool. A first portion 12a of the surface layer 12 is arranged on the tile body 12. A second portion 12b of the surface layer 12 extends beyond the tile body 11. A guide 14a is provided, adapted to form a fold guidance for folding of the second portion 12b of the surface layer 12 in relation to the first portion 12a of the surface layer 12 by folding about an axis A being parallel to the longitudinal extension of one side edge 18 of the tile body 11. The guide 14a may comprise a crease 22, preferably arranged in the side of the surface layer 12 facing the tile body 11. The guide 14a may comprise a profile 21 extending along one of the side edges of the tile body 11. If the guide 14 is in form of a crease 22, the crease 22 extends preferably along one of the side edges of the tile body 11 adjacent said side edge. Preferably, an additional guide 14b is provided further dividing the second portion 12b of the surface layer 12. Preferably, the additional guide 14b may be arranged at distance from the first guide 14 corresponding to the height of tile body 11 and extending along the same side edge 18.

[0082] In fig 9b, the second portion 12b of the surface layer 12 has been folded about the axis A parallel to the longitudinal extension of said side edge 18. Thereby, the second portion 12b of the surface layer 12 is arranged on said side edge 18 of the tile body 11. In the figure, an additional guide 14b is provided, thereby allowing folding about a second axis parallel to the longitudinal extension of said side edge 18. The second portion 12b of the surface layer 12 is thereby completely covering said side edge 18.

[0083] In the figure, the surface layer 12 has been folded about two side edges 18, 20. A person skilled in the art will easily understand that a single side edge may be covered by the surface layer 12, or that more than one side edge may be covered by the surface layer 12.

[0084] By providing a tile body 11, arranging a surface layer 12 on a front side 16 of the tile body 11, providing a guide 14 adapted to form a fold guidance for folding of a second portion 12b of the surface layer 12 in relation to a first portion 12a of the surface layer 12 by folding about an axis A being parallel to the longitudinal extension of one side edge 17, 18, 19, 20 of the tile body 11, folding the second portion 12b of the surface layer 12 about said axis A in relation to the first portion 12a of the surface layer 12, a surface layer 12b is formed on one of said side edges 17, 18, 19, 20 of the tile body 11.

[0085] This method may be used for applying a surface

layer 12 to a side edge 17, 18, 19, 20 during manufacturing of the tile unit 10'. It may also be used after a tile unit 10' has been cut to fit a specific space when mounting the suspended ceiling. Under some circumstances, the side edge of the tile unit 10' becomes visible and has to be covered by a surface layer 12. A portion of the tile body 11 is removed without removing or affecting the surface layer 12, thereby forming a new side edge of the tile body 11. Then the surface layer 12 is folded about said side edge of the tile body 11. Thereby, a side edge covered a surface layer 12 is formed. The surface layer 12 may for instance be a layer of paint.

[0086] A further embodiment is shown in cross-section in fig 10. The tile unit 10 comprises as previously described a tile body 11, a surface layer 12, a groove and a guide 14. In this embodiment, the guide 14 is formed of a guide body 33 arranged in the groove 13. The guide body 33 is made of a compressible material. In one embodiment, the material may be a foamed material, or any other material having resilient properties such as rubber. In another embodiment, the material may be compressed fibre material, such as mineral fibre and more specifically glass wool. The guide body 33 guides the direction of the folding between the tile body sections 11 a, 11 b, protects the surface layer 12 and relieves any forces actuating on the surface layer 12. If the first tile body section 11a is inclined upwardly in relation to the second tile body section 11 b, the guide body 33 is compressed, which is shown in fig 10. Contrary, if the first tile body section 11 b is to be inclined downwardly in relation to the second tile body section 11 b, the guide body 33 is inserted in the groove such that the guide body 33 becomes pretensioned. When the first tile body section 11 a is inclined in relation to the second tile body section 11 b, the guide body 33 of the compressible material expands from its pretensioned state (not shown). Alternatively, the guide body may be attached to the edges of the first and second tile body sections facing the groove and may expand when the first and second tile body sections are inclined in relation to each other (not shown).

[0087] The embodiment wherein the guide body 33 is made of mineral fibre will now be described in more detail. The mineral fibre material of which the tile body 11 is formed is preferably orientated. Advantageously, the fibres of the tile body 11 are extending in a plane parallel to the surface layer 12. The fibres of the guide body 33, made of mineral fibre material, forming the guide 14 are orientated such that the fibres extend in a plane being perpendicular to the surface layer 12. Consequently, the fibres of the guide body 33 of mineral fibre material forming the guide 13 are extending in a plane being perpendicular to the plane in which the fibres of the tile body 11 extend. When the first tile body section 11a is inclined in relation to the second tile body section 11 b, the section 33 of mineral fibre material guides the folding and protects and stabilise the surface layer 12. Depending of the angle between the first and second tile sections 11 a, 11 b, the guide body 33 of mineral fibre is either compressed

or expanded as described above.

[0088] In the above described embodiments, the guide body 33 is arranged in a groove 13 having a rectangular cross-section. Alternatively, the groove may have a profiled shape, and the guide body 33 may have a shape corresponding to the shape of the groove (not shown).

[0089] It is contemplated that there are numerous modifications of the embodiments described herein, which are still within the scope of the invention as defined by the appended claims.

[0090] In the above described embodiments, the guide is described as a crease, a profile or a material insertable in the groove. However, it is contemplated that the guide may comprise any design adapted to guide the position and direction of the folding between the first and second tile body portions and to relieve the forces affecting the surface layer when inclining the second tile body portion in relation to the first tile body portion, for example a weakened portion of the surface layer facilitating the folding of surface layer. Further, it is contemplated that the guide may comprise a portion of the surface layer being reinforced such that the surface layer resists the forces formed when inclining the first tile body section in relation to the second tile body section without causing the surface layer to crack. It is also contemplated that the groove itself may form the guide, which is shown in figs 11 a and 11 b. The tile unit in figs 11a-11 b is of the type previously described for example in connection to figs 2a-c except the guide 14. In this embodiment, the guide 14 is formed of the specific shape of the groove 13. The groove 13 comprises, in addition to a V-shaped upper part, a lower part 34. The lower part 34 of the groove is formed in the tile body adjacent the surface layer 12. Material is removed from the tile body sections 11 a, 11 b such that convex surfaces are formed, facing the surface layer 12. The convex surfaces of the first and second tile body sections form a guide for a smooth transition between the first and second body sections 11 a, 11 b when they are inclined in relation to each other (which is shown in fig 11 b).

[0091] It is further contemplated that the guide may comprise both a crease in the surface layer and a profile insertable in the groove.

[0092] Both a profile having a circular and a rectangular cross-section has been disclosed, but it is to be contemplated that a profile with any other cross-sectional shape may be used. It is also contemplated that the profile may be formed as a curved sheet. The radius of the curve is adjusted to the desired radius of curvature of the inclined tile unit. The ends of the profile are inserted into grooves in the first and second tile body sections.

[0093] In the shown embodiments, the surface layer is arranged on the front side of the tile body. It is contemplated that a surface layer may be arranged on rear side, and/or on the at least one side edge as well.

[0094] It is to be understood that the dimensions of the tile units shown in the appended drawings are highly exaggerated in order to visualise details in the embodi-

ments.

Claims

1. A ceiling tile unit (10), comprising a tile body (11) made of mineral fibre material, a surface layer (12) and a guide (14; 14a, 14b), the tile body (11) having a front side (16), a rear side (15) and at least one side edge (17, 18, 19,20), the surface layer (12) being arranged on said front side (16) of said tile body (11), wherein a groove (13; 13a, 13b) is provided in said rear side (15) of said tile body (11) dividing said tile body (11) into a first tile body section (11a) and a second tile body section (11 b), and wherein said guide (14; 14a, 14b) is adapted to form a fold guidance for inclination of said first tile body section (11a) in relation to said second tile body section (11 b) by folding about an axis (A) parallel to the longitudinal extension of said groove (13; 13a, 13b).
2. A ceiling tile unit (10) according to claim 1, wherein the guide (14; 14a, 14b) comprises a crease (22) formed in said surface layer (12).
3. A ceiling tile unit (10) according to claim 1 or 2, wherein the guide (14; 14a, 14b) comprises a guide body (33) of a compressible material, the guide body (33) being adapted to be arranged in the groove (13; 13a, 13b).
4. A ceiling tile unit (10) according to any one of claims 1-3, wherein the guide (14; 14a, 14b) comprises a profile (21) insertable in said groove (13; 13a, 13b).
5. A ceiling tile unit (10) according to claim 4, wherein the profile (21) is at least partially enclosed by the tile body (11) when inserted in said groove (13; 13a, 13b) and when the first tile body section (11 a) is inclined in relation to the second tile body section (11 b).
6. A ceiling tile unit (10) according to any one of claims 4 or 5, wherein the profile (21) is included in a supporting system for supporting said tile body (11).
7. A ceiling tile unit (10) according to any one of claims 1-6, wherein the surface layer (12) comprises a layer of paint.
8. A ceiling tile unit (10) according to any one of claims 1-7, wherein the groove (13) has a depth corresponding to the thickness of the tile body (11).
9. A ceiling tile unit (10) according to any one of claims 1-8, further comprising an angle bar (30) for locking the first tile body section (11a) in relation to the sec-

ond tile body section (11 b) in an inclined position.

10. A ceiling tile unit (10) according to claim 9, wherein the profile (21) comprises protrusions (32) forming the angle bar (32). 5

11. A ceiling tile unit (10) according to any one of claims 1-10, further comprising an additional groove (13b) provided in said rear side (15) of said tile body (11), said groove (13a) and said additional groove (13b) dividing said tile body (11) into said first tile body section (11 a), said second tile body section (11 b) and a third tile body section (11c), and wherein an additional guide (14b) is adapted to form a fold guidance for inclination of said third tile body section (11 c) in relation to said first tile body section (11 b) by folding about an axis being parallel to said additional groove (13b). 10
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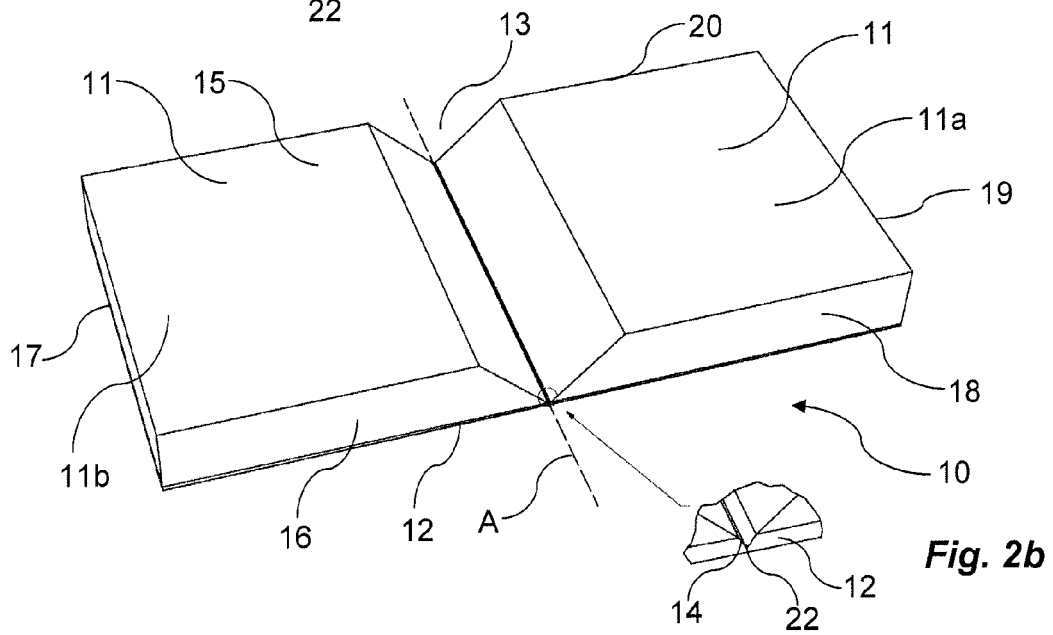
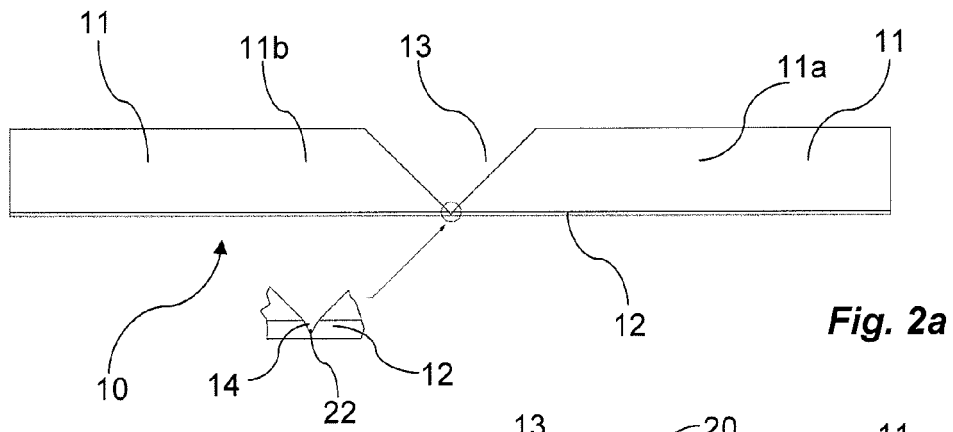
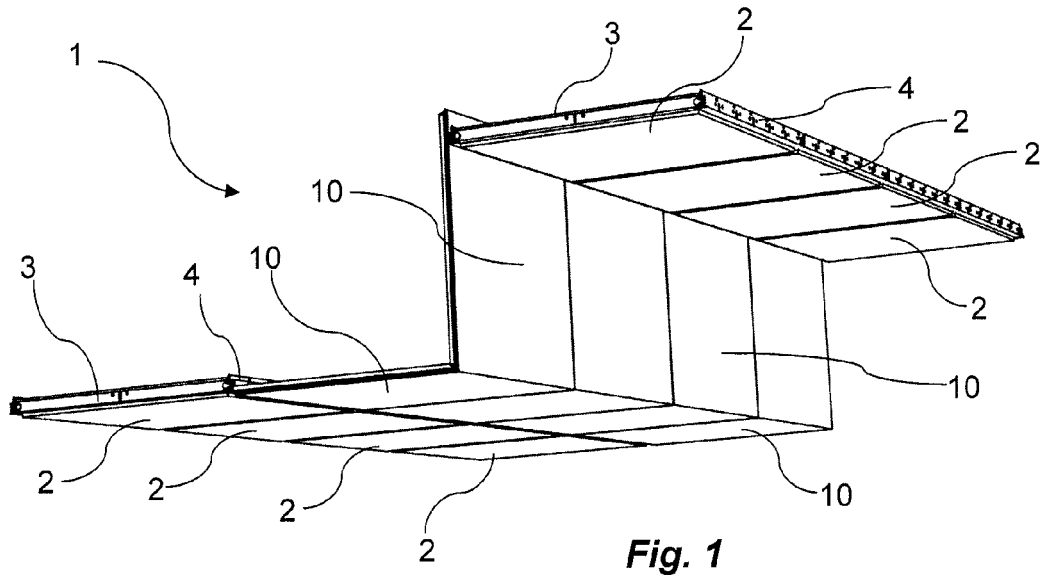
12. A ceiling tile unit (10) according to any one of claims 1-11, wherein the groove (13; 13a, 13b) has a square cross section and has a width corresponding to a thickness of the tile body (11). 20

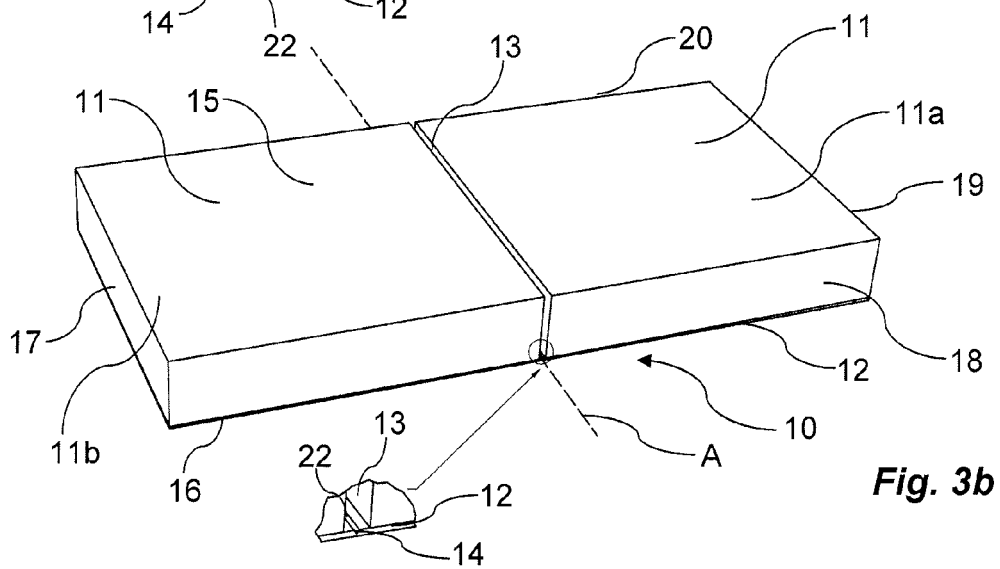
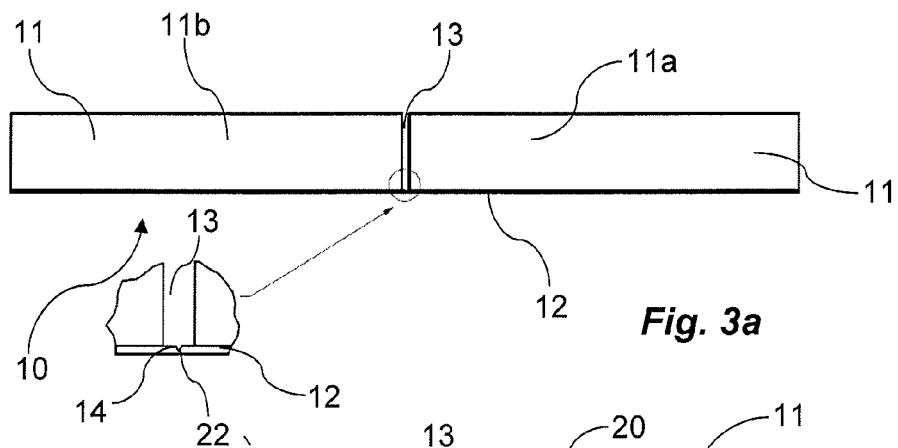
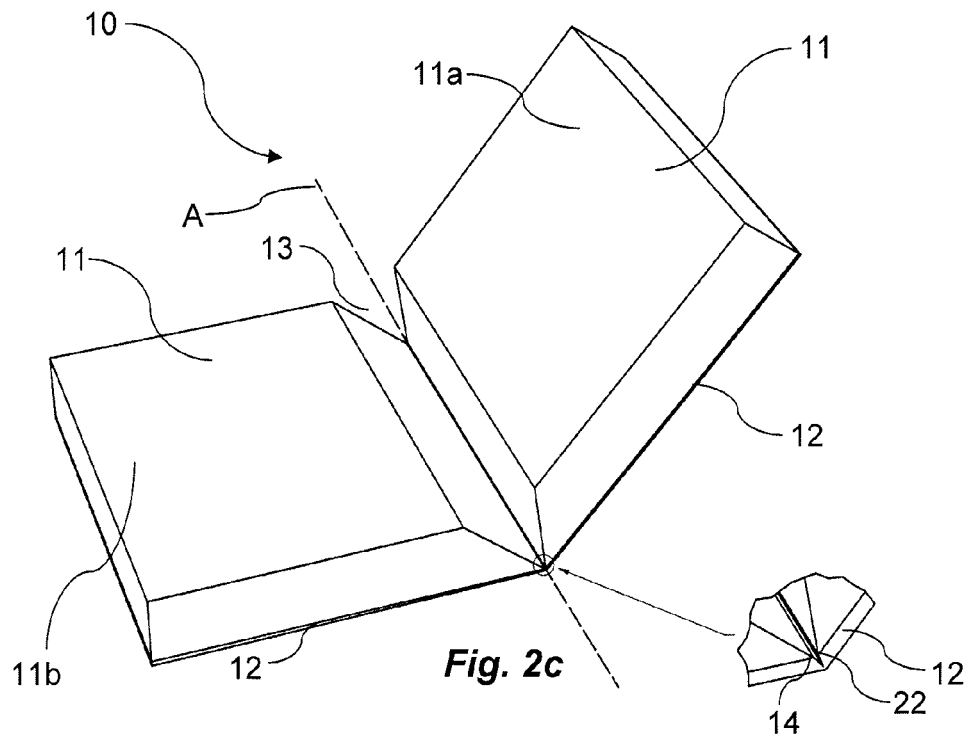
13. A suspended ceiling (1) comprising at least one ceiling tile unit (10) according to any one of claims 1-12. 25

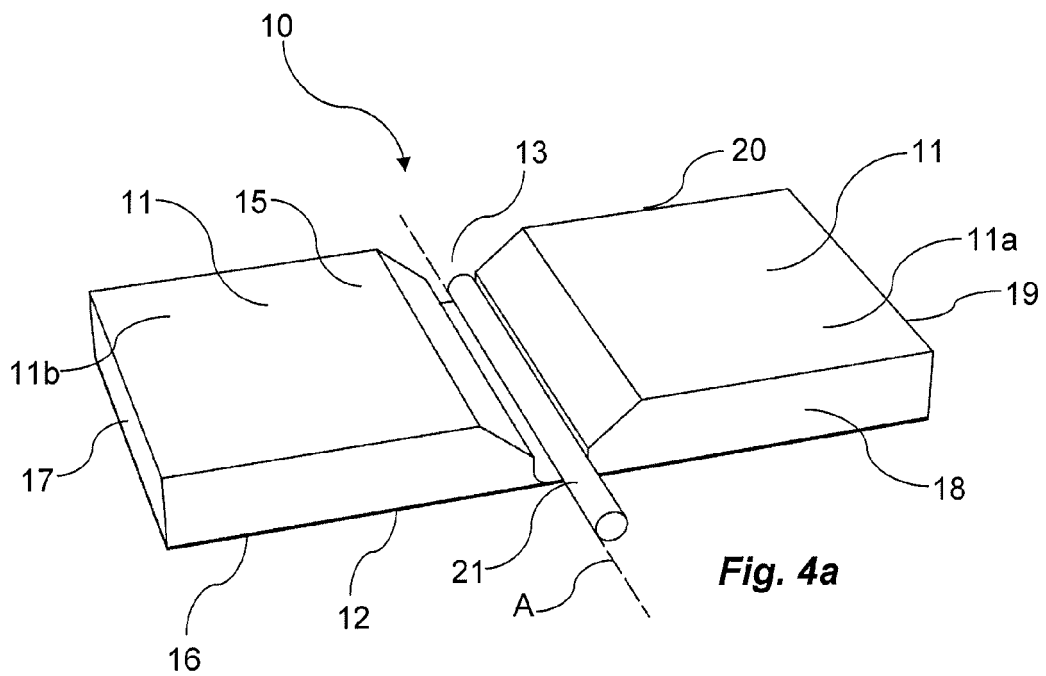
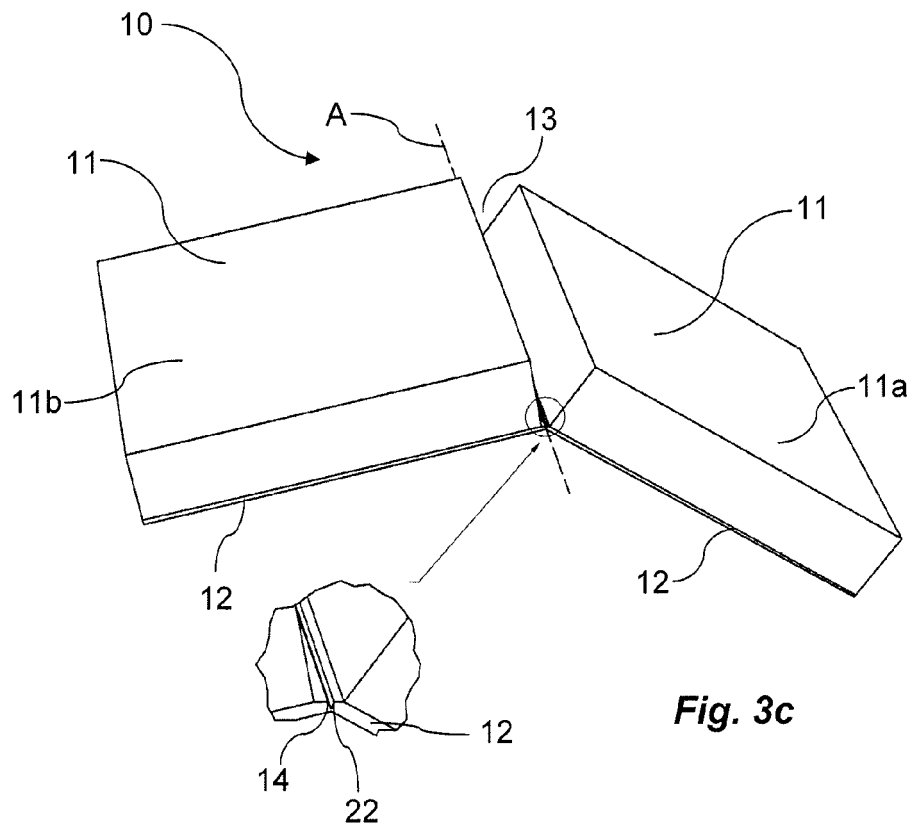
14. A method for forming a ceiling tile unit (10), comprising providing a ceiling tile unit (10) comprising a tile body (11) made of mineral fibre material and a surface layer (12), said tile body (11) having a front side (16), a rear side (15) and at least one side edge (17, 18, 19, 20), and said surface layer (12) being arranged on said front side (16) of said tile body (11), forming a groove (13; 13a, 13b) in said rear side (15) of said tile body (11) dividing said tile body (11) into a first tile body section (11a) and a second tile body section (11 b), providing a guide (14; 14a, 14b) adapted to form a fold guidance for inclination of said first tile body section (11a) in relation to said second tile body section (11b) by folding about an axis (A) parallel to the longitudinal extension of said groove (13; 13a, 13b). 30
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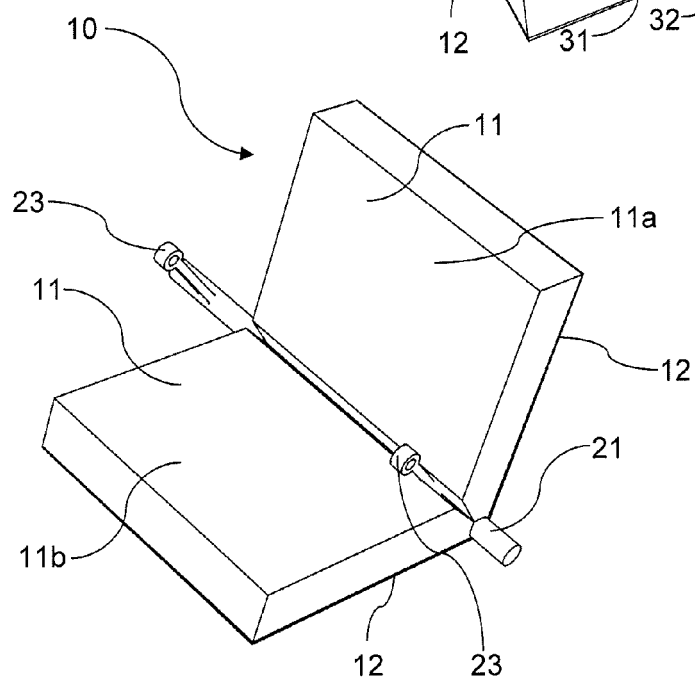
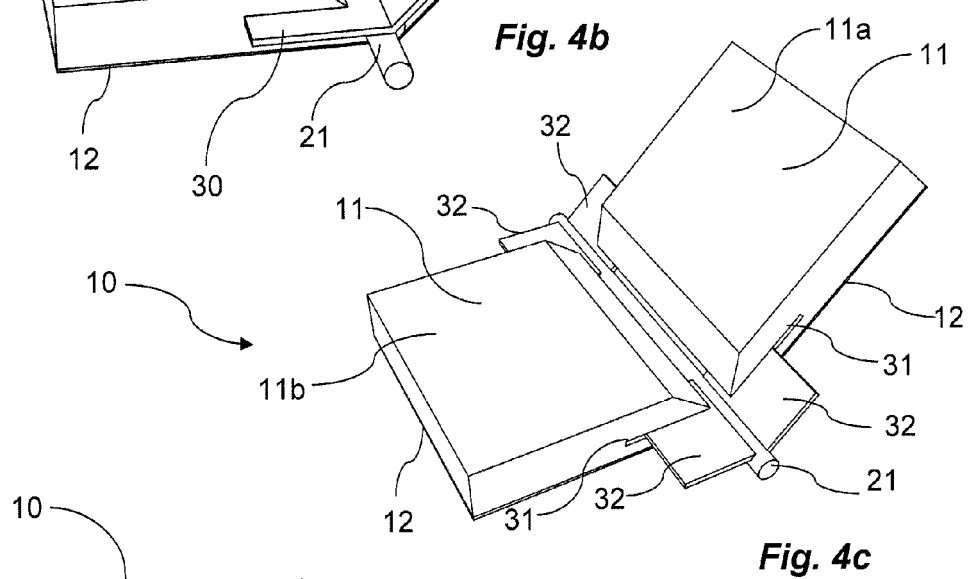
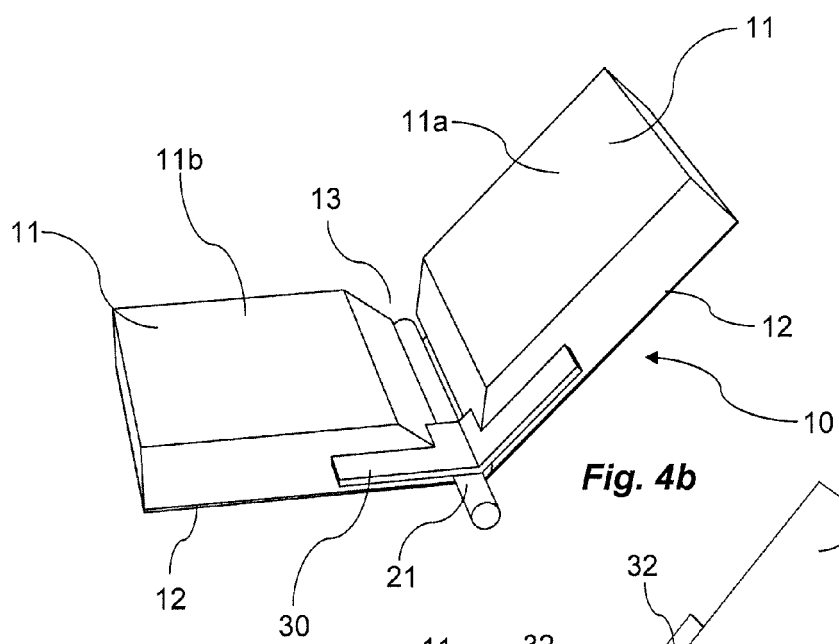
15. A method according to claim 14, further comprising inclining said first tile body section (11 a) in relation to said second tile body section (11 b) about said axis (A). 50

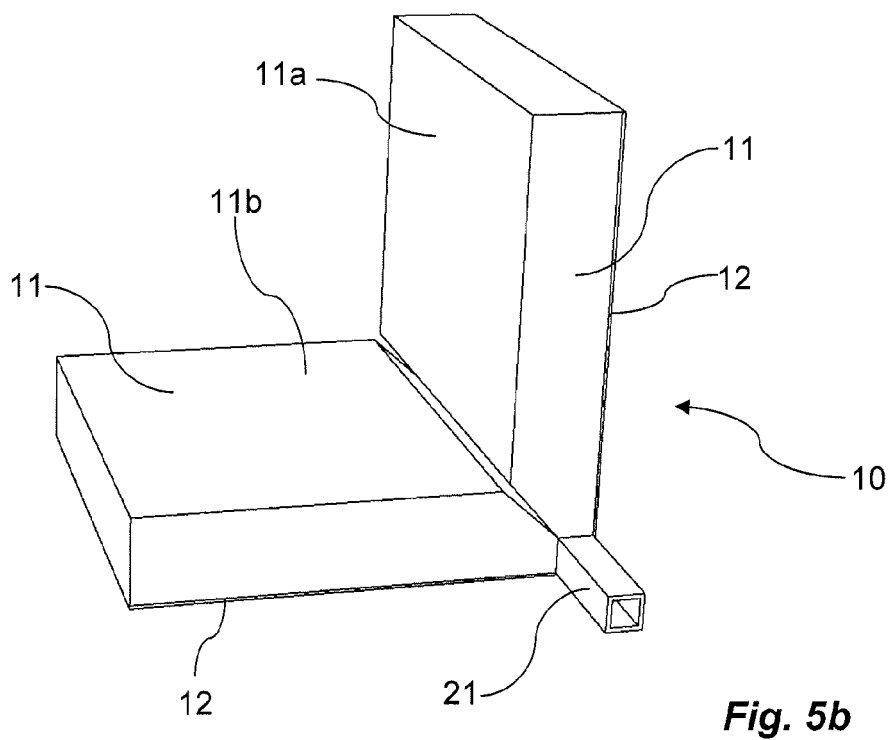
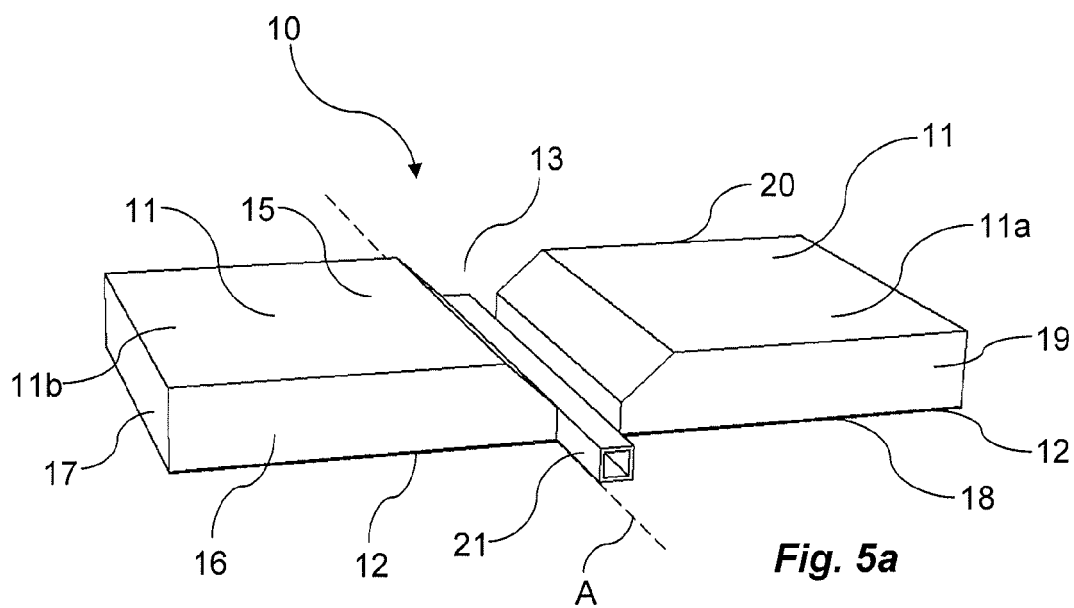
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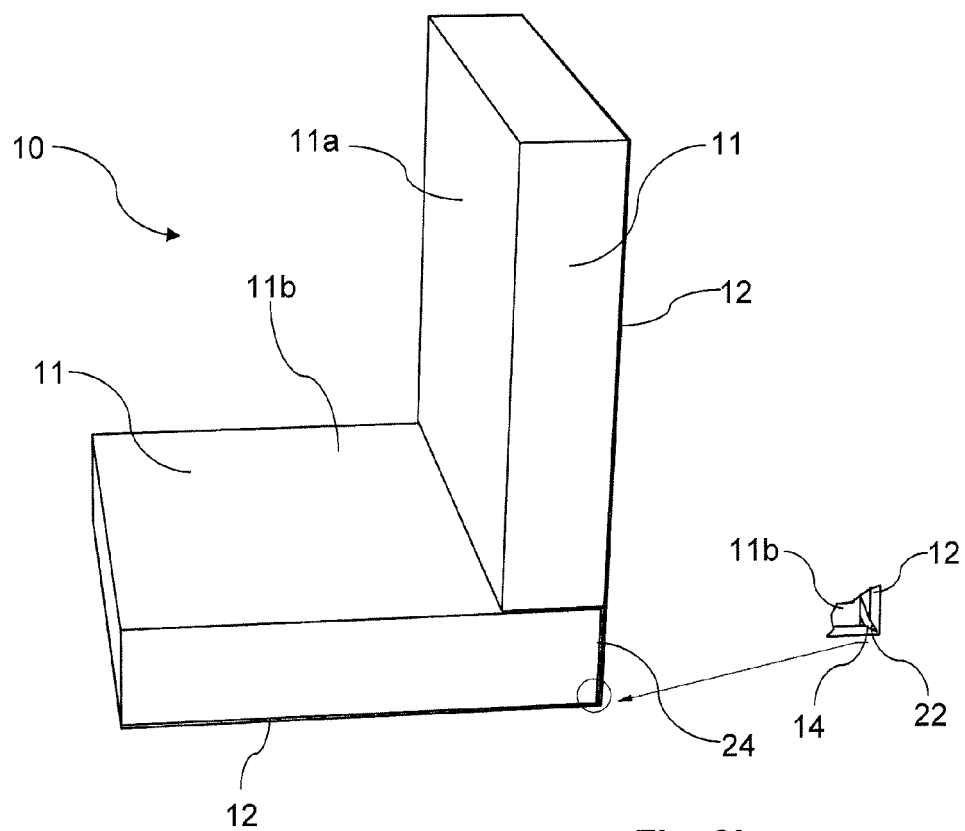
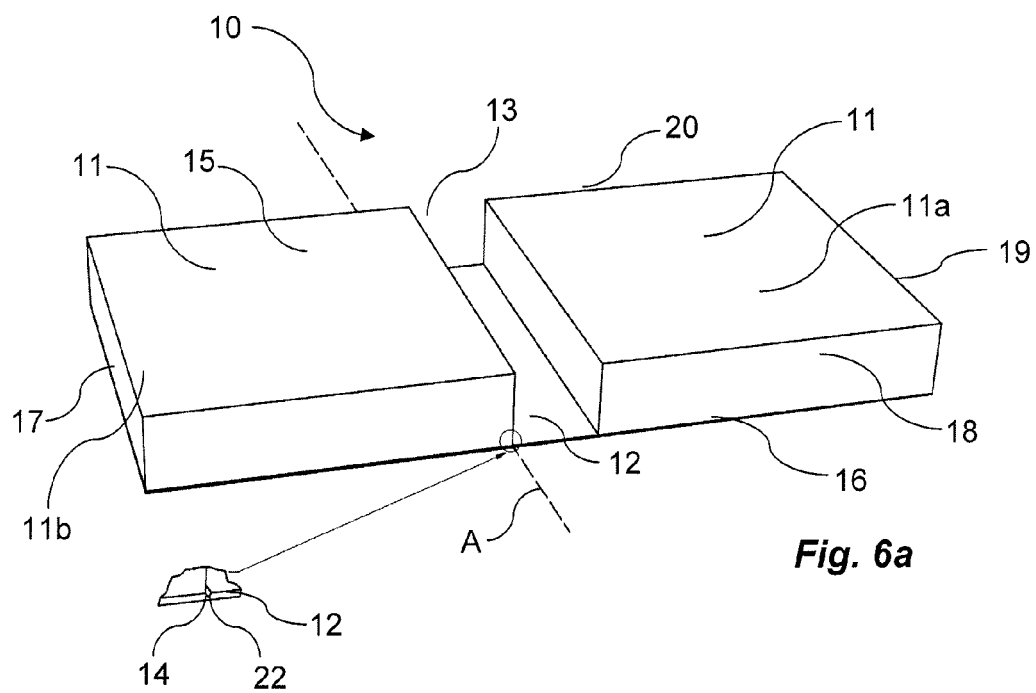


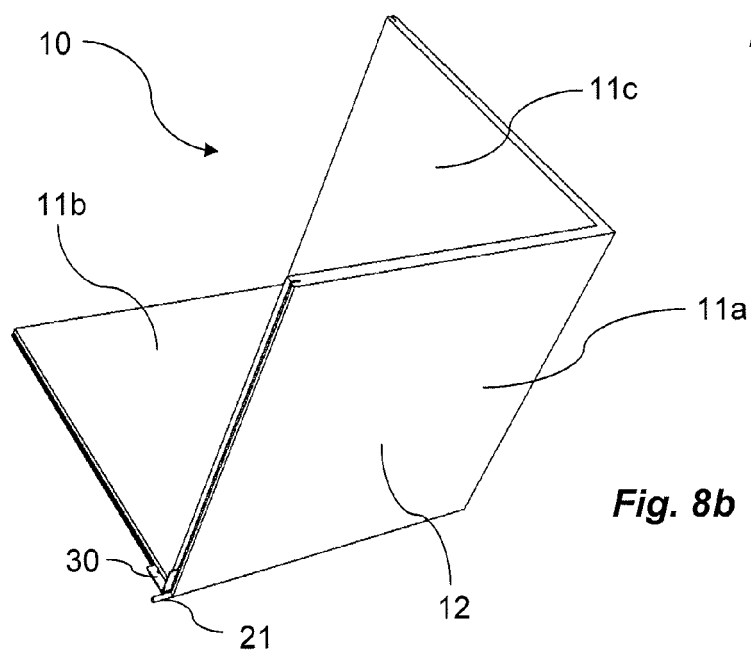
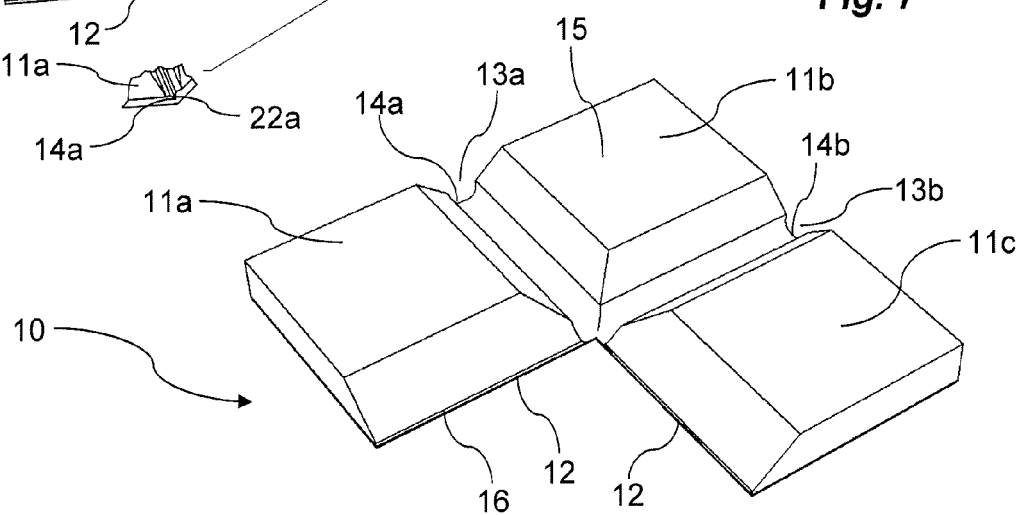
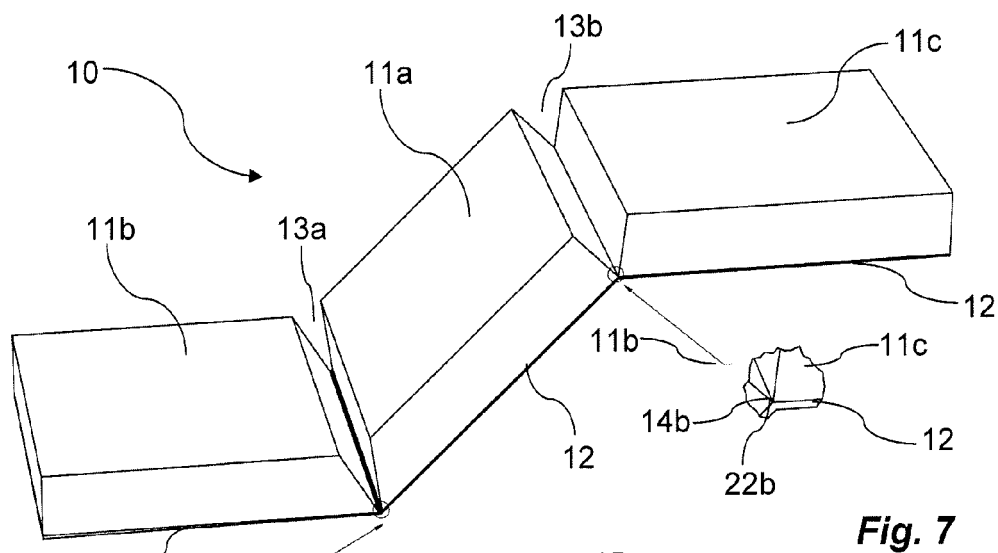


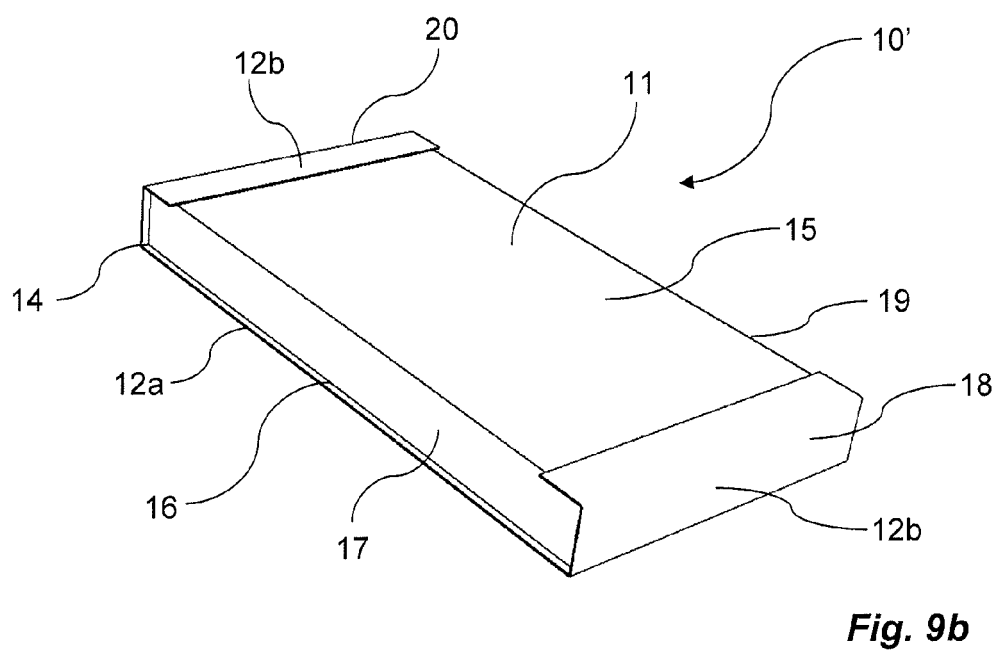
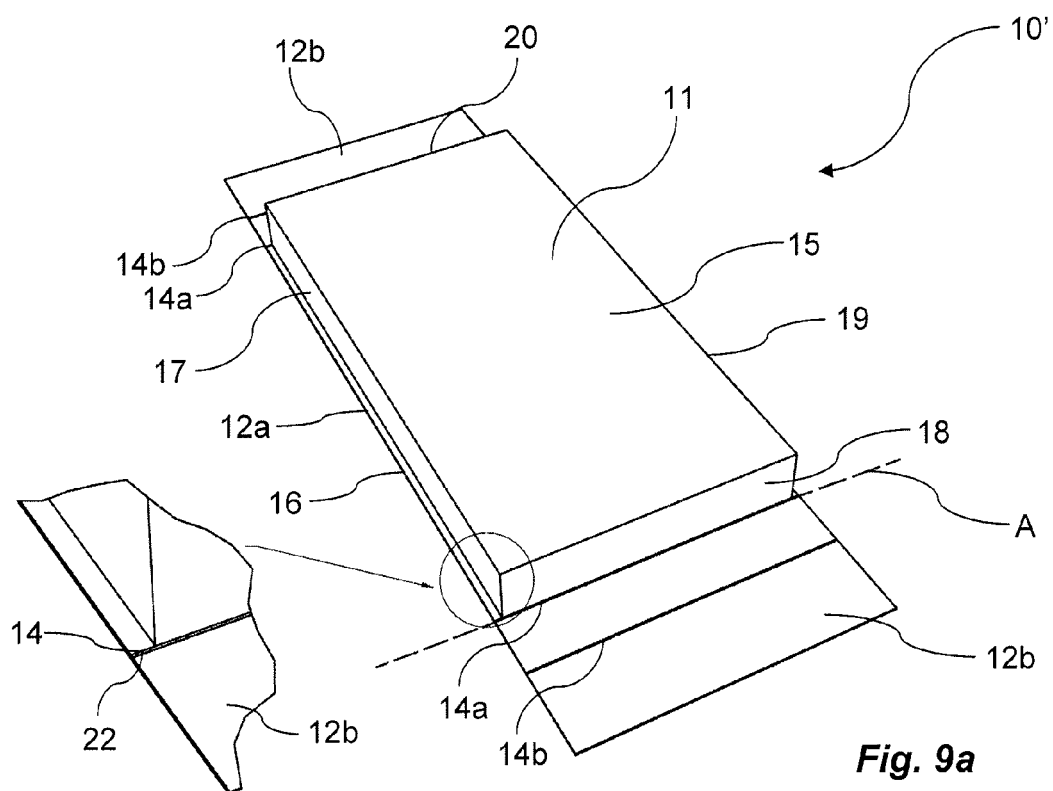


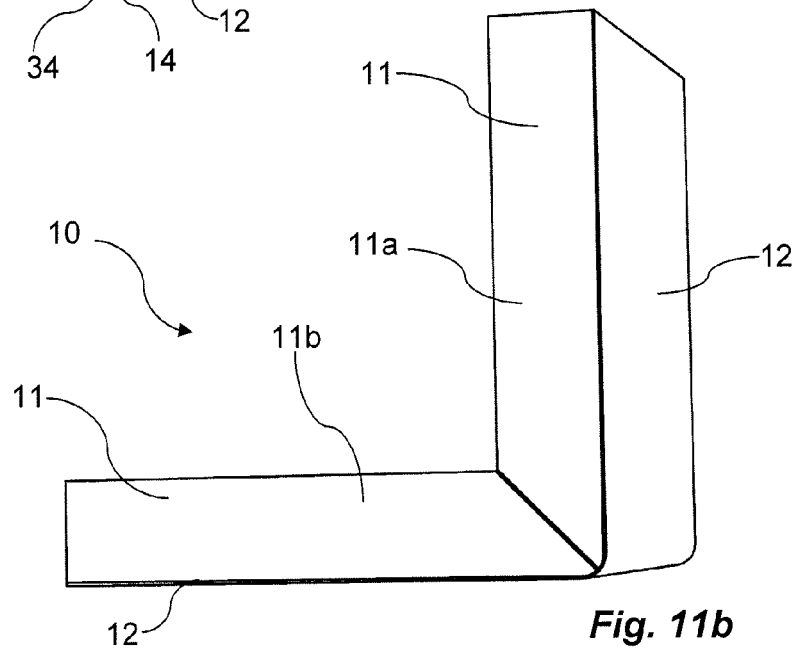
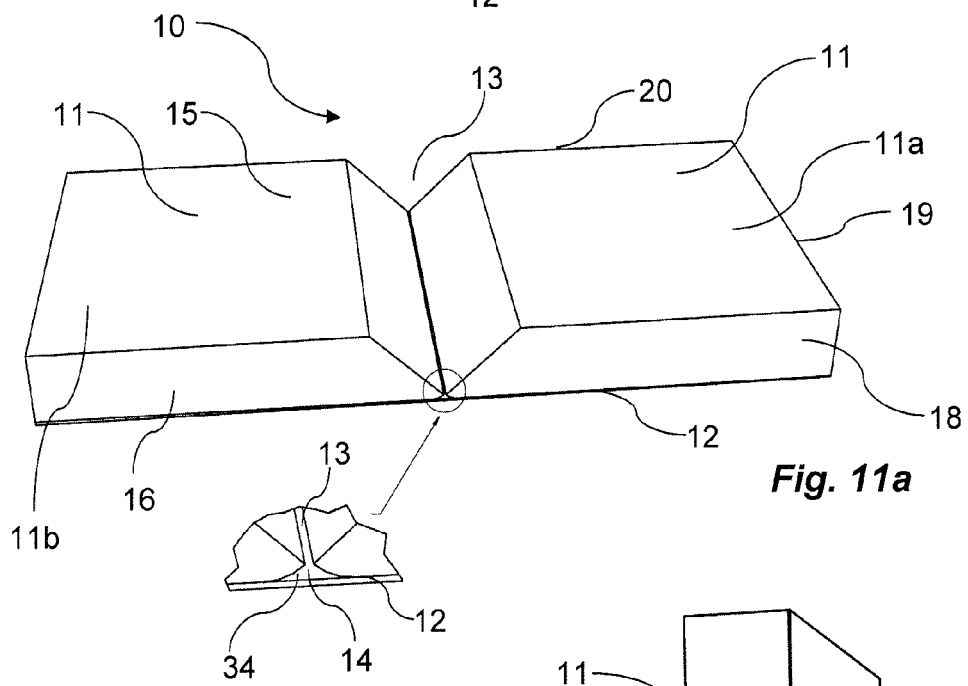
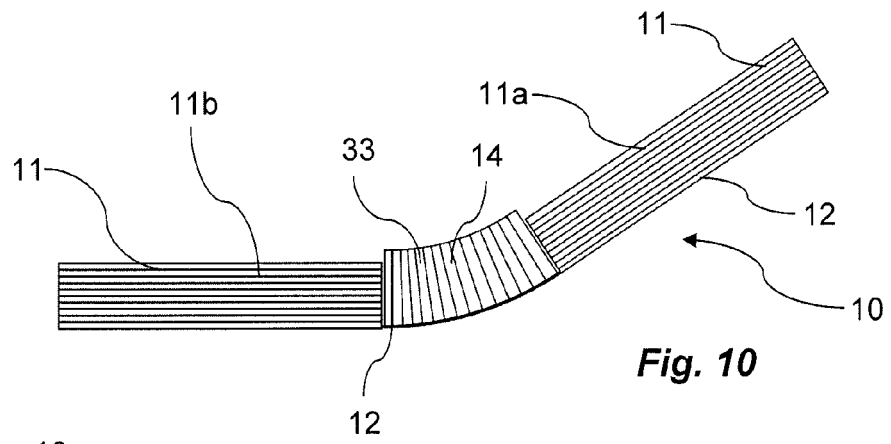














EUROPEAN SEARCH REPORT

Application Number
EP 09 18 0422

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 June 2010	Examiner Righetti, Roberto
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	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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29-06-2010

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