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(54) **Method for providing a transport unit, a transport unit**

Verfahren zur Bereitstellung einer Transporteinheit, Transporteinheit

Procédé permettant de fournir une unité de transport, unité de transport

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Description

Field of the invention

[0001] The present invention relates to a method for providing of a transport unit comprising a plurality of tiles, wherein each ceiling tile includes a front surface, a rear surface, at least one side surface and a front surface layer arranged on the front surface. The invention further relates to a transport unit comprising at least one stack including a plurality of ceiling tiles and a ceiling tile.

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 usually comprise ceiling tiles and a supporting structure. The supporting structure normally comprises supporting profiles, which are arranged in a grid defining compartments for individual ceiling tiles or groups of ceiling tiles. The ceiling 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 fibre material such as mineral wool and especially glass wool.

[0004] Ceiling tiles are voluminous products, which is a disadvantage during distribution and transport of the ceiling tiles due to cost and due to environmental reasons. A typical ceiling tile made of glass wool consists of 95 % of air, the remaining 5 % mainly being fibres of glass wool. Consequently, a large portion of the volume that is transported is in fact air.

[0005] Insulation material, for example insulation material made of glass wool and to a certain degree also of rock wool, is often temporarily compressed after manufacture in order to reduce the volume of the product during transport. After being transported, the insulation material is allowed to return to its uncompressed state. However, insulation material is not visible after being mounted to walls or joists. Thereby, no aesthetic requirements are to be considered for the insulation material. If the visual appearance of the insulation material changes during compression is of minor importance. Further, insulation material often lacks a surface layer which could be damaged during compression.

[0006] Contrary to insulation material, the aesthetical impression is of large importance for a ceiling tile, and especially the appearance of the front surface of the ceiling tile facing the room. The front surface layer is often covered by a surface layer which may be painted. Thereby, the front surface layer is especially delicate. Consequently, the ceiling tile must be handled by care during transport in order to avoid damages. If a ceiling tile, and especially a front surface of the ceiling tile, is damaged during transport, the ceiling tile can not be used due to aesthetical reasons and must be discarded.

[0007] DE 10 2004 022280 A1 discloses a packing unit comprising insulating panels arranged in a stack with front surfaces facing each other. A pressure-resistant frame-shaped device encloses sides surfaces of the stack.

[0008] Accordingly, transportation of ceiling tiles is troublesome both due to their large volume and due to ceiling tiles being sensitive to impacts. Additionally, their large volume causes high costs for transport and is considered to be drawback having environmental considerations in mind.

Summary of the invention

[0009] It is an object of the present invention to provide an improvement over the above described techniques and prior art.

[0010] A further object is to reduce costs associated with transport of ceiling tiles and reduce damages of the ceiling tiles originating from transport and handling.

[0011] At least some of these and other objects and advantages that will be apparent from the description have been achieved by a method for providing a transport unit comprising a plurality of ceiling tiles made of mineral fibres and a binder, each ceiling tile including a front surface, a rear surface, at least one side surface and a front surface layer arranged on the front surface, the method comprising

arranging said plurality of ceiling tiles in a at least one stack including a top ceiling tile, a bottom ceiling tile and at least one intermediate ceiling tile, wherein the front surface layer of each intermediate ceiling tile is facing a front surface layer of an adjacent ceiling tile,

compressing said at least one stack to a compressed state, and

securing said at least one stack in said compressed state.

[0012] An advantage of the inventive method is that the volume of the stack in its compressed state is reduced compared to the volume of the stack of ceiling tiles in the uncompressed state. A higher number of ceiling tiles may be transported and stored per volume unit. Thereby, the cost for transportation and storage of each ceiling tile is reduced. Further, the environmental influence due to transport is reduced since the transport of ceiling tiles becomes more efficient. The volume occupied just by air in a ceiling tile is reduced.

[0013] Due to their large volume but low weight, the load capacity of a lorry is limited by the available volume when transporting ceiling tiles, not by the weight of the ceiling tiles. By compressing the stack of ceiling tiles, the volume of the ceiling tiles is reduced. Due to their low weight, the load capacity is still not limited by the weight of the ceiling tiles.

[0014] Further, by arranging the front surface layer of each intermediate ceiling tile such that it is facing the front surface layer of an adjacent ceiling tile, the surface layer remains unaffected by the compression and the risk is significantly reduced that the surface layers get damaged when the ceiling tiles are compressed. The surface layers facing each other distribute the pressure uniformly.

[0015] By arranging the ceiling tiles in a stack, a more efficient method is achieved compared to compressing each individual ceiling tile and then collect the ceiling tiles to a stack of ceiling tiles for transport and distribution.

[0016] The ceiling tile returns to its original uncompressed state when not longer being affected by a compressing force. Further, the ceiling tile maintains its properties after being compressed and when it has returned to its original uncompressed state. For example, the sound-absorbing properties of the ceiling tile remain unchanged after compression.

[0017] Another advantage associated with the inventive method is that it is possible to offer ceiling tiles having a larger thickness compared to a conventional ceiling tile. The sound-absorbing ability of a ceiling tile made of mineral fibre increases in proportion to the thickness of the ceiling tile. Therefore, it may be desirable to offer ceiling tiles having large thickness. Further, the sound-absorbing properties in the low frequency spectrum are also improved by aceiling tile having large thickness. Previously, it has not been cost-effective to transport ceiling tiles having a larger thickness due to the cost for transport. By compressing the stack of ceiling tiles, the drawbacks associated with of ceiling tile having large thickness will be reduced.

[0018] The step of arranging said plurality of ceiling tiles in said at least one stack may further include arranging the bottom ceiling tile on a bottom end plate and arranging a top end plate on top of the top ceiling tile. The bottom and top end plates distribute the pressure uniformly over the stack and protect the top and bottom ceiling tiles during storage and transport. Further, if a surface layer of the top or end ceiling tiles is abutting the end plate or the bottom end plate, the top or bottom end plate protects the surface layer.

[0019] The method may further comprise arranging said plurality of ceiling tiles in two or more stacks. The stacks may be compressed individually or together. If the stacks are compressed together in one step, two or more stacks of ceiling tiles may be arranged adjacent each other between the top and bottom end plate and then be compressed in one step. By collecting ceiling tiles having a relatively small area into several stacks, ceiling tiles having a relatively small area may also be compressed in an efficient way.

[0020] The step of securing said at least one stack in said compressed state may comprise arranging at least one strap surrounding said at least one stack. The strap ensures that the stack is maintained in its compressed state during transport and distribution. If top and bottom end plates are used, the strap may also surround the top and bottom end plates. When the stack of ceiling tiles is in the room where they should be mounted, the strap is removed from the stack and the ceiling tiles return to their original uncompressed state.

[0021] The step of securing said at least one stack in said compressed state may comprise arranging a protective film enclosing said at least one stack. The protective film ensures that the stack is maintained in its compressed state during transport and distribution. Additionally, the protective film protects the stack of ceiling tiles from moisture or dust. When the stack of ceiling tiles is in the room where they should be mounted, the protective film is removed from the stack and the ceiling tiles return to their original uncompressed state. Alternatively, the protective film may be used in combination with a strap surrounding the stack. In this case, the protective film mainly protects the stack from moisture and dust.

[0022] The method may further comprise arranging two or more ceiling tiles in an encapsulation to form a sub-stack, wherein one or more sub-stacks form said at least one stack. Forming an encapsulation comprising a number of ceiling tiles facilitates handling of the ceiling tiles both before compression and when the stack returns to its uncompressed state. The sub-stacks are compressed in one step such that they together form one stack.

[0023] According to a second aspect of the invention, the present invention is realised by a transport unit comprising at least one stack including a plurality of ceiling tiles made of mineral fibres and a binder, each ceiling tile comprising a front surface, a rear surface, at least one side surface and a front surface layer arranged on the front surface. Said at least one stack comprises a top ceiling tile, a bottom ceiling tile and at least one intermediate ceiling tile, wherein the front surface layer of each intermediate ceiling tile is facing a front surface layer of an adjacent ceiling tile, wherein said plurality of ceiling tiles are in a compressed state.

[0024] Compared to a conventional transport unit comprising ceiling tiles which are not in a compressed state, the inventive transport unit occupies a reduced volume. With the inventive transport unit, a higher number of ceiling tiles may be stored and transported per volume unit. Thereby, the cost for transport and storage of each ceiling tile is reduced. Further, the environmental influence due to transport is reduced since the transport of ceiling tiles becomes more efficient. The volume occupied just by air in a ceiling tile is reduced.

[0025] The ceiling tiles return to its original uncompressed state when not longer being affected by a compressing force. Further, the ceiling tile maintains its properties after being compressed and when it has returned to its original uncompressed state. For example, the sound-absorbing properties of the ceiling tile remain unchanged after compression.

[0026] Due to that the front surface layer of each intermediate ceiling tile is facing a front surface layer of an adjacent ceiling tile, the surface layer remains unaffected by the compression and when the ceiling tiles return to its original uncompressed state. The risk that the surface layer is damaged when the ceiling tiles are compressed is significantly reduced.

[0027] Another advantage of the inventive transport unit is that the transport unit makes it possible to offer ceiling tiles having a larger thickness compared to a conventional ceiling tile. The sound-absorbing ability of a ceiling tile made of mineral fibre increases in proportion to the thickness of the ceiling tile. Therefore, it may be desirable to offer ceiling tiles having large thickness. Further, the sound-absorbing properties in the low frequency spectrum are also improved by a ceiling tile having large thickness. Previously, it has not been cost-effective to transport ceiling tiles having a larger thickness due to the cost for transport. With the transport unit including compressed ceiling tiles, the drawbacks associated with of ceiling tiles having large thickness will be reduced.

[0028] Said at least one stack may further comprise a bottom end plate and a top end plate, wherein the bottom ceiling tile is arranged on the bottom end plate and the top end plate is arranged on top of the top ceiling tile. The bottom and top end plates distribute the pressure uniformly over the stack and protect the top and bottom ceiling tiles during storage and transport.

[0029] The transport unit may comprise two or more stacks of ceiling tiles. Thereby, ceiling tiles having a relatively small area may be arranged adjacent each other in stacks and the stacks may then be compressed together. Thereby, a more efficient handling of small ceiling tiles is obtained.

[0030] Two or more ceiling tiles may be arranged in an encapsulation forming a sub-stack, wherein one or more sub-stacks form said at least one stack. The encapsulation comprising a number of ceiling tiles facilitates handling of the ceiling tiles both before compression and after compression when the stack returns to its original uncompressed state.

[0031] The bottom end plate may comprise a pallet. Thereby, the transport unit may be operated by fork-lift truck.

[0032] According to a third aspect of the invention, the present invention is realised by a ceiling tile made of mineral fibres and a binder, comprising a front surface, a rear surface, at least one side surface and a front surface layer arranged on the front surface. The mineral fibres are homogenously distributed and orientated in a plane parallel with the front surface. The front surface layer is air permeable and comprises a layer of paint, and said ceiling tile being elastically compressible.

[0033] By the ceiling tile being elastically compressible is meant that the ceiling tile returns to its original uncompressed state when not being subjected to external forces affecting the ceiling tile. The ceiling tile maintains its properties when being compressed and after it has returned to its original thickness. After being compressed, the ceiling tile returns to its original thickness, or at least to a thickness being at least 90% of its original thickness. The ceiling tile may be elastically compressible to a compressed thickness corresponding to at least 1/3, preferably 1/5, of an original thickness of said ceiling tile. Thereby, the volume to be transported may be reduced to 1/5 of the original volume.

[0034] One advantage of a ceiling tile being elastically compressible is that it is possible to compress the ceiling tile. Thereby, the volume of the ceiling tile in its compressed state is reduced. The ceiling tile may be kept in its compressed state during transport and storage.

[0035] The reduced volume is favourable due to that a higher number of ceiling tiles may be stored per volume unit. Consequently, the cost for transportation and storage of each ceiling tile is reduced. Further, the environmental influence due to transportation is reduced since the transport of ceiling tiles becomes more efficient. The volume occupied just by air in a ceiling tile is reduced.

[0036] A ceiling tile having the above defined properties returns to its original uncompressed state when not longer being affected by a compressing force. Further, the ceiling tile maintains its properties after being compressed and when it has returned to its original uncompressed state. For example, the sound-absorbing properties of the ceiling tile remain unchanged after compression.

[0037] Additionally, it is possible to offer ceiling tiles having a larger thickness compared to a conventional ceiling tile. The sound-absorbing ability of a ceiling tile made of mineral fibre increases in proportion to the thickness of the ceiling tile. Therefore, it may be desirable to offer ceiling tiles having large thickness. Further, the sound-absorbing properties in the low frequency spectrum are also improved by a ceiling tile having large thickness. Previously, it has not been cost-effective to transport ceiling tiles having large thickness due to the cost for transportation. With a ceiling tile being elastically compressible, the drawbacks associated with of a ceiling tile with larger thickness will be reduced, since the ceiling tile may be compressed to a reduced thickness.

[0038] Further, the inventive ceiling tile makes it possible to compress a ceiling tile having a front surface layer without damaging the front surface layer. The front surface layer remains unaffected when the ceiling tile returns to its original uncompressed state.

[0039] The front surface layer may fulfil fire safety requirements according to Euroclass A2-s1, d0.Euroclass A2-s1, d0 is a class within the reaction to fire classification system for linings and material in Europe according to the classification standard EN 13501-1. A2 denotes the main level, s1 denotes the class for smoke production and d0 denotes the class for occurrence of flaming droplets/particles.

[0040] The sound-absorbing ceiling tile may further comprise a rear surface layer arranged on the rear surface. The rear surface layer improves the rear surface of the ceiling tile and the visual appearance.

[0041] The sound-absorbing ceiling tile may further comprise a side surface layer arranged on said at least one side surface. Since the side surface in some arrangements is visible for a person in the room when the ceiling tile has been mounted in a suspension system, it is desirable to provide the side surface with a surface layer, which may include a layer of paint.

[0042] Said at least one side surface may have an inclined surface portion. In order to facilitate the compressing of the tile, the side surface may be provided with an inclined portion. Especially if the side surface is provided with a surface layer, it is advantageous to arrange an inclined surface portion on the side surface. The inclined surface portion facilitates compressing of the ceiling tile and reduces the risk that the side surface layer is damaged when the ceiling tile is compressed.

[0043] Said at least one side surface may comprise a cut-out. In order to facilitate the compressing of the tile, the side surface may be provided with a cut-out. Especially if the side surface is provided with a surface layer, it is advantageous to arrange a cut-out on the side surface. The cut-out facilitates compressing of the ceiling tile and reduces the risk that the side surface layer is damaged when the ceiling tile is compressed.

[0044] The mineral fibres may have a fibre diameter of 4-7 μm and the binder is present in an amount of 4-10 wt%, preferably about 7 wt%.

Brief description of the drawings

[0045] The present invention will by way of example be described in more detail with reference to the appended schematic drawings, which show an embodiment of the present invention.

Figure 1 shows a ceiling tile made of fibre material.

Figure 2 shows a ceiling tile made of fibre material in a compressed state.

Figure 3a shows a first embodiment of a ceiling tile comprising a side surface layer.

Figure 3b shows the ceiling tile in figure 3a in cross-section.

Figure 3c shows the ceiling tile in figure 3a in a compressed state.

Figure 3d shows the ceiling tile in figure 3c in cross-section.

Figure 4a shows a second embodiment of a ceiling tile comprising a side surface layer.

Figure 4b shows the ceiling tile in figure 4a in cross-section.

Figure 4c shows the ceiling tile in figure 4a in a compressed state.

Figure 4d shows the ceiling tile in figure 4c in cross-section.

Figure 5a shows a third embodiment of a ceiling tile comprising a side surface layer.

Figure 5b shows the ceiling tile in figure 5a in cross-section.

Figure 5c shows the ceiling tile in figure 5a in a compressed state.

Figure 5d shows the ceiling tile in figure 5c in cross-section.

Figure 6a shows schematically a ceiling tile having a laminated structure.

Figure 6b shows the ceiling tile in figure 6a in cross-section in a compressed state.

Figure 7a shows schematically a ceiling tile having a laminated structure.

Figure 7b shows the ceiling tile in figure 7a in cross-section in a compressed state.

Figure 8a shows schematically a device for compressing ceiling tiles in cross-section.

Figure 8b shows the device in figure 8a in cross section.

Figure 9 shows a first embodiment of a transport unit comprising a plurality of ceiling tiles.

Figure 10 shows a second embodiment of the transport unit comprising more four stacks of ceiling tiles.

Figure 11 shows a third embodiment of the transport unit in cross section.

Detailed description

[0046] Figure 1 shows a ceiling tile 1 comprising a tile body 2, a front surface 4, a rear surface 3 and at least one side surface. In the shown embodiment, the ceiling tile 1 comprises four side surfaces 5, 6, 7, 8. In the shown embodiment, the ceiling tile 1 has a rectangular parallelepiped shape, but any other shape is also possible, such as cylindrical, elliptical, cubic etc.

[0047] The ceiling tile 1 has sound-absorbing properties. The ceiling tile 1 may also, or alternatively, have sound-insulation properties.

[0048] The front surface 4 is adapted to face the room when the ceiling tile 1 is mounted in a grid for forming a suspended ceiling. The rear surface 3 is adapted to face the ceiling structure of the building. The ceiling tile 1 is adapted to form part of a suspended ceiling. The ceiling tiles 1 are adapted to be supported by profiles or runners forming a grid.

[0049] The tile body 2 comprises a mineral fibre material. More specifically, the mineral fibre material may be a man-made mineral fibre material. The mineral fibre material may be mineral wool. Preferably, the mineral fibre material is glass wool. In addition to mineral fibres, the material comprises a binder. Other additives are also possible. The binder may be an organic binder. In one embodiment, the binder is present in an amount of 4-10 wt %, preferably the binder is present in an amount of about 7 wt%.

[0050] The fibre diameter of the mineral fibres may be 4-7 μm. Further, the fibres are homogenously distributed and mainly orientated in a plane parallel with the front and rear surfaces 3, 4. The original density of the ceiling tile may be 20-60 kg/m^3.

[0051] The tile body 2 comprises a high extent of air, for example 95 % of air and 5 % of fibre material per volume unit. In the following, reference will be made to a compressed state and an uncompressed state of the ceiling tile.

[0052] A front surface 10 layer is arranged on the front surface 4. The front surface layer 10 is made of glass tissue or woven glass fibre. The front surface layer 10 comprises a layer of paint. Preferably, the layer of paint is mainly non-continuous. The front surface layer 10 is air permeable such that sound waves can be transmitted through the surface layer 10 to the tile body 2 and to the fibre material of the tile body 2. The front surface layer 10 fulfils the fire safety requirements according to Euroclass A2-s1, d0 according to the classification standard EN 13501-1.

[0053] In one embodiment, a rear surface layer 13 is arranged on the rear surface 3. The rear surface layer 13 may be made of glass tissue or woven glass fibre which is painted or unpainted.

[0054] Further, in other embodiments which are shown in figures 3a-d, 4a-d and 5a-d, a side surface layer 11, 12 may be arranged on said at least one side surface 5, 6. The side surface layer 11, 12 comprise a layer of paint. Having a painted side surface layer 11, 12 may be desirable in an arrangement wherein the side surface 5, 6 is visible when the ceiling tile 1 is mounted to a suspension system. The side surface layer 11, 12 may be painted on the side surface 5, 6 or may be applied in accordance with the method disclosed in EP 2 027 990.

[0055] The surface layers may all be susceptible to cracking, i.e. being sensitive to impact and easily damaged.

[0056] The ceiling tile 1 is elastically compressible. With elastically compressible is meant that the ceiling tile 1 resumes its original uncompressed state when not being subjected to external forces affecting the ceiling tile 1 to be in its compressed state. The ceiling tile 1 maintains its properties, for example its sound-absorbing properties, when being compressed and after it has returned to its original thickness. After being compressed, the ceiling tile 1 returns to its original thickness, or at least to a thickness being 90% of its original thickness.

[0057] In figure 2, to which reference now is made, the ceiling tile 1 is in a compressed state. In the compressed state, the ceiling tile 1 has been compressed to a density of approximately 100 kg/m^3, regardless the original density of the ceiling tile 1. The ceiling tile 1 may be compressed to a compressed thickness being at least 1/3, preferably 1/5, of its original thickness. Thereby, the volume of each ceiling tile 1 which is to be transported is reduced to 1/5 of the original volume.

[0058] As an example, a ceiling tile 1 having an original density of 30 kg/m^3 can be compressed to a compressed thickness of 1/3 of the original thickness.

[0059] The ceiling tile 1 has been compressed in a direction being perpendicular to the plane of the front surface and rear surface 3, 4. A uniform pressure has been applied in order to obtain a uniform compression of the ceiling tile 1. Any surface layer 10, 13 arranged on the front and/or rear surface 3, 4 remains planar in the compressed state of the ceiling tile 1 and is therefore not affected or damaged by the compression.

[0060] The homogenously distribution and the orientation of the mineral fibres in a direction planar to the front and rear surfaces 3, 4 allows a uniform compression of the ceiling tile 1 and that any surface layer 10, 13 does not get damaged during compression.

[0061] Further, the sound-absorbing properties of the ceiling tile 1 remain unchanged by the compression.

[0062] Since the ceiling tile 1 strives to be in its uncompressed state, a force forcing the ceiling tile 1 to remain in its compressed state must be applied in order to keep the ceiling tile 1 in its compressed state. When no force is applied to the ceiling tile 1, the ceiling tile 1 will return to its uncompressed state due to its elastically compressible properties.

[0063] A method for compressing the ceiling tile 1 will be described below in more detail.

[0064] If a side surface layer 11, 12 is arranged to one or more of the at least one side surface 5, 6, 7, 8, the side surface may be modified in order to facilitate compression of the ceiling tile 1 without damaging the side surface layer 11, 12.

[0065] In the embodiment shown in figures 3a-b, to which reference now is made, the side surfaces 5, 6 are inclined, as visible in the cross section in figure 3b. Alternatively, only a portion of the side surfaces 5, 6 may be inclined.

[0066] In figures 3c-d, the ceiling tile 1 in figure 3a is shown when being compressed. The inclined side surface 5, 6 facilitates compression of ceiling tile 1 without affecting the side surface layer 11, 12 such that damages on the side surface layer 11, 12 may be avoided. When being compressed, the inclination angle of the inclined side surface 5, 6 increases, but the surfaces 5, 6 on which the side surface layer 11, 12 are applied to are not affected by the compression.

[0067] In another embodiment, which is shown in figures 4a-d, the side surfaces 5, 6 of the ceiling tile 1 having a side surface layer 11, 12 is provided with a cut-out 20, 21. In the embodiment shown in figures 4a-d, the cut-out 20, 21 is V-shaped and extends towards the centre of the ceiling tile 1. However, the cut-out may have another shape or that more than one cut-out is provided in the side surface of the ceiling tile 1. Alternatively, the side surface may have straight portions combined with cutouts.

[0068] The cut-out 20, 21 divides the side surface 5, 6 into a first side surface portion and a second side surface portion. The V-shaped cut-out 20, 21 functions as a hinge when the ceiling tile 1 is compressed. The side surface layer 11, 12 is adhered to the inclined portions of the cut-out 20, 21.

[0069] When the ceiling tile 1 is compressed, which is shown in figures 4c-d, the side surface portions are displaced towards each other. However, the side surface layer 11, 12 is not affected by the compression and the risk for damages on the side surface layer 11, 12 is reduced.

[0070] In the embodiment shown in figures 5a-d, a ceiling tile 1 having side surfaces layers 11, 12 is disclosed. The side surfaces 5, 6, 7, 8 are provided with a first and second inclined surface portions 5a, 6b, 8a, 8b, as visible in figure 5b. The inclined surface portions form an edge functioning as a hinge during compression. When the ceiling tile 1 is compressed, the surface portions 5a, 5b, 8a, 8b are displaced towards each other and the angle between the two surface portions is reduced as shown in figures 5c-d. However, the side surface layer 11, 12 is not affected by the compression and the risk for damages on the side surface layer 11, 12 is reduced.

[0071] Alternatively, in order to avoid problems associated with compression of a side surface layer 11, 12, the side surface layer 11, 12 may be flexible.

[0072] For some applications, the ceiling tile 1 may have a laminated structure, which is shown in figures 6a-b. The laminar structure comprises a first tile body portion 2a adapted to face the room and a second tile body portion 2b adapted to face the ceiling structure. The first and the second tile body portions 2a, 2b are adhered to each other to form one ceiling tile 1. In the shown embodiment, the front surface 4 is provided with a front surface layer 10 and the rear surface 3 is provided with a rear surface layer 13.The first and the second tile body portions 2a, 2b may have different properties. For example, the second tile body portion 2b may have a lower density and larger thickness compared to the first tile body portion 2a. Since the second tile body portion 2b has lower density, the second tile body portion 2b may be compressed to a larger extent than the first tile body portion 2a, which is shown in figure 6b. When the ceiling tile 1 has returned to its original uncompressed state and when being mounted to a suspended ceiling in a room, the second tile body portion 2b improves the sound-absorbing properties of the ceiling tiles 1, especially in the low frequency spectrum. Since the sound-absorbing capacity for a mineral fibre material increases with the thickness of the ceiling tile 1 but does not vary largely with the density, a ceiling tile 1 having a larger thickness is favourable. The possibility to compress the ceiling tile 1 offers a possibility to provide such a thicker ceiling tile 1 in a rational manner.

[0073] Further, ceiling tiles 1 having an edge including a complicated profile, for example for hiding a supporting grid, are usually made of a tile body 2 having a comparably high density. A high density is often required in order to machine the desired profile. Due to the high density, the ceiling tile may not be compressed to a desirable extent. In order to still make the ceiling tile compressible, the ceiling tile 1 may have a laminar structure, which is shown in figures 7a-b to which reference now is made. The laminar structure comprises a first ceiling tile body portion 2a adapted to face the room which have a high density. The profile of the side surfaces 5, 6 is machined in the first tile body portion 2a. A second tile body portion 2b is adhered to the first tile body portion 2a. The second tile body portion 2b has a lower density compared to the first tile body portion 2a, thus being compressible to a higher extent. Additionally, the thickness of the first body portion 2a may be less than the thickness of the second tile body portion 2b. Thereby, the total volume of the ceiling tile 1 may still be reduced when the ceiling tile 1 is compressed. In figure 7b the ceiling tile 1 having the laminar structure is shown in its compressed state, wherein the second tile body portion 2b is compressed to a higher extent compared to the first tile body portion 2a.

[0074] A method for manufacturing a transport unit 100 comprising ceiling tiles 1 will now be described in more detail with reference to figures 8a-b. The ceiling tiles 1 are of the above described type comprising mineral fibre and a binder. The method comprises arranging ceiling tiles 1 in a stack 30. The stack 30 includes at least a top ceiling tile 1a forming the top of the stack, a bottom ceiling tile 1 b forming the bottom of the stack, and at least one intermediate ceiling tile 1 c arranged between the top and the bottom ceiling tiles 1 a, 1 b. If the stack includes three ceiling tiles 1 a, 1 b, 1 c, one intermediate ceiling tile 1c is included in the stack. In the embodiment shown in figures 8a-b, the stack 30 comprises a top and bottom ceiling tiles 1a, 1b and two intermediate ceiling tiles 1c.

[0075] The ceiling tiles 1a, 1b, 1c are arranged such that the front surface layer 10 of each intermediate ceiling tile 1c is facing a front surface layer 10 of an adjacent ceiling tile 1a, 1 b. For example, in the shown embodiment, the front surface layer 10 of the bottom ceiling tile 1 b is facing the surface layer 10 of the first intermediate ceiling tile 1 c. Further, the front surface layer 10 of the top ceiling tile 1 a is facing the front surface layer 10 of the second intermediate ceiling tile 1 c.

[0076] By arranging the ceiling tiles 1 a, 1 b, 1c with their front surface layer 10 facing the front surface layer 10 of the adjacent ceiling tile 1 a, 1 b, 1 c, the two planar surfaces 10 stabilises each other and uniformly distributes the pressure.

[0077] In the embodiment shown in figures 8a-b, the bottom ceiling tile 1 b is arranged on a bottom end plate 16. The bottom end plate 16 has an area corresponding to the area of the bottom ceiling tile 1b, or an area exceeding the area of the bottom ceiling tile 1 b. A top end plate 15 is arranged on top of the top ceiling tile 1 a. The top end plate 15 has an area corresponding to the area of the top ceiling tile 1 a, or an area exceeding the area of the top ceiling tile 1 a. The bottom end plate 16 may comprise a pallet.

[0078] If the stack 30 comprises an uneven number of ceiling tiles 1, the front surface layer 10 of the top or the bottom ceiling tile 1 a, 1 b is preferably arranged such that its front surface layer 10 faces the top or bottom end plate 15, 16, respectively. Preferably, the stack 30 comprises an even number of ceiling tiles 1, such that a front surface layer 10 is facing a front surface layer 10 of an adjacent ceiling tile 1. A person skilled in the art will easily appreciate that the number of ceiling tiles 1 in a stack 30 may be varied.

[0079] The stack 30 comprising the ceiling tiles 1 a, 1 b, 1 c is then compressed to a compressed state. Pressure is applied in a direction perpendicular to the plane of the front surfaces 4 having the front surface layer 10 of the ceiling tiles 1a, 1b, 1c. Consequently, the stack 30 is compressed in a direction being perpendicular to the plane of the front surfaces 3 of the ceiling tiles 1 a, 1b, 1c. The pressure is uniformly applied over the stack 30. Preferably, the pressure is applied to the top end plate and/or the bottom end plate 15, 16.

[0080] When a desired degree of compression is achieved, the stack 30 is secured in its compressed state. Thereby, the compression of the stack of ceiling tiles 1 is maintained as long as desired. The securing of the stack may be obtained by means of at least one strap 17 enclosing the stack, including any top and bottom end plates, or by means of a protective film 18 enclosing the stack 30, a combination thereof or by any other suitable means.

[0081] A transport unit 100, which is shown in figure 9, comprising at least one stack 30 is thereby obtained. The stack 30 includes a plurality of ceiling tiles 1 a, 1 b, 1 c made of mineral fibre such as glass wool and a binder and having a front surface 4 with a front surface layer 10, a rear surface 4 and at least one side surface 5, 6, 7, 8. The at least one stack 30 comprises consequently the top ceiling tile 1 a, the bottom ceiling tile 1 and at least one intermediate ceiling tile 1c, wherein the front surface layer 10 of each intermediate ceiling tile 1 c is facing a front surface layer 10 of an adjacent ceiling tile 1 a, 1 b, wherein the plurality of ceiling tiles 1 a, 1 b, 1 c are in a compressed state.

[0082] When the ceiling tiles 1 a, 1 b, 1 c are to be mounted, the strap 17 or the protective film 18 is removed from the stack, and the ceiling tiles 1 return their original uncompressed state. The ceiling tiles 1 may then be mounted to the supporting grid forming part of a suspended ceiling.

[0083] As described above, the ceiling tiles 1 may also be provided with a rear surface layer 13 arranged on the rear surface 3 of the ceiling tile 1. In this embodiment, when arranged in a stack, the rear surface layer 13 is facing a front or rear surface layer 10, 13 of an adjacent ceiling tile.

[0084] Further, the ceiling tiles 1 may be arranged in more than one stack, which is shown in figure 10. If the ceiling tiles 1 are relatively small, it may be advantageous to arrange the ceiling tiles 1 in more than one stack. For example, four stacks of ceiling tiles 1 may be arranged together, or two stacks of ceiling tiles. In the embodiment shown in figure 10, four stacks 30, 31, 32, 33 of ceiling tiles 1 form a transport unit 100. The individual ceiling tiles 1a, 1b, 1c are arranged in the same manner as described above with a surface layer of one ceiling tile facing a surface layer of an adjacent ceiling tile. The stacks 30, 31, 32, 33 are arranged adjacent each other. The stacks 30, 31, 32, 33 are then compressed together in a single step. Alternatively, the stacks are compressed individually. The stacks 30, 31, 32, 33 may be arranged on a single common bottom end plate 16 as described above. A single common top end plate 15 may be arranged on top of the stacks 30, 31, 32, 33. As previously described, at least one strap 17 and/or a protective film 18 may enclose the stacks 30, 31, 32, 33.

[0085] In order to facilitate handling of a large number of ceiling tiles which are compressed in one stack or in several stacks, it is advantageous to arrange a number of ceiling tiles, for example four by four, in an encapsulation 19. Each encapsulation 19 forms a sub-stack. One or more sub-stacks are arranged such that they form at least one stack. The transport unit 100 comprises in this embodiment a stack formed of a number of sub-stacks. When the ceiling tiles 1 return to its uncompressed state when the strap 17 or protective film 18 is removed, the encapsulation keeps a number of ceilings tiles 1 together and facilitates handling of the ceiling tiles 1.

[0086] In the embodiment shown in figure 11, four ceiling tiles 1 a, 1 b, 1c are arranged in an encapsulation 19. Two encapsulations 19 each comprising four ceiling tiles 1 a, 1 b, 1c are arranged adjacent such that they form two stacks 30, 31. As previously described, the bottom ceiling tile 1 b is arranged on bottom end plate 16 and a top end plate 15 is arranged on top of the top ceiling tile 1a. Instead of a strap surrounding the transport unit 100, a protective film 18 is surrounding the transport unit 100 and securing the ceiling tiles (1a, 1b, 1c) in their compressed state. Further, in this embodiment, the bottom end plate 16 comprises a pallet 26. A person skilled in the art will appreciate that both the protective film 18 and the pallet 16 may be used in combination with or as alternatives to any other embodiment disclosed herein.

[0087] The compression of the stack of ceiling tiles is made by means of a compression device 200, which is shown in figures 8a-b. The compression device 200 comprises a frame 202 on which the bottom end plate 16 is arranged. The compression device 200 further comprises an upper part 201 adapted to make contact with the top end plate 15. The upper part 201 of the compression device 200, and/or the frame 202 is movable such that pressure is applied to top and bottom end plate 15, 16. Thereby, the ceiling tiles 1 arranged in the stack 30 are compressed.

[0088] 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.

Claims

1. A method for providing a transport unit (100) comprising a plurality of ceiling tiles (1,1 a, 1 b, 1 c) made of mineral fibres and a binder, each ceiling tile (1,1 a, 1 b, 1 c) including a front surface (4), a rear surface (3), at least one side surface (5, 6, 7, 8) and a front surface layer (10) arranged on the front surface (4), the method comprising

arranging said plurality of ceiling tiles (1,1 a, 1 b, 1c) in a at least one stack (30) including a top ceiling tile (1 a), a bottom ceiling tile (1b) and at least one intermediate ceiling tile (1c), wherein the front surface layer (10) of each intermediate ceiling tile (1 c) is facing a front surface layer (10) of an adjacent ceiling tile (1a, 1b, 1c),
compressing said at least one stack (30) to a compressed state, and
securing said at least one stack (30) in said compressed state.

2. A method according to claim 1, wherein the step of arranging said plurality of ceiling tiles (1,1 a, 1 b, 1c) in said at least one stack (30) further includes arranging the bottom ceiling tile (1b) on a bottom end plate (16) and arranging a top end plate (15) on top of the top ceiling tile (1a).

3. A method according to any one of claim 1 or 2, further comprising arranging said plurality of ceiling tiles (1,1 a, 1 b, 1 c) in two or more stacks (30, 31, 32, 33).

4. A method according to any one of claims 1-3, wherein the step of securing said at least one stack (30) in said compressed state comprises arranging at least one strap (17) surrounding said at least one stack (30).

5. A method according to any one of claims 1-4, wherein the step of securing said at least one stack (30) in said compressed state comprises arranging a protective film (18) enclosing said at least one stack (30).

6. A method according to any one of claims 1-5, further comprising arranging two or more ceiling tiles (1,1 a, 1b, 1c) in an encapsulation (19) to form a substack, wherein one or more sub-stacks form said at least one stack (30).

7. A transport unit (100) comprising at least one stack (30) including a plurality of ceiling tiles (1,1 a, 1 b, 1 c) made of mineral fibres and a binder, each ceiling tile (1,1 a, 1 b, 1 c) comprising a front surface (4), a rear surface (3), at least one side surface (5, 6, 7, 8) and a front surface layer (10) arranged on the front surface (4),
wherein said at least one stack (30) comprises a top ceiling tile (1 a), a bottom ceiling tile (1b) and at least one intermediate ceiling tile (1 c), wherein the front surface layer (10) of each intermediate ceiling tile (1c) is facing a front surface layer (10) of an adjacent ceiling tile (1a, 1b, 1c),
wherein said plurality of ceiling tiles (1,1 a, 1b, 1 c) are in a compressed state.

8. A transport unit according to claim 7, wherein said at least one stack further comprises a bottom end plate and a top end plate, wherein the bottom ceiling tile is arranged on the bottom end plate and the top end plate is arranged on top of the top ceiling tile.

9. A transport unit (100) according to any one of claims 7 or 8, comprising two or more stacks (30, 31, 32, 33) of ceiling tiles.

10. A transport unit (100) according to any one of claims 7-9, wherein two or more ceiling tiles (1,1 a, 1 b, 1 c) are arranged in an encapsulation (19) forming a sub-stack, wherein than one or more sub-stacks form said at least one stack (30).

11. A transport unit according to any one of claims 7-10, wherein the bottom end plate (16) comprises a pallet (26).

Patentansprüche

1. Verfahren zur Bereitstellung einer Transporteinheit (100), die mehrere Deckenplatten (1, 1 a, 1 b, 1 c) aus Mineralfasern und einem Bindemittel umfasst, wobei jede Deckenplatte (1, 1 a, 1 b, 1 c) eine Vorderfläche (4), eine Rückfläche (3), wenigstens eine Seitenfläche (5, 6, 7, 8) und eine Vorderflächenschicht (10), die an der Vorderfläche (4) angeordnet ist, umfasst, wobei das Verfahren Folgendes umfasst:

Anordnen der mehreren Deckenplatten (1, 1 a, 1 b, 1 c) in wenigstens einem Stapel (30), der eine obere Deckenplatte (1 a), eine untere Deckenplatte (1 b) und wenigstens eine dazwischenliegende Deckenplatte (1 c) umfasst, wobei die Vorderflächenschicht (10) jeder dazwischenliegenden Deckenplatte (1 c) zu einer Vorderflächenschicht (10) einer benachbarten Deckenplatte (1 a, 1 b, 1 c) gewandt ist,
Zusammenpressen des wenigstens einen Stapels (30) in einen zusammengepressten Zustand, und
Befestigen des wenigstens einen Stapels (30) in dem zusammengepressten Zustand.

2. Verfahren nach Anspruch 1, wobei der Schritt des Anordnens der mehreren Deckenplatten (1, 1 a, 1 b, 1 c) in dem wenigstens einen Stapel (30) ferner das Anordnen der unteren Deckenplatte (1b,) auf einer unteren Endplatte (16) und das Anordnen einer oberen Endplatte (15) auf der oberen Deckenplatte (1 a) umfasst.

3. Verfahren nach einem aus Anspruch 1 oder 2, ferner umfassend das Anordnen der mehreren Deckenplatten (1, 1 a, 1 b, 1 c) in zwei oder mehr Stapeln (30, 31, 32, 33).

4. Verfahren nach einem der Ansprüche 1 bis 3, wobei der Schritt des Befestigens des wenigstens einen Stapels (30) in dem zusammengepressten Zustand das Anordnen wenigstens eines Bands (17), das den wenigstens einen Stapel (30) umgibt, umfasst.

5. Verfahren nach einem der Ansprüche 1 bis 4, wobei der Schritt des Befestigens des wenigstens einen Stapels (30) in dem zusammengepressten Zustands das Anordnen eines Schutzfilms (18), der den wenigstens einen Stapel (30) umschließt, umfasst.

6. Verfahren nach einem der Ansprüche 1 bis 5, ferner umfassend das Anordnen von zwei oder mehr Deckenplatten (1, 1 a, 1 b, 1 c) in einer Verkapselung (19), um einen Unterstapel zu bilden, wobei einer oder mehrere Unterstapel den wenigstens einen Stapel (30) bilden.

7. Transporteinheit (100), umfassend wenigstens einen Stapel (30), der mehrere Deckenplatten (1, 1 a, 1 b, 1 c) aus Mineralfasern und einem Bindemittel umfasst, wobei jede Deckenplatte (1, 1 a, 1 b, 1 c) eine Vorderfläche (4), eine Rückfläche (3), wenigstens eine Seitenfläche (5, 6, 7, 8) und eine Vorderflächenschicht (10), die an der Vorderfläche (4) angeordnet ist, umfasst,
wobei der wenigstens einen Stapel (30) eine obere Deckenplatte (1 a), eine untere Deckenplatte (1b) und wenigstens eine dazwischenliegende Deckenplatte (1c) umfasst, wobei die Vorderflächenschicht (10) jeder dazwischenliegenden Deckenplatte (1c) zu einer Vorderflächenschicht (10) einer benachbarten Deckenplatte (1 a, 1 b, 1 c) gewandt ist,
wobei sich die mehreren Deckenplatten (1, 1 a, 1 b, 1 c) in einem zusammengepressten Zustand befinden.

8. Transporteinheit nach Anspruch 7, wobei der wenigstens eine Stapel ferner eine untere Endplatte und eine obere Endplatte umfasst, wobei die untere Deckenplatte auf der unteren Endplatte angeordnet ist und die obere Endplatte auf der oberen Deckenplatte angeordnet ist.

9. Transporteinheit (100) nach einem der Ansprüche 7 oder 8, umfassend zwei oder mehr Stapel (30, 31, 32, 33) von Deckenplatten.

10. Transporteinheit (100) nach einem der Ansprüche 7 bis 9, wobei zwei oder mehr Deckenplatten (1, 1 a, 1 b, 1 c) in einer Verkapselung (19) angeordnet sind, die einen Unterstapel bildet, wobei der eine oder mehrere Unterstapel den wenigstens einen Stapel bilden (30).

11. Transporteinheit nach einem der Ansprüche 7 bis 10, wobei die untere Endplatte (16) eine Palette (26) umfasst.

Revendications

1. Procédé destiné à fournir une unité de transport (100) comprenant une pluralité de dalles de plafond (1, 1 a, 1 b, 1 c) fabriquées à partir de fibres minérales et d'un liant, chaque dalle de plafond (1, 1 a, 1 b, 1 c) comprenant une surface avant (4), une surface arrière (3), au moins une surface latérale (5, 6, 7, 8) et une couche de surface avant (10) agencée sur la surface avant (4), le procédé comprenant :

l'arrangement de ladite pluralité de dalles de plafond (1, 1 a, 1 b, 1 c) dans au moins une pile (30) comprenant une dalle de plafond supérieure (1 a), une dalle de plafond inférieure (1b) et au moins une dalle de plafond intermédiaire (1 c), la couche de surface avant (10) de chaque dalle de plafond intermédiaire (1 c) étant tournée vers une couche de surface avant (10) d'une dalle de plafond (1 a, 1 b, 1 c) adjacente,
la compression de ladite au moins une pile (30) en un état comprimé, et
la fixation de ladite au moins une pile (30) dans ledit état comprimé.

2. Procédé selon la revendication 1, dans lequel l'étape d'arrangement de ladite pluralité de dalles de plafond (1, 1 a, 1 b, 1 c) dans au moins une pile (30) comprend en outre la disposition de la dalle de plafond inférieure (1 b) sur une plaque terminale inférieure (16) et la disposition d'une plaque terminale supérieure (15) par-dessus la dalle de plafond supérieure (1 a).

3. Procédé selon l'une quelconque des revendications 1 ou 2, comprenant en outre l'arrangement de ladite pluralité de dalles de plafond (1, 1 a, 1 b, 1 c) dans deux piles ou plus (30, 31, 32, 33).

4. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel l'étape de fixation de ladite au moins une pile (30) dans ledit état comprimé comprend l'arrangement d'au moins une sangle (17) entourant ladite au moins une pile (30).

5. Procédé selon l'une quelconque des revendications 1 à 4, dans lequel l'étape de fixation de ladite au moins une pile (30) dans ledit état comprimé comprend l'arrangement d'un film protecteur (18) enveloppant ladite au moins une pile (30).

6. Procédé selon lus des revendications 1 à 5, comprenant en outre l'arrangement de deux dalles de plafond ou plus (1, 1 a, 1 b, 1 c) en une encapsulation (19) pour former une sous-pile, une ou plusieurs sous-piles formant ladite au moins une pile (30).

7. Unité de transport (100) comprenant au moins une pile (30) comprenant une pluralité de dalles de plafond (1, 1 a, 1 b, 1 c) fabriquées à partir de fibres minérales et d'un liant, chaque dalle de plafond (1, 1 a, 1 b, 1 c) comprenant une surface avant (4), une surface arrière (3), au moins une surface latérale (5, 6, 7, 8) et une couche de surface avant (10) disposée sur la surface avant (4),
dans laquelle ladite au moins une pile (30) comprend une dalle de plafond supérieure (1a), une dalle de plafond inférieure (1b) et au moins une dalle de plafond intermédiaire (1 c), la couche de surface avant (10) de chaque dalle de plafond intermédiaire (1 c) étant tournée vers une couche de surface avant (10) d'une dalle de plafond adjacente (1 a, 1 b, 1 c),
dans laquelle ladite pluralité de dalles de plafond (1, 1 a, 1 b, 1 c) se trouve dans un état comprimé.

8. Unité de transport selon la revendication 7, dans laquelle ladite au moins une pile comprend en outre une plaque terminale inférieure et une plaque terminale supérieure, la dalle de plafond inférieure étant disposée sur la plaque terminale inférieure, et la plaque terminale supérieure étant disposée par-dessus la dalle de plafond supérieure.

9. Unité de transport (100) selon l'une quelconque des revendications 7 ou 8, comprenant deux piles ou plus (30, 31, 32, 33) de dalles de plafond.

10. Unité de transport (100) selon l'une quelconque des revendications 7 à 9, dans laquelle deux dalles de plafond ou plus (1, 1 a, 1 b, 1 c) sont arrangées en une encapsulation (19) formant une sous-pile, les une ou plusieurs sous-piles formant ladite au moins une pile (30).

11. Unité de transport selon l'une quelconque des revendications 7 à 10, dans laquelle la plaque terminale inférieure (16) comprend une palette (26).

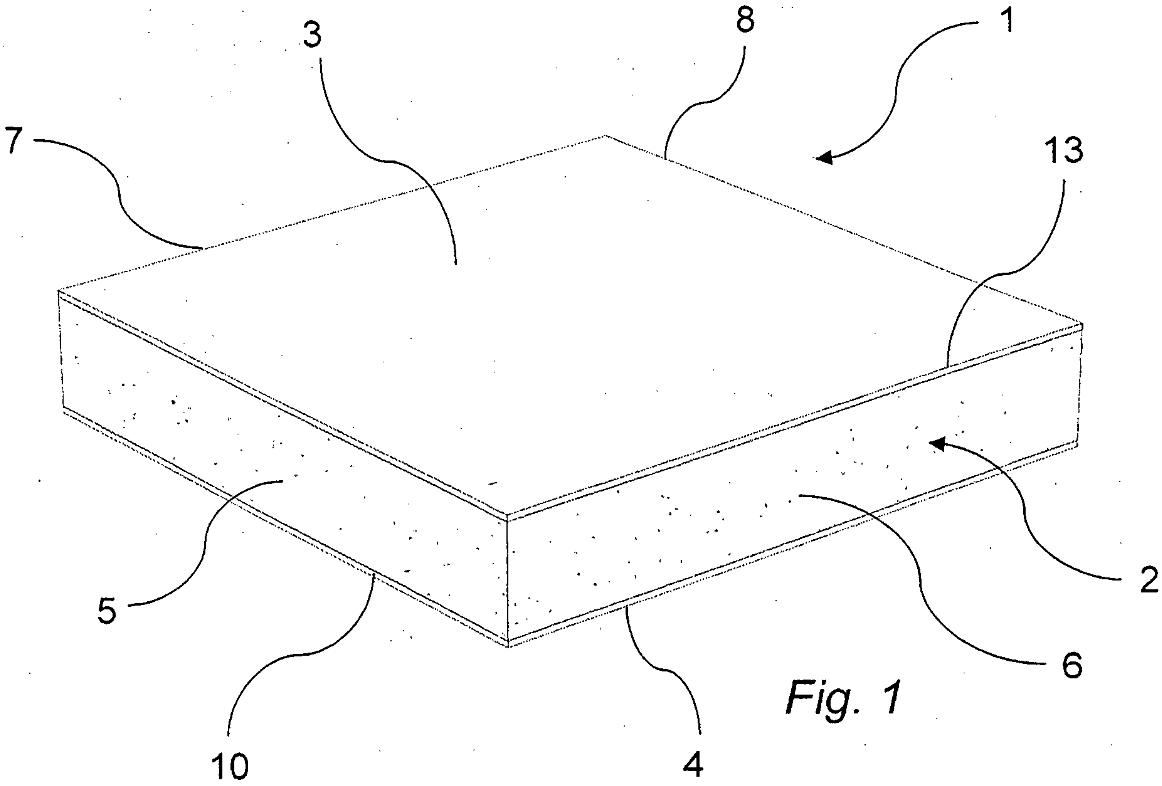

Fig. 1

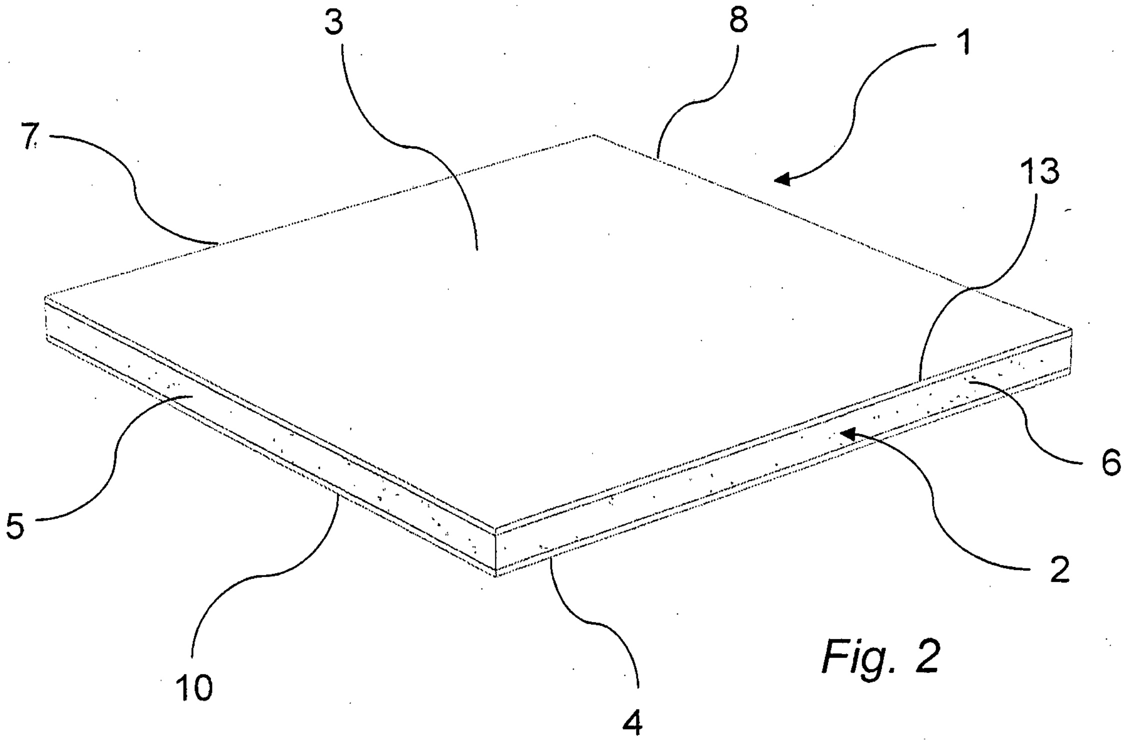

Fig. 2

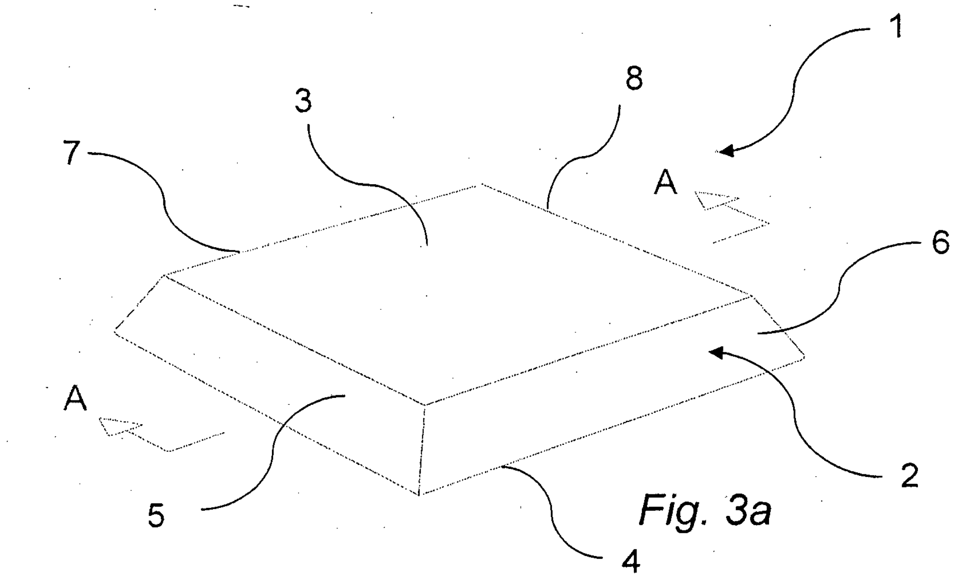

Fig. 3a

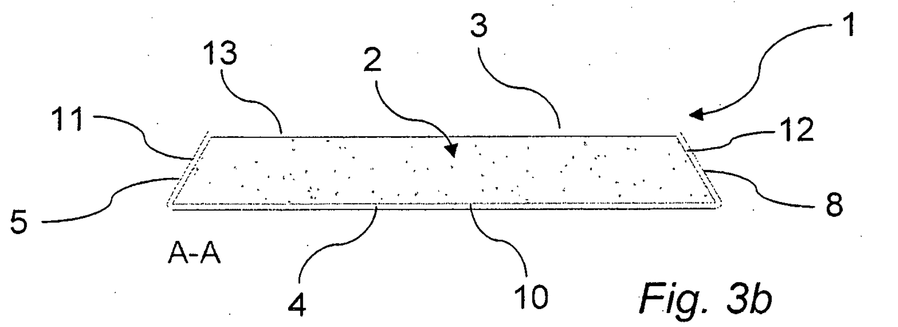

Fig. 3b

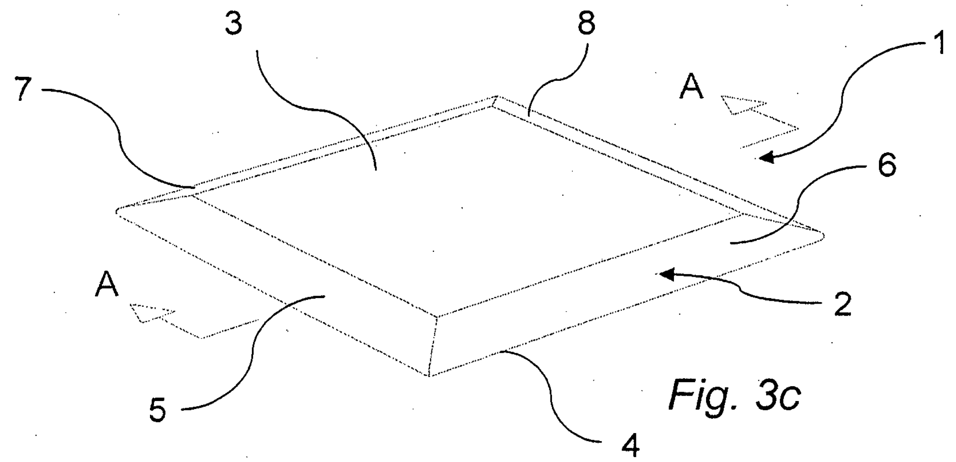

Fig. 3c

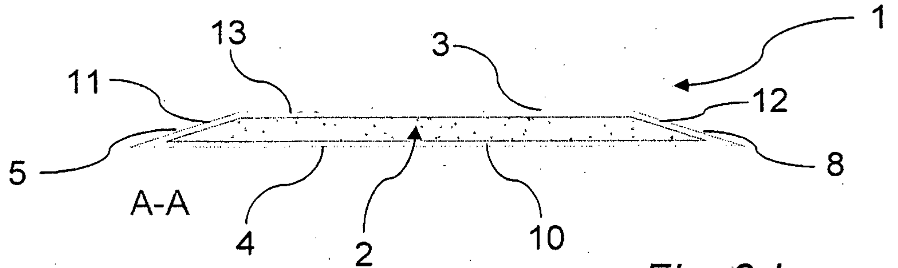

Fig. 3d

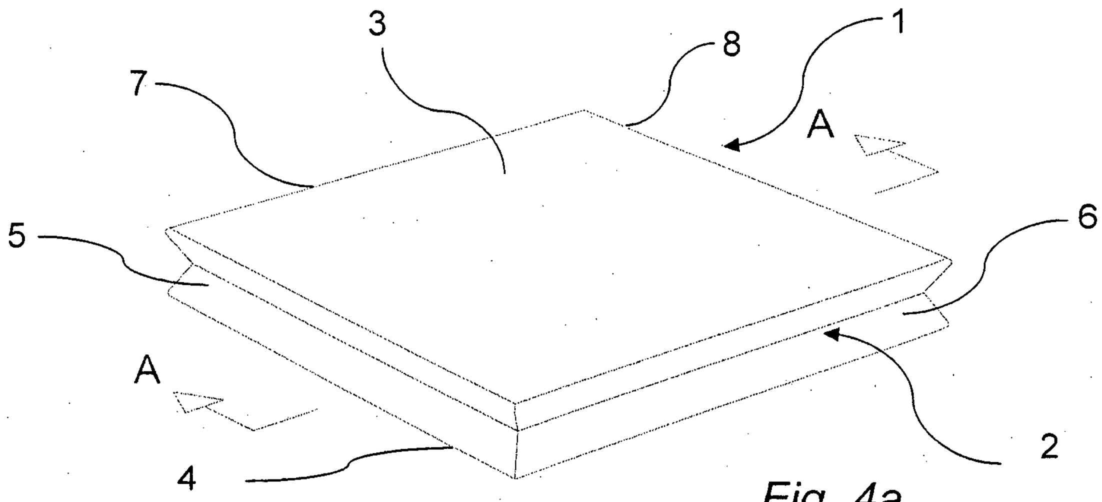

Fig. 4a

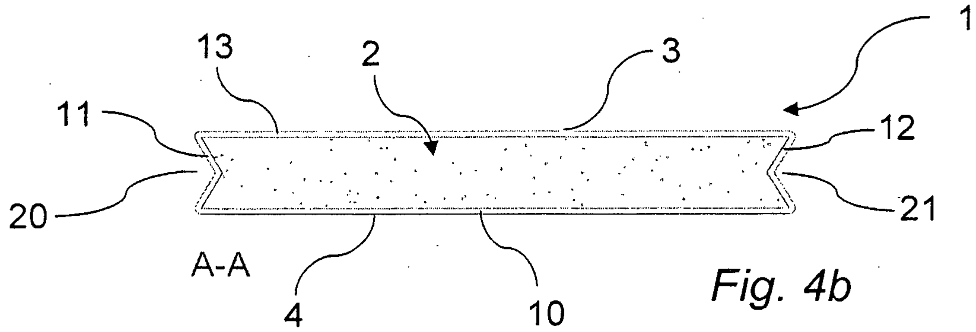

Fig. 4b

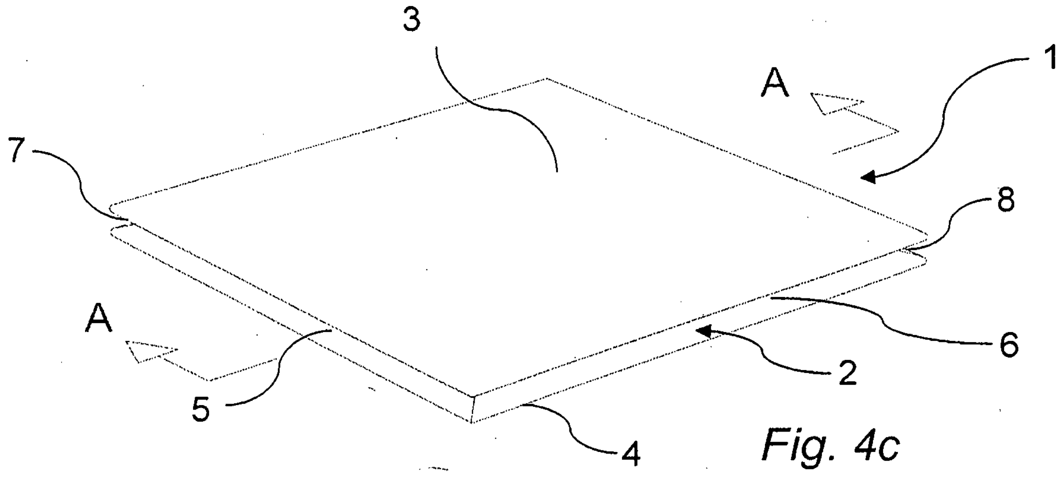

Fig. 4c

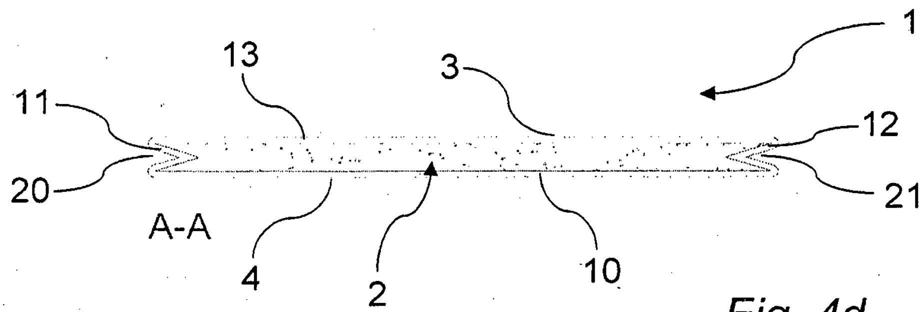

Fig. 4d

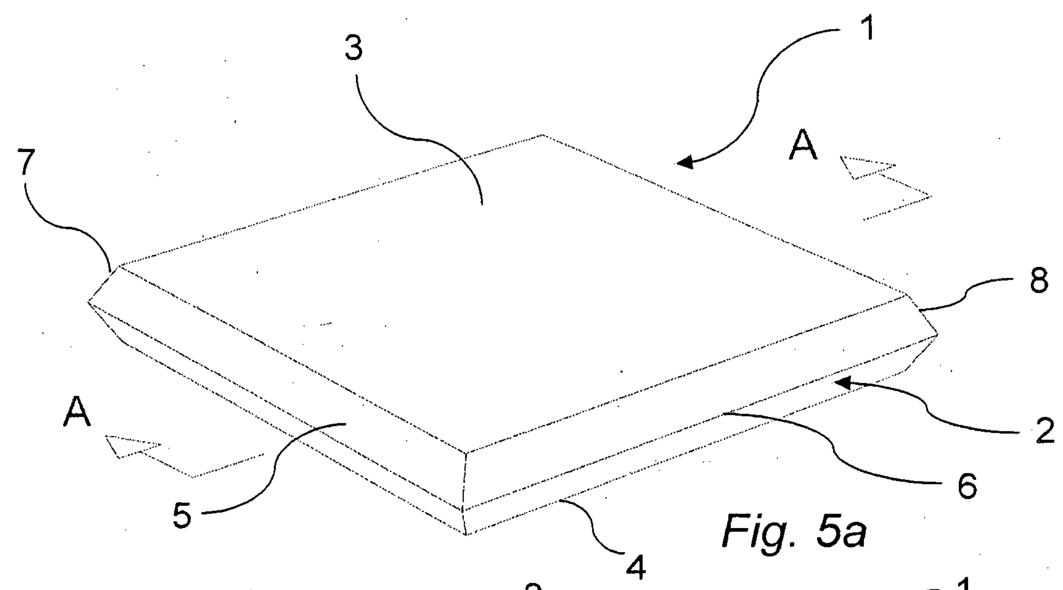

Fig. 5a

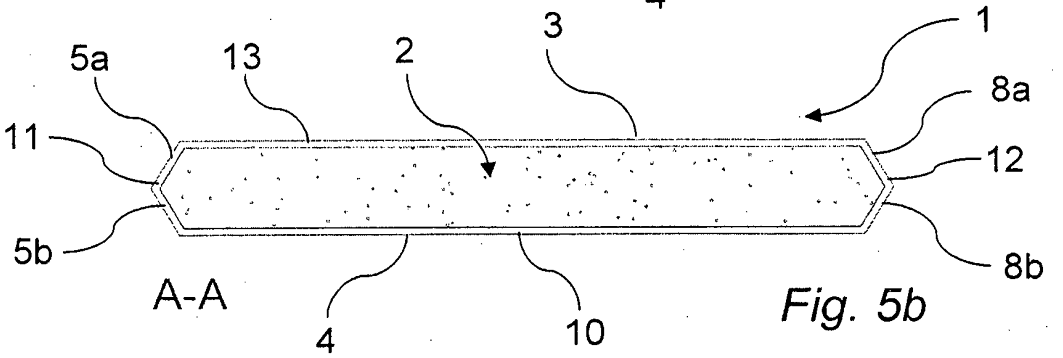

Fig. 5b

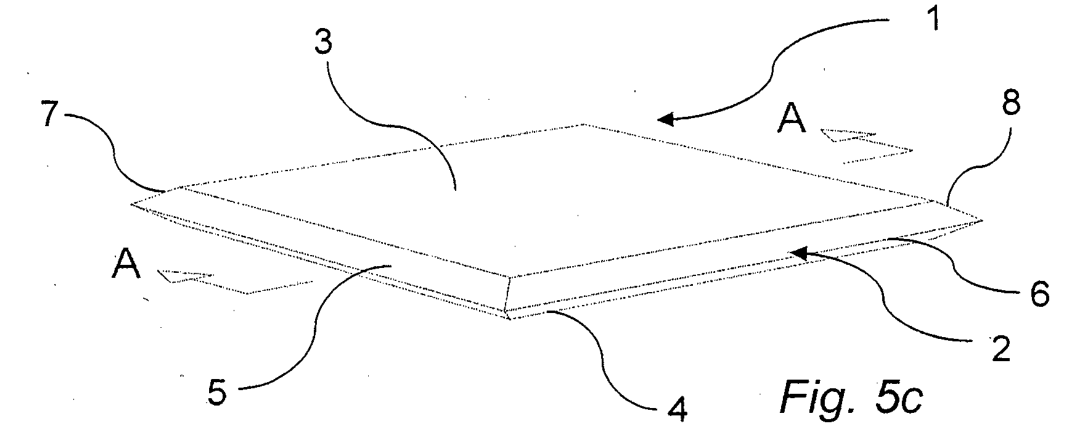

Fig. 5c

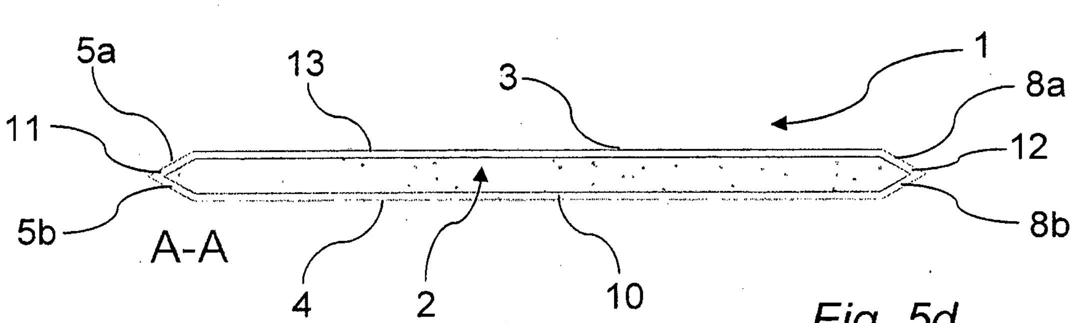

Fig. 5d

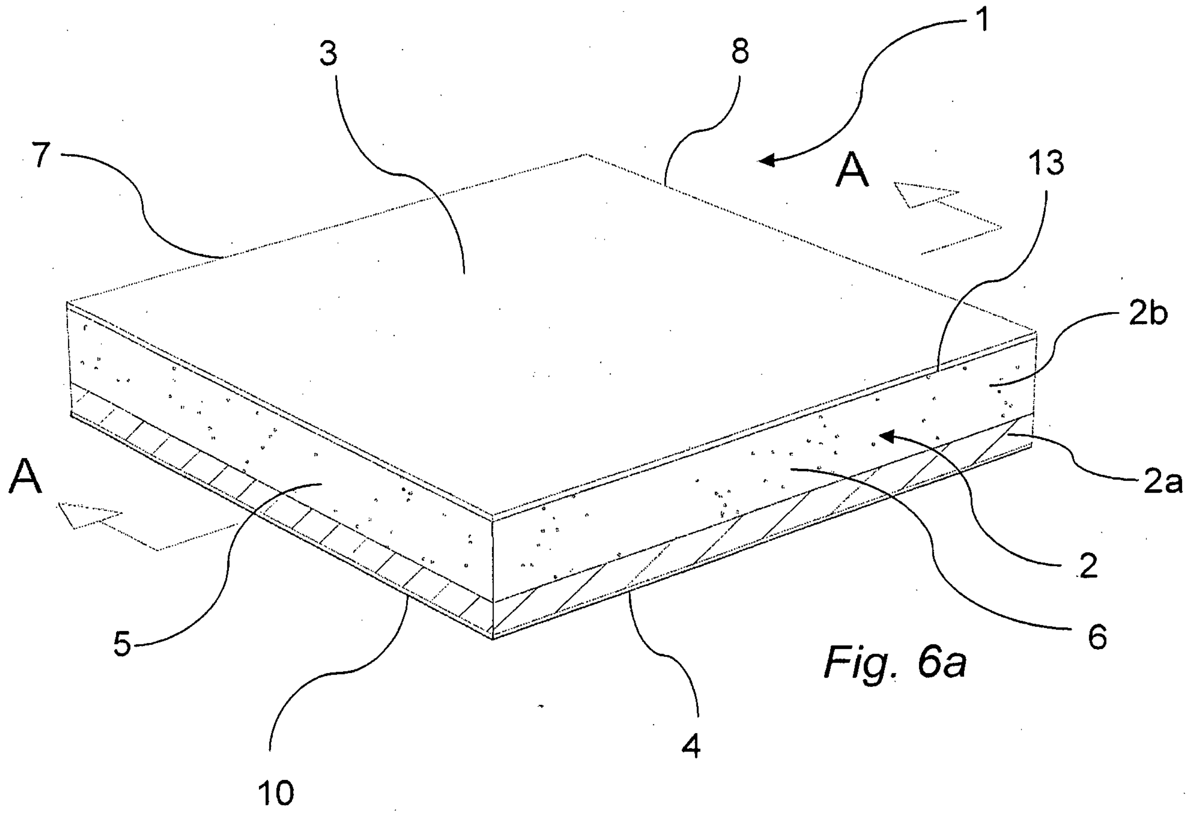

Fig. 6a

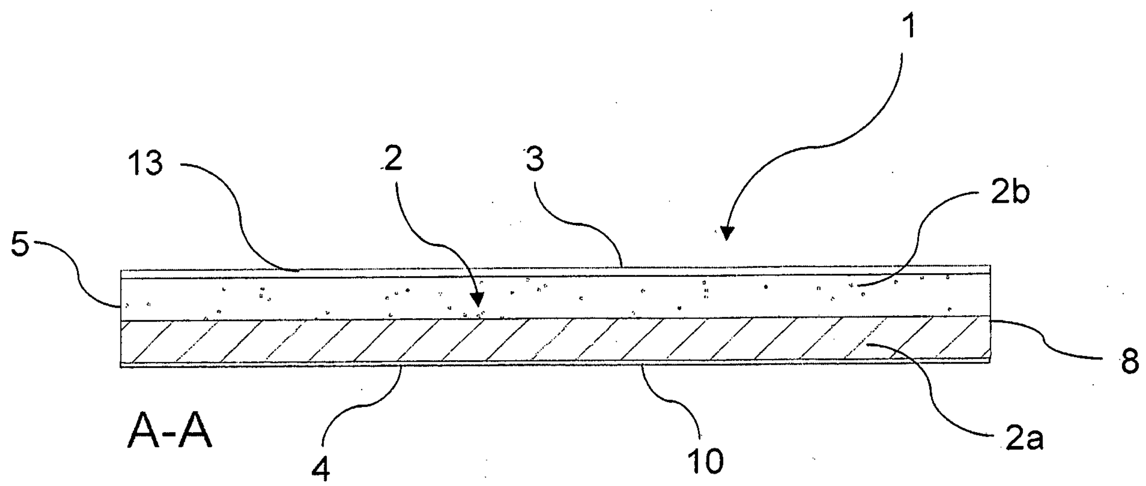

Fig. 6b

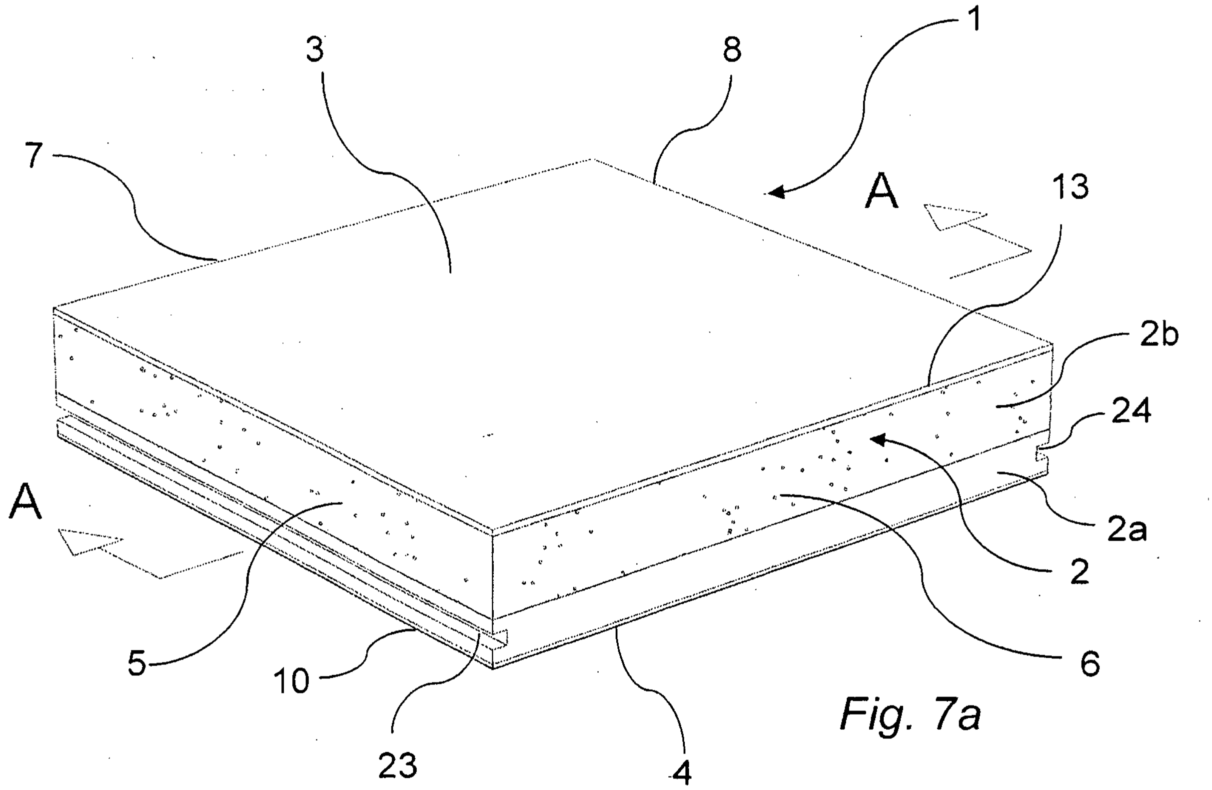

Fig. 7a

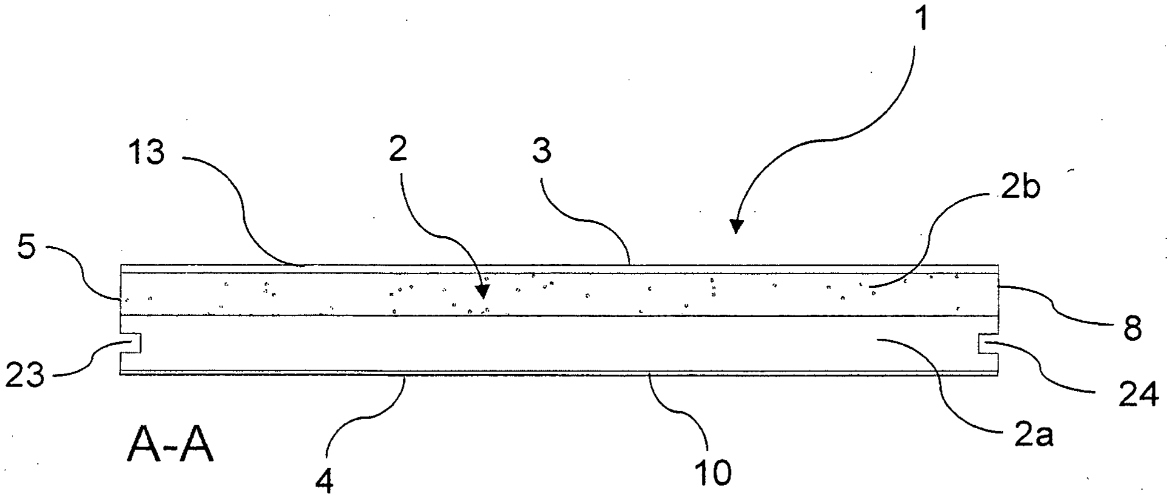

Fig. 7b

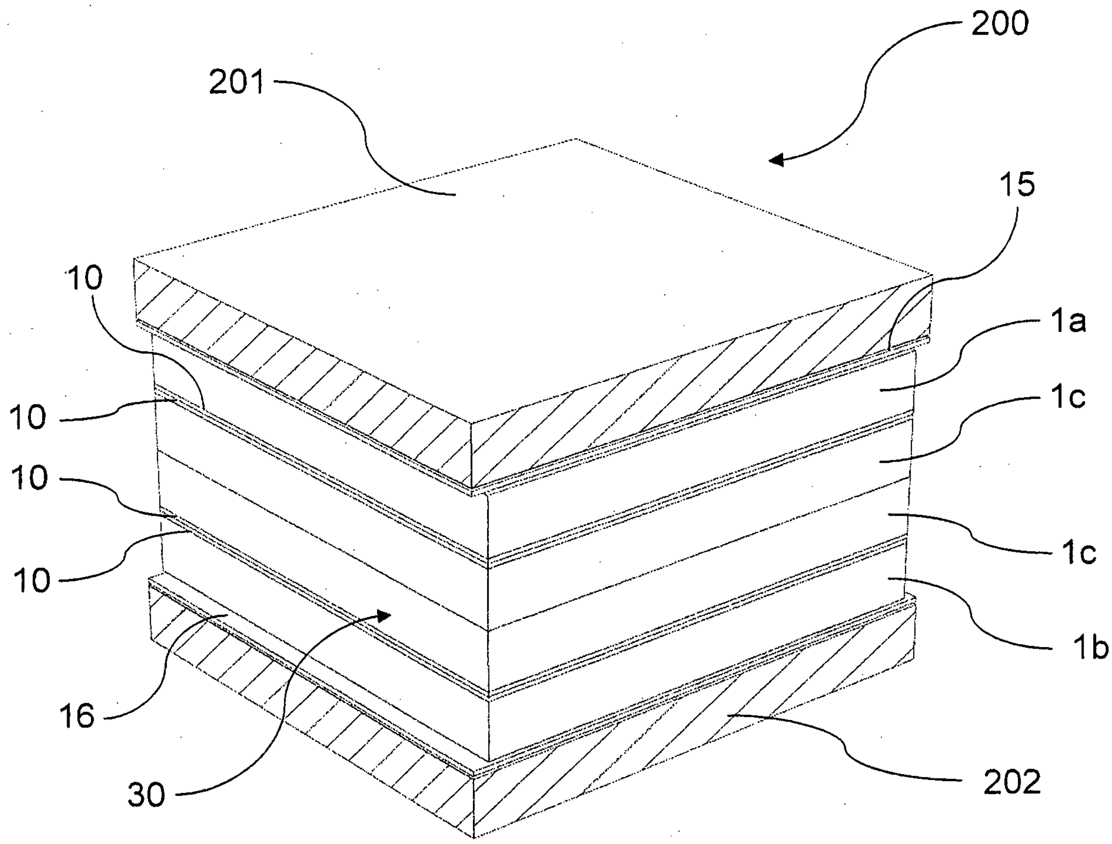
200
201
15
10
1a
10
1c
10
1c
10
1b
16
202
30

Fig. 8a

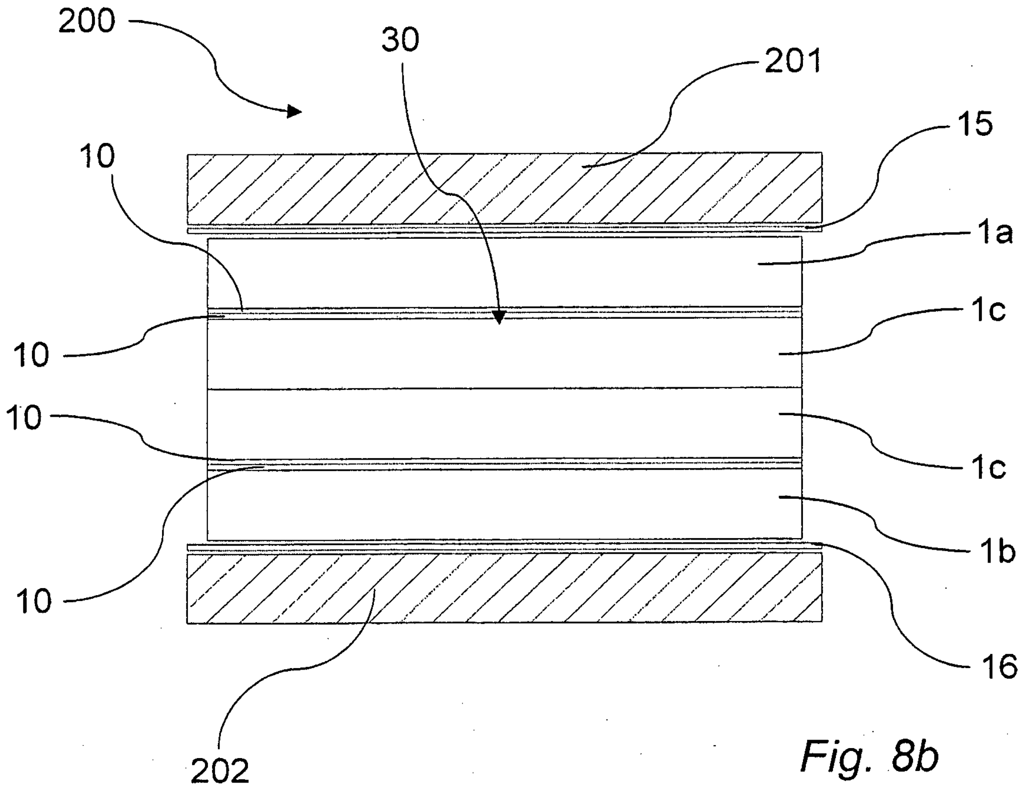
200
30
201
15
10
1a
10
1c
10
1c
1b
10
16
202

Fig. 8b

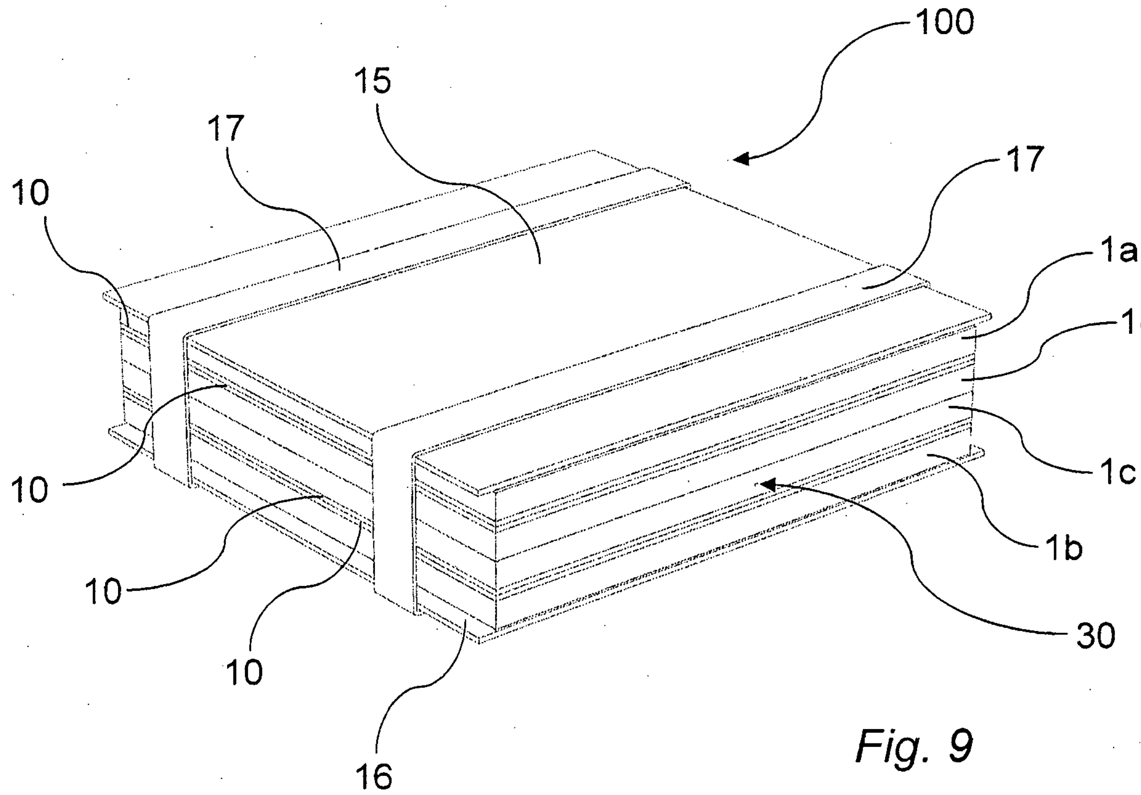
100
15
17
10
17
1a
1c
1c
10
1b
10
10
30
16

Fig. 9

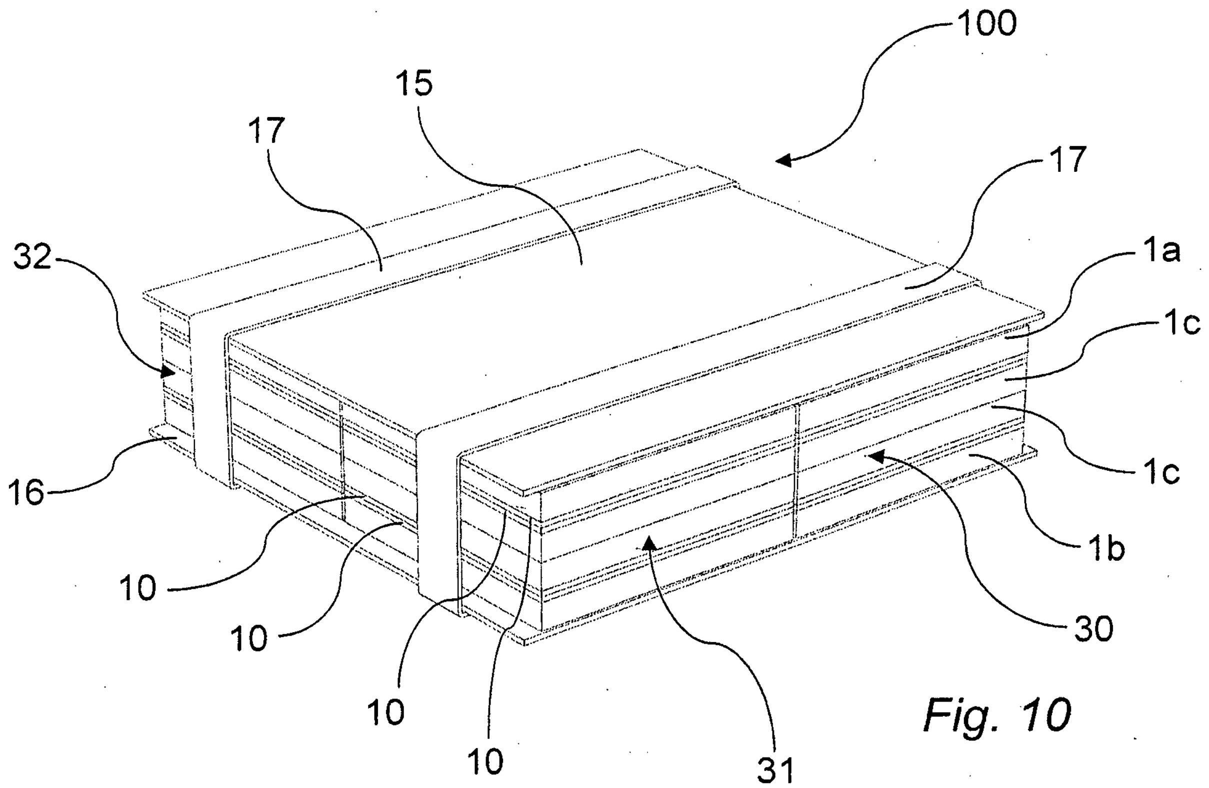
100
15
17
17
32
1a
1c
16
1c
1b
10
10
30
10
10
31

Fig. 10

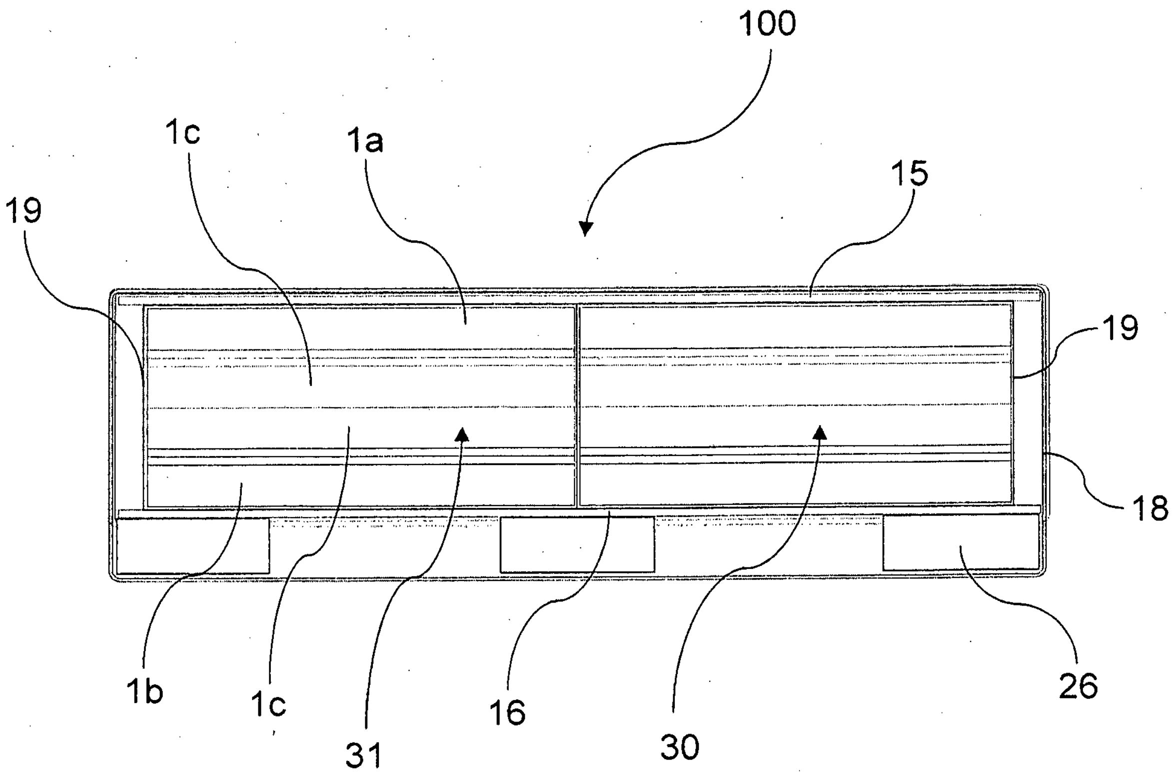

Fig. 11

REFERENCES CITED IN THE DESCRIPTION

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- EP 2027990 A **[0054]**