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(72) Inventors:
• **Persson, Torbjörn**
252 86 Helsingborg (SE)
• **Wilkens, Jan**
263 39 Höganäs (SE)

(74) Representative: **Awapatent AB**
P.O. Box 1066
251 10 Helsingborg (SE)

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

(54) **TRANSPORT UNIT FOR COMPRESSIBLE CEILING TILES**

(57) There is disclosed a transport unit (100) comprising at least one secondary pack (200), wherein the at least one secondary pack comprises at least two primary packs (210), each comprising a plurality of compressible ceiling tiles (212) and a first securing member (250), and a second securing member. The ceiling tiles of each primary pack are compressed along a compression axis (C) to a compressed state and secured in the compressed state by means of the first securing member, wherein the at least two primary packs are stacked along the compression axis. The second securing member is arranged to at least partly enclose the at least two primary packs in order to counteract an expansion of any of the at least two primary packs from the compressed state in the event of failure of the first securing member associated thereto. There is also disclosed a method for providing such a transport unit.

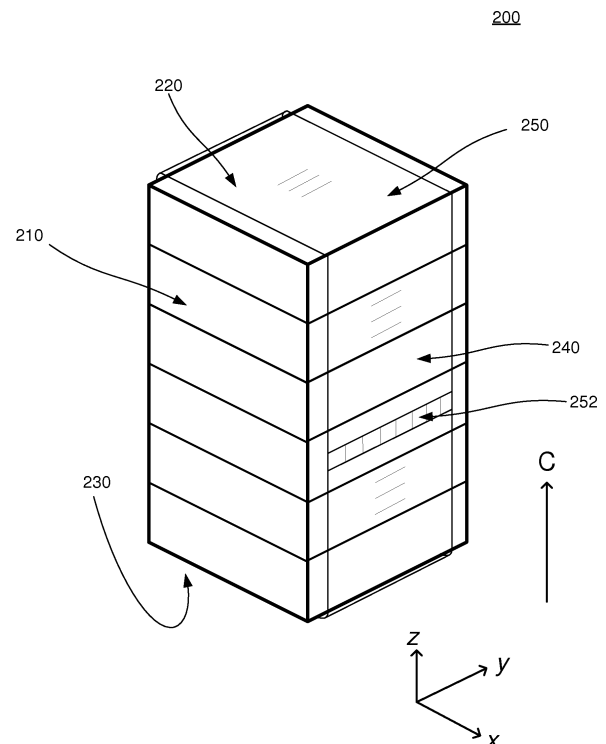


Fig 2

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Description

Field of the invention

[0001] The present inventive concept generally relates to a transport unit. More specifically, the present inventive concept relates to a transport unit for transporting a plurality of compressible ceiling tiles. The present inventive concept also relates to a method for providing such a transport unit.

Background art

[0002] A suspended ceiling typically comprises a supporting structure in the form of a grid of profiles and a plurality of ceiling tiles which in a mounted state are arranged in the grid of profiles. The purpose of having a suspended ceiling may be to absorb sound, to reflect light, to lower the ceiling height, or to hide installations such as ventilation ducts or wiring.

[0003] The ceiling tiles may be of compressible type, e.g. made out of glass wool or rock wool. In fact, most of the space occupied by this type of ceiling tiles consists of air which makes them suitable for compaction. Indeed, the ceiling tiles are typically very voluminous which may pose a problem when transporting them. Compressible ceiling tiles are typically transported in a compressed condition in order to save space and to reduce costs. For example, in the disclosure EP 2 460 738 A1, there is disclosed a transport unit comprising a plurality of ceiling tiles, wherein the ceiling tiles are put in a compressed state and whose sensitive parts are protected from being damaged. By way of example, the compressed state may be accomplished by arranging a strap around a stack of ceiling tiles or by means of a protective film enclosing the stack.

[0004] However, there may be scenarios when the transport unit becomes fractured. For example, the fracture may arise during transportation or during handling of the transport unit. In this case, the ceiling tiles may be brought out of their compressed states and may consequently exert a large expansion force in the process. This may constitute a danger for a person handling the transport unit. Additionally, it may cause the transport unit to get jammed which may result in a troublesome further handling of the transport unit.

Summary of the invention

[0005] In view of the above, it is therefore an object of the present inventive concept to provide a safer transport unit for transporting ceiling tiles.

[0006] It is a further object of the present invention to provide a method for providing such a transport unit.

[0007] According to a first aspect of the invention, there is provided a transport unit comprising at least one secondary pack. The at least one secondary pack comprises at least two primary packs, each comprising a plurality

of compressible ceiling tiles and a first securing member, and a second securing member. The ceiling tiles of each primary pack are compressed along a compression axis to a compressed state and secured in the compressed state by means of the first securing member, and the at least two primary packs are stacked along the compression axis. Moreover, the second securing means is arranged to at least partly enclose the at least two primary packs in order to counteract an expansion of any of the at least two primary packs from the compressed state in the event of failure of the first securing member associated thereto.

[0008] Since the ceiling tiles in the primary packs are compressed, there is a risk of a outward expansion of the primary packs along the compression axis in case a first securing member of a primary pack would fail. This expansion may constitute an unsafe working environment for a person handling the transport unit, e.g. when the transport unit is loaded or when opening the transport unit for accessing the ceiling tiles. In accordance with the inventive concept, the second securing means may counteract such a rapid outward expansion, whereby an outward force from the expanding primary pack may be suppressed.

[0009] In view of the above, a safer transport unit is thereby provided.

[0010] Another advantage of the present inventive concept is that, by being compressed, the ceiling tiles may occupy a smaller volume as compared to a volume of the ceiling tiles in an uncompressed state. In particular, this may be accomplished without compromising safety when handling the transport unit. Thereby, for a given volume of space, a larger number of ceiling tiles may be transported and/or stored in that volume of space. Additionally, less packing material may be needed for transporting the ceiling tiles, whereby the transporting costs may be reduced.

[0011] The inventive transport unit is adapted to be transported between different locations. The transport unit may be transported in a cargo space in a transport vehicle, such as a lorry, a cargo ship, a cargo transport plane, or a freight train. Several inventive transport units may be placed in the cargo space. Optionally, the different transport units may be interlocked by means of well-known techniques. Alternatively, or additionally, the transport unit may be used for storing the ceiling tiles for a period of time, e.g. in a warehouse.

[0012] A shape of the primary pack may correspond to a shape of the ceiling tiles. The primary pack may be shaped as a parallelepiped. In particular, the primary pack may be shaped as a rectangular parallelepiped. Alternatively, however, the primary pack may assume other shapes, such as a cylinder, etc. Moreover, the primary pack may comprise an upper portion, a lower portion, and four side-edge portions. The primary pack may comprise a top ceiling tile, a bottom ceiling tile, and at least one intermediate ceiling tile.

[0013] In non-limiting examples, there may be 4, 6, 8

or 10 ceiling tiles comprised in a primary pack.

[0014] Each ceiling tile may comprise a front surface, a back surface, as well as side edges. The front surface and back surface may be parallel. Also, the shape of the back surface may correspond to a shape of the front surface. In a non-limiting example, the ceiling tile comprises a rectangular front surface. It is understood that other shapes of the front surfaces, such as squares, triangles etc., are equally conceivable. According to one alternative, the front surface is planar. According to another alternative, the front surface is curved.

[0015] Moreover, the ceiling tiles may be acoustical ceiling tiles which are adapted to absorb sound or they may be reflective ceiling tiles which are adapted to reflect sound. The ceiling tile may comprise fibre material. The fibre material may be mineral wool such as rock wool or, especially, glass wool.

[0016] Preferably, each ceiling tile comprised in the primary pack is compressible. The ceiling tile is preferably compressible at least in a thickness direction of the ceiling tile. Preferably, the ceiling tile admits elastic deformation whereby the ceiling tile assumes an original shape after having been in a compressed state.

[0017] In a non-limiting example the ceiling tiles in a primary pack are of a similar type, e.g. having the same shape, material, weight, etc.

[0018] A shape of the secondary pack may correspond to the shape of the primary pack. In particular, the secondary pack may be shaped as the primary pack. The secondary pack may be shaped as a parallelepiped. In particular, the secondary pack may be shaped as a rectangular parallelepiped. Alternatively, however, the secondary pack may assume other shapes, such as a cylinder, etc. Moreover, the secondary pack may comprise a top portion, a bottom portion, and four side-edge surfaces.

[0019] A secondary pack may comprise a top primary pack, a bottom primary pack and at least one intermediary primary pack. The intermediary primary packs may be arranged between the top and bottom primary packs.

[0020] Furthermore, the secondary packs in the transport unit may be arranged in abutment with each other. Alternatively, the secondary packs in the transport unit may be arranged separated from each other.

[0021] The secondary pack may be a multipack comprising primary packs in the form of single packs.

[0022] In non-limiting examples, there may be 2, 4, 6, 8 or 10 primary packs comprised in a secondary pack.

[0023] The first securing member may be arranged around the top ceiling tile and the bottom ceiling tile of the primary pack. Optionally, the first securing member may enclose all the ceiling tiles in the primary pack. The first securing member may be arranged to maintain the compressed ceiling tiles in the primary pack in a compressed state. The first securing member may be rigid. Alternatively, the first securing member may be ductile. In a non-limiting example, the first securing member is a plastic film. The plastic film is preferably sufficiently

strong in order to maintain the compressed ceiling tiles in the primary pack in a compressed state. The plastic film material may be plastically deformable. Other first securing members are equally conceivable, such a strap, a cord, a flexible strip, etc. There may be protective coverings arranged on the top and the bottom ceiling tiles in order to reduce the risk of damaging the ceiling tiles when arranging the first securing member around them.

[0024] The second securing member is arranged to counteract an expansion of the primary packs. According to one example, the second securing member is attached to at least two portions of the primary packs for forming an elongated securing member. For example, the second securing member may be a strip which is glued to an upper and a lower portion of the primary pack and stretched in between. According to another example, the second securing member is completely enclosing the primary packs. For example, the second securing member may be a sheet, such as a plastic, which encloses the primary packs.

[0025] The second securing member may be ductile. Moreover, the second securing member may be flexible. Alternatively, the second securing member may be rigid.

[0026] The second securing member may be a plastic film material. The plastic film material may be plastically deformable.

[0027] There may be protective casings arranged on the top and the bottom primary packs in order to reduce the risk of damaging the primary packs when arranging the second securing member around them.

[0028] The compression axis of a ceiling tile may be normal to the front surface of the ceiling tile. Alternatively, or additionally, the compression axis of a ceiling tile may be normal to the back surface of the ceiling tile. Thereby, the ceiling tile may be compressed in a thickness direction of the ceiling tile. Other compression axes are equally conceivable. In particular, the compression axis may form a non-zero angle with the normal to the front or back surface of the ceiling tile. For example, when the ceiling tiles have varying thicknesses, several ceiling tiles may be stacked together in order to form ceiling tile assemblies in the form of rectangular parallelepipeds. In this case, the compression axis may be normal to an outer surface of a rectangular parallelepiped formed by the stack of ceiling tiles. When the ceiling tiles are tapered ceiling tiles, they may be stacked in pairs in order to form ceiling tile assemblies in the form of rectangular parallelepipeds. In particular, a thick portion of a first tapered ceiling tile may be arranged in abutment with a narrow portion of a second tapered ceiling tile.

[0029] The compression axis may be parallel with a longitudinal direction of a primary pack comprised in an associated secondary pack. Alternatively, the compression axis may be parallel with a longitudinal direction of the associated secondary pack.

[0030] The term "stacked along the compression axis" is to be construed as being arranged in a direction substantially parallel or anti-parallel with the compression

axis.

[0031] Before compressing the ceiling tiles, the ceiling tiles may be associated with original parameters, such as original shapes, original thicknesses, original weights, etc. Here and in the following, this state is referred to as an original state of the ceiling tiles. The original state of the ceiling tiles may be a state of the ceiling tiles after they have been manufactured. An uncompressed state may be a state of the ceiling tiles before or after the ceiling tiles have been compressed. In particular, an uncompressed state may be an original state.

[0032] By a compressed state of the ceiling tiles is here meant a state in which the ceiling tiles in a primary pack are compressed along the compression axis. The term "compressed along the compression axis" is to be construed as being compressed in a direction substantially parallel or anti-parallel with the compression axis. The ceiling tiles may thereby obtain a thickness which is smaller than the thickness of the ceiling tiles in the original state. Preferably, the ceiling tiles may assume a shape which corresponds to the original shape after the ceiling tiles have been in the compressed state, and an uncompressed state once again is assumed. In the compressed state, the ceiling tiles may be secured over time by means of the first securing member.

[0033] In a first example, the entire front and back surfaces of the ceiling tiles are compressed, thereby reducing the original thicknesses of the ceiling tiles. The compression may be a uniform compression of the ceiling tiles by which is meant a similar amount of compression throughout the front and back surfaces of the ceiling tiles. For example, the ceiling tiles may be compressed by placing a face of the top ceiling tile and a face of the bottom ceiling tile between two parallel planar contact surfaces and by moving the planar contact surfaces towards each other and thereby compressing the ceiling tiles. The faces may be a front surface or a back surface of the ceiling tile. In a second example, only portions of the front and back surfaces of the ceiling tiles are compressed. For example, only centre portions of the ceiling tiles may be compressed.

[0034] By removing the first securing member the ceiling tiles may assume an uncompressed state. In particular, when the ceiling tiles are elastically deformable, the uncompressed state may coincide with the original state, at least after a minimum period of time has elapsed.

[0035] In a non-limiting example, each ceiling tile has a density of 30 kg/m³ in an uncompressed state and in a compressed state the ceiling tile may be compressed to 1/3 of a thickness of the ceiling tile in the uncompressed state.

[0036] The second securing member is arranged to counteract an expansion of any of the primary packs from the compressed state in the event of failure of the first securing member of a primary pack. By way of example, the first securing member may fail in the case of sabotage or in the case the transport unit is being transported in a rough environment, such as a strongly vibrating environ-

ment or an environment having a high temperature. For example, when the first securing member is a plastic film it may be sabotaged by cutting it with a knife. It is understood that the term "failure" also encompasses situations in which the first securing member is released intentionally, for instance in connection with opening of the transport unit.

[0037] In case one of the first securing members fails, the compressed ceiling tiles in the associated primary pack may expand. In particular, the primary pack may expand along the compression axis. By having the second securing member arranged to at least partly enclose the primary packs this expansion along the compression axis may be counteracted. Thereby, a safer transport unit may be provided.

[0038] With respect to an axis being "coplanar" with a plane is here meant that the axis may be parallel transported to be extended along the plane. In other words, the axis is perpendicular to a normal of the plane. It is noted that the axis may be rotated by any angle between 0° and 360° and still be extended along the plane.

[0039] According to one embodiment, the second securing member is a non-stretchable plastic film material. By non-stretchable is here meant that the plastic film material is resistant towards being stretched by an expansion of one of the primary packs comprised in the secondary pack. The non-stretchable plastic film material may be chosen so that a presupposed expansion becomes less than a critical expansion. In a non-limiting example, the critical expansion may be 100 millimetres. The non-stretchable plastic film material may be a plastic collar. A thickness of the plastic film material may be less than 1 millimetre.

[0040] The plastic film material may be non-stretchable at least along a first direction of the material. The plastic film material may be non-stretchable along a first direction of the material and stretchable along a second direction of the material. The second direction may be perpendicular to the first direction.

[0041] The non-stretchable plastic film material may have a high tensile modulus of elasticity such that it becomes rigid. The elongation before breakage of the non-stretchable plastic film material may be less than 10 %.

[0042] According to one embodiment, the plastic film material has a tensile strength in the range of 10 MPa (N/mm²) and 50 MPa.

[0043] According to one embodiment, the compression axes of each of the at least one secondary pack are mutually parallel. The secondary packs comprised in the transport unit may thereby be oriented in the same direction. A side-edge surface of a first secondary pack may be arranged in abutment with a side-edge surface of a second secondary pack. Alternatively, a top portion of a first secondary pack may be arranged in abutment with a bottom portion of a second secondary pack.

[0044] According to one embodiment, the at least two primary packs are bonded by means of an adhesive. Thereby, the primary packs in a secondary pack may be

bonded to each other. An advantage of the present embodiment is that the handling of the primary packs is improved. In particular, the primary packs may be prevented from falling off the stack of constituent primary packs when the secondary securing member is removed. The adhesive preferably has a low adhesive capacity such that two primary packs, which thereby are softly bonded to each other by means of the adhesive, may easily be separated from each other without damaging any of the two primary packs. Alternatively, however, the adhesive capacity of the adhesive may be high so that a tool, e.g. a knife or pliers, may be needed for separating the primary packs from each other.

[0045] According to one embodiment, the transport unit further comprises a load carrier for supporting the at least one secondary pack, wherein the at least one secondary pack is arranged on a planar load surface of the load carrier. The load carrier may be a pallet. The load carrier may comprise wood, metal, plastic, etc. In particular, the load carrier may be a EUR-pallet. Preferably, the load carrier is designed to support a plurality of secondary packs without deforming to any appreciable extent. The load surface may have a rectangular shape, but other shapes are equally conceivable, such as a square, a circle, a triangle, etc. The surface area of a supporting surface of the secondary pack, which is adapted to engage with the load surface, is preferably smaller than an area of the load surface. A supporting surface of a secondary pack may be a top portion, a bottom portion, or a side-edge surface of the secondary pack.

[0046] There may be a bottom protection sheet arranged between the planar load surface of the load carrier and the lowermost secondary packs which are closest to the load carrier for protecting the bottom portion of the lowermost secondary packs. Moreover, there may be a top protection sheet arranged on the secondary packs for protecting the uppermost secondary packs which are arranged furthest away from of the load carrier, at the top.

[0047] The protection sheets may be fabricated out of plastic, paper, etc. In one example, the protection sheets are stretchable. In another example, the protection sheets are non-stretchable.

[0048] According to one embodiment, the compression axes of each of the at least one secondary pack are coplanar with the planar load surface. A supporting side-edge surface of a secondary pack may thereby be placed on the load surface. Supporting side-edge surfaces of additional secondary packs may be placed on top of this secondary pack. For instance, an supporting side-edge surface of a first secondary pack may engage with a receiving side-edge surface of a second secondary pack. In one example, the compression axes of each of the secondary packs are mutually parallel. In another example, at least two compression axes of the secondary packs are non-parallel. An advantage of the present embodiment is that in the event of failure of a first securing member, the expansion of the associated secondary pack from the compressed state toward an uncom-

pressed state is directed in a direction along the planar load surface. This may result in a safer handling of ceiling tiles comprised in the transport unit.

[0049] According to an alternative embodiment, the compression axis forms an angle with the load surface of the load carrier. The angle may be comprised in the interval 1-45 degrees, more preferably in the interval 1-25 degrees, and most preferably in the interval 1-10 degrees. By way of example, this embodiment may be preferred when the ceiling tiles are tapering so that the back surface and the front surface of the ceiling tiles are non-parallel.

[0050] According to one embodiment, the at least one secondary pack are arranged on top of each other in a direction which is normal to the planar load surface. By means of this embodiment, several secondary packs may be arranged on the same load carrier. The compression axes may be perpendicular to the normal to the planar load surface. Alternatively, the compression axes may be parallel to the normal to the planar load surface. More generally, the compression axes may form an angle with respect to the normal to the planar load surface.

[0051] In one example, the compression axes of each of the secondary packs which are arranged on top of each other are mutually parallel. In another example, at least two compression axes of the secondary packs which are arranged on top of each other are non-parallel. In yet another example, the compression axes of each pair of adjacent secondary packs which are arranged on top of each other are perpendicular.

[0052] According to one embodiment, a length of the at least one secondary pack is smaller than an extension of the planar load surface for formation of an expansion zone. An advantage of the present embodiment is that when one of the first securing members fails, the associated secondary pack may expand into the expansion zone only, whereby the risk of wedging or jamming the secondary pack into a neighbouring area, e.g. a neighbouring transport unit or a wall, may be reduced.

[0053] A length of the expansion zone along the compression axis may be adapted to an amount of an expansion length of a secondary pack in case of failure. In one example, the length of the expansion zone is chosen to be larger than the expansion length of the secondary pack in case of failure. In another example, the length of the expansion zone is chosen to be smaller than the expansion length of the secondary pack in case of failure.

[0054] Optionally, there may be a spacer arranged in the expansion zone. The spacer may prevent the secondary pack from being jammed into an adjacent object or area, such as another secondary pack, a pallet or a wall. Additionally, the spacer may be shock absorber which is arranged to absorb expansion forces from the transport unit in case of failure, e.g. when a primary pack is rapidly expanding after a fracture in the primary pack. The spacer may be a chunk of wood, expanded polystyrene, etc.

[0055] According to one embodiment, the at least one

secondary pack is fastened to the load carrier. The secondary packs may be fastened by means of stretch wrap around the secondary packs as well as the load carrier. Alternatively, shrink wrap or some other fastening means well-known to a person skilled in the art may be used.

[0056] According to one embodiment, each primary pack further comprises a plastic wrapping arrangement which sealingly encloses the plurality of compressible ceiling tiles, the compressed state being obtained by means of a negative pressure within the plastic wrapping arrangement. The plastic wrapping arrangement may be a plastic foil. The sealing of the plastic wrapping arrangement may be accomplished by means of gluing, welding, mending with tape, etc. A volume of the plastic wrapping arrangement may be smaller than a volume of the ceiling tiles in an uncompressed state. For example, the plastic wrapping arrangement may be arranged in a sealing manner around the compressed ceiling tiles, and thereafter the ceiling tiles may expand towards an uncompressed state. However, a full expansion to an uncompressed state may be prevented by the negative pressure within the plastic wrapping arrangement once the ceiling tiles have expanded to a sufficient extent.

[0057] A shape of the ceiling tiles in a primary pack, as given in their uncompressed state, may correspond to a shape of the primary pack comprising the plastic wrapping arrangement wherein the ceiling tiles are compressed. When the ceiling tiles in a primary pack are shaped as right parallelepipeds in their uncompressed states, the primary pack, comprising the plastic wrapping arrangement and the compressed ceiling tiles, may assume a shape in the form of a right parallelepiped. In particular, the shape of corners of the primary pack may remain undeformed.

[0058] According to one embodiment, the plurality of compressible ceiling tiles are compressed by means of a frame compression device, wherein the frame compression device comprises an upper and a lower frame, between which the plurality of ceiling tiles are arranged, and a strap arrangement arranged around the upper and lower frames. By means of the strap arrangement, an expansion of the ceiling tiles towards an uncompressed state may be counteracted. An advantage of having a frame compression device is that a uniform compression may be obtained. Moreover, the ceiling tiles may be protected from being damaged by the strap arrangement.

[0059] The ceiling tiles may be provided with front surface layers on front surfaces of the ceiling tiles. The front surface layers may comprise at least one of glass tissue and woven glass fibre. The front surface layers may comprise a layer of paint. Moreover, the front surface layers may be air permeable. According to one embodiment, the plurality of compressible ceiling tiles comprises a top ceiling tile, a bottom ceiling tile, and at least one intermediate ceiling tile, wherein a front surface layer of each intermediate ceiling tile is facing a front surface layer of an adjacent ceiling tile. Thereby, the risk of damaging the surface layers may be reduced.

[0060] Optionally, also back surfaces and/or edge surfaces of the ceiling tiles may be provided with surface layers. These surface layers may comprise at least one of glass tissue and woven glass fibre. The surface layers may comprise a layer of paint and may be air permeable.

[0061] According to a second aspect of the invention, there is provided a method for providing a transport unit. The method comprises: providing at least one secondary pack, wherein the at least one secondary pack comprises at least two primary packs, each comprising a plurality of compressible ceiling tiles and a first securing member, and a second securing member, the ceiling tiles of each primary pack being compressed along a compression axis to a compressed state and secured in the compressed state by means of the first securing member, wherein the at least two primary packs are stacked along the compression axis, and the second securing member being arranged to at least partly enclose the at least two primary packs in order to counteract an expansion of any of the at least two primary packs from the compressed state in the event of failure of the first securing member associated thereto, providing a load carrier for supporting the at least one secondary pack, and arranging the at least one secondary pack on a planar load surface of the load carrier.

[0062] The details and advantages of the second aspect of the invention are largely analogous to those of the first aspect of the invention, wherein reference is made to the above. In addition, it is noted that the order of the acts of the inventive method may be varied.

[0063] According to one embodiment, the compression axes of each of the at least one secondary pack are mutually parallel, and coplanar with the planar load surface.

[0064] 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, step, etc]" are to be interpreted openly as referring to at least one instance of said element, device, component, means, step, etc., unless explicitly stated otherwise.

Brief Description of the Drawings

[0065] 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 preferred 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 schematically illustrates a perspective view of an embodiment of the inventive transport unit comprising four secondary packs and a load carrier.

Fig. 2 is a schematic illustration of a secondary pack comprised in the transport unit in Fig. 1.

Fig. 3 is a schematic illustration of a primary pack comprised in the secondary pack in Fig. 2.

Fig. 4 is a side view of the transport unit in Fig. 1 taken along the line A-A.

Fig. 5 is a block diagram of a method for providing a secondary pack according to an embodiment of the inventive concept.

Fig. 6 is a block diagram of a method for providing a transport unit according to an embodiment of the inventive concept.

Description of Embodiments

[0066] Next, the inventive concept will be described with reference to preferred embodiments.

[0067] Fig. 1 is a schematic illustration of a perspective view of an embodiment of an inventive transport unit 100. The transport unit 100 comprises eight secondary packs 200 and a load carrier 300 which is a wooden pallet, such as a EUR-pallet with dimensions 1200 x 800 x 144 millimetres. The eight secondary packs 200 comprise four lower secondary packs 202 and four upper secondary packs 204. The upper secondary packs 204 are arranged on top of the lower secondary packs 202. The secondary packs 200 are kept in position inter alia by gravitational forces acting in a normal direction to a planar load surface 302 of the load carrier 300, i.e. downwards in Fig. 1.

[0068] The four lower secondary packs 202 are arranged on a bottom protection sheet 310 which is arranged on the planar load surface 302 of the load carrier 300. Moreover, there is a top protection sheet 320 arranged on the four upper secondary packs 200. The top protection sheet 320 comprises folded parts along its side edges which are arranged around edge portions of the upper secondary packs 204.

[0069] The secondary packs 200 are fastened to the load carrier 300 by means of stretch wrap 330 which is arranged around the secondary packs 200 as well as around the load carrier 300 and the protection sheets 310, 320. For clarity, the extension of the stretch wrap 330 in Fig. 1 is indicated by three short parallel lines. In particular, the stretch wrap 330 is arranged around the secondary packs 200 between the top protection sheet 320 and a longitudinal side edge 303 of the load carrier 300 and between the top protection sheet 320 and a transverse side edge 304 of the load carrier 300.

[0070] One of the secondary packs 200 in the transport unit 100 in Fig. 1 is schematically illustrated in Fig. 2. It is understood that all of the eight secondary packs 200 in the transport unit 100 have a similar structure and shape. The secondary pack 200 is shaped as a right parallelepiped.

[0071] The secondary pack 200 comprises six primary packs 210. It is understood that, according to alternative embodiments, any number of primary packs 210 may be comprised in the secondary pack 200. The primary packs 210 are stacked and compressed along a compression

axis C. Moreover, the secondary pack 200 comprises a top portion 220, a bottom portion 230 and four side-edge portions 240. In Fig. 1, a respective side-edge portion 240 of the four lower secondary packs 202 is arranged on the planar load surface 302 of the load carrier 300. The compression axes C of the secondary packs 200 in Fig. 1 are mutually parallel. Moreover, the compression axes C of the secondary packs 200 in Fig. 1 are coplanar with the planar load surface 302 of the load carrier 300.

[0072] According to the present embodiment each of the secondary packs 200 has the dimensions 480 x 400 x 600 millimetres, which in Fig. 1 is not according to scale.

[0073] The secondary pack 200 further comprises a second securing member 250 comprising a non-stretchable plastic film material in the form of a plastic foil. The second securing member 250 encloses the primary packs 210. More specifically, the second securing member 250 encloses the top portion 220, the bottom portion 230 and two side-edge portions 240 of the secondary pack 200. For clarity, the extension of the second securing member 250 in Fig. 2 is indicated by three short parallel lines. According to the present embodiment, the second securing member 250 is glued using an adhesive along an overlap portion 252 to form an endless strip of plastic film material. The adhesive may have such properties that the second securing member may be released by pulling or peeling of a tab of the overlap portion. According to alternative embodiments, the second securing member 250 may be welded, mended with tape, etc.

[0074] It is noted that for the sake of clarity the primary packs 210 and the second securing member 250 are not indicated in Fig. 1.

[0075] Fig. 3 schematically illustrates one of the primary packs 210 comprised in the secondary pack 200. The primary pack 210 comprises rectangular ceiling tiles 212. The ceiling tiles 212 are stacked. For illustrative purposes, the primary pack 210 only comprises four ceiling tiles 212, but clearly, according to alternative embodiments, any number of ceiling tiles may be comprised in the primary pack 210. Hence, according to the present embodiment the transport unit 100 transports a total number of 192 ceiling tiles 212. In Fig. 3, a corner of the primary pack 210 in Fig. 3 is removed for illustrative purposes, showing the ceiling tiles 212 in a compressed state.

[0076] Moreover, the primary pack 210 comprises an upper portion 214, a lower portion 216 and four side-edge portions 218.

[0077] Each primary pack 210 further comprises a first securing member 260 in the form of a sealed plastic wrapping arrangement, in this case a plastic foil, which encloses the ceiling tiles 212. It is understood that the corner of the plastic wrapping arrangement which is to be arranged over the side-edge portions 218 in Fig. 3 has been removed for illustrative purposes only, and that in use the plastic wrapping arrangement is supposed to enclose all outer portions of the stack of ceiling tiles 212. The first securing member 260 in the form of the plastic wrapping arrangement is sealed by means of welding or other

methods which are well-known to a person skilled in the art, such as gluing, mending with tape, etc. According to alternative embodiments, the first securing member may be a strap, a cord, a flexible strip, etc.

[0078] According to the present embodiment, each primary pack 210 has the dimensions 80 x 400 x 600 millimetres.

[0079] The ceiling tiles 212 are compressible and are fabricated out of a compressed fibre material. The compressed fibre material may be mineral wool such as rock wool or, especially, glass wool. According to the present embodiment, each ceiling tile 212 has a uniform thickness. A front surface of the ceiling tile 212 is parallel with a back surface of the ceiling tile 212. The front surface is provided with a front surface layer which is made out of glass tissue or woven glass fibre. The ceiling tiles 212 comprise a top ceiling tile, a bottom ceiling tile, and two intermediate ceiling tiles. The front surface layer of each intermediate ceiling tile 212 is facing the front surface layer of an adjacent ceiling tile 212. Thus, in the present embodiment the front surface layer of a first intermediate ceiling tile 212 is facing the front surface layer of the top ceiling tile 212 and the front surface layer of a second intermediate ceiling tile 212 is facing the front surface layer of the bottom ceiling tile 212.

[0080] According to the present embodiment, each rectangular ceiling tile 212 has the dimensions 25 x 400 x 600 millimetres in an uncompressed state. The thickness of a ceiling tile may be in the range of 15 - 60 mm.

[0081] In the compressed state of the present embodiment, the thickness of the tile is decreased from 25 millimetres to 20 millimetres.

[0082] In another embodiment, the ceiling tile may be compressed to between 1/3 and 1/2 of the thickness of the ceiling tile in the uncompressed state.

[0083] The ceiling tiles may be arranged in a primary pack such that the front surfaces of two adjacent ceiling tiles are facing each other.

[0084] In Figs. 1-3 there are indicated a three-dimensional right-handed coordinate system having axes x, y and z. The coordinate system is associated with a secondary pack 200, the primary packs 210 comprised in the secondary pack 200, and the ceiling tiles 212 comprised in these primary packs 210. The ceiling tiles 212 in the primary pack 210 in Fig. 3 are in a compressed state. More specifically, the ceiling tiles 212 have been compressed along the compression axis C which is parallel to the z axis. The compressed state is obtained by compressing the ceiling tiles 212, by arranging the first securing member 260 (i.e. the plastic wrapping arrangement) which sealingly encloses the ceiling tiles 212, and by means of a negative pressure within the plastic wrapping arrangement. According to the present embodiment, the z axis is parallel to the compression axis C, but it is clear that according to alternative embodiments, other compression axes C may be chosen. Moreover, as shown in Fig. 2, the primary packs 210 are arranged along the z axis which is parallel to the compression axis

C. As shown in Fig. 3, the z axis associated with each secondary pack 200 is coplanar with the planar load surface 302 of the load carrier 300. The secondary packs 200 are stacked on top of each other along the y axis.

[0085] A longitudinal length of the secondary packs 200 along the z axis is smaller than a longitudinal length of the load carrier 300 along the z axis. Thereby, there are formed expansion zones 340 on both sides of the secondary packs 200 in the longitudinal direction. This is made clearer in Fig. 4 which is a side view of the transport unit in Fig. 1 taken along the line A-A. A length of each expansion zone along the z direction is 100 millimetres. Clearly, this length is an exemplification and other lengths are equally conceivable. It is remarked that, as in Fig. 1, the extension of the stretch wrap 330 in Fig. 4 is indicated by three short parallel lines. Analogously to Fig. 1, it is also noted that for keeping the figures uncluttered, the primary packs 210 and the second securing member 250 are not indicated in Fig. 4.

[0086] A maximal expansion of each secondary pack 200 along the z axis in case of a failure of a first securing member 260 associated to a primary pack 210 comprised in the secondary pack 200 is 80 millimetres, which is less than 100 millimetres. Hence, by means of the expansion zone 340 the transport unit 100 is prevented from being jammed into an adjacent transport unit 100 or into a wall next to the transport unit 100. Consequently, the risk for a transport unit 100 to be jammed in a cargo space of for instance a lorry is eliminated or at least substantially reduced.

[0087] As described above, according to the present embodiment, a transverse length of two secondary packs 200 along the x axis is the same as a transverse length of the load carrier 300 along the x axis.

[0088] According to an alternative embodiment, there may be a plurality of layers of secondary packs 200 arranged on the load carrier 300. For example, in the case when the secondary packs 200 has the dimensions 600 x 600 x 700 millimetres, each layer may comprise two secondary packs 200 which may be arranged in an "overturned" manner in abutment with each other on a load carrier in the form of a EUR-pallet which has dimensions 1200 x 800 x 144 millimetres. By "overturned" is here meant that the compression axis C of each of the secondary packs 200 is coplanar with the planar surface of the pallet 300. Thereby, there will be an expansion zone 340 of 50 millimetres on each side of the secondary packs 200 in a transverse direction of the pallet 300. According to this alternative embodiment, each layer has a height of 600 millimetres and each secondary pack 200 comprises five primary packs 210, wherein each primary pack 210 has the dimensions 600 x 600 x 140 millimetres. For example, there may be three layers. It is understood that other dimensions of the pallet 300, the secondary packs 200, the primary packs 210, the ceiling tiles 212 and the expansion zones 340 are equally conceivable.

[0089] Hereafter, a method for providing a secondary pack 200 will be described.

[0090] Initially, an embodiment of a method for providing a primary pack 210 will be described. It should be noted that a primary pack 210 provided by the method now to be described may be provided for other purposes than to be included in a secondary pack of a transport unit in accordance with the present invention. The primary pack 210 and the method for providing it may thus constitute separate inventions by themselves.

[0091] The method for providing a primary pack (or simply a pack, if the intention is not to include the pack in a secondary pack) comprises:

- providing a stack of compressible ceiling tiles,
- wrapping a plastic foil around the stack,
- compressing the stack along compression axis
- sealing the plastic foil such that it hermetically encloses the stack while it still is compressed,
- partially decompressing the stack such that a negative pressure is established inside the pack,
- wherein sealing of the plastic foil is provided such that the step of partially decompressing the stack is enabled.

[0092] The term "plastic foil" used in defining the method corresponds to the previously used term "first securing member 260".

[0093] The plastic foil may for instance be sealed with a degree of slack, such that the stack may partially decompress after termination of the compressing step. By the term "partially decompress" is meant that the ceiling tiles are allowed to decompress slightly, but not entirely back to their uncompressed state. For instance, the stack may be compressed such that each ceiling tile achieves a desired compressed state (which may be between 1/3 and 1/2 of the thickness of the ceiling tile in an uncompressed state) plus an additional compression corresponding to between 10-20% of the thickness in the uncompressed state. Since the foil is hermetically sealed, the decompression (corresponding to said additional compressing) will result in the formation of a negative pressure within the pack. Each pack may be shaped as a rectangular parallelepiped.

[0094] With reference to the block diagram in Fig. 5, a method for providing a secondary pack 200 will be described (Box 400).

[0095] First, a group of compressible ceiling tiles 212 is provided (Box 410). The group comprises a plurality of ceiling tiles 212. The ceiling tiles 212 of each group are arranged in stacks along a compression axis C which is associated to a group. Then the ceiling tiles 212 of each group are compressed along the associated compression axis C (Box 420). Thereafter, a first securing member 260 in the form of a sealed plastic wrapping arrangement 260 is arranged around the ceiling tiles 212 in each group. The compression is released whereby the ceiling tiles 212 may expand to a point of equilibrium in which the outward expansion tendency of the ceiling tiles 212 is balanced by a negative pressure which is caused

by the compressed ceiling tiles 212 being wrapped in the sealed plastic wrapping arrangement 260. Thereby, a primary pack 210 associated to a group of compressible ceiling tiles 212 and a first securing member 260 is formed (Box 430). Each primary pack 210 is shaped as a rectangular parallelepiped.

[0096] Next, the primary packs 210 are arranged along the compression axis C (Box 440). In each adjacent pair of primary packs the upper portion 214 of one primary pack is bonded by means of an adhesive to a lower portion 216 of the other primary pack. Thereby, the primary packs 210 are softly bonded to each other. In order to jointly secure the primary packs 210, a second securing member 250 comprising a non-stretchable plastic film material is arranged around the primary pack 210. The plastic film material is sealed by means of welding in an overlap portion, whereby an endless second securing member 250 is obtained. Thereby, a secondary pack 200 is provided.

[0097] Next, with reference to the block diagram in Fig. 6, a method for providing the transport unit 100 will be described (Box 500). The method starts with providing a load carrier 300 in the form of a pallet (Box 510). The pallet 300 has a planar load surface 302 which is adapted to receive goods which are to be transported. A bottom protection sheet 310 is arranged on the planar load surface 302. Thereafter, a plurality of secondary packs 200 is provided (Box 520), wherein each secondary pack 200 is provided according to the method 400 described above.

[0098] The secondary packs 200 are arranged on the pallet 300 (Box 530) in such a way that the compression axis C of each secondary pack 200 is coplanar with the planar surface 302 of the pallet 300. More specifically, secondary packs 200 are arranged in a matrix form comprising several layers of secondary packs 200, wherein each layer comprises several secondary packs 200. At the lowermost layer, a side-edge surface 240 of each secondary pack 200 is contacting the bottom protection sheet 310 which is arranged on the planar load surface 302.

[0099] Lastly, a top protection sheet 320 is arranged on the uppermost secondary packs 200 for protecting them from being damaged (Box 540). According to the present embodiment, wherein the compression axis C of each secondary pack 200 is coplanar with the planar surface 302 of the pallet 300, the top protection sheet 320 is arranged on side-edge surfaces 240 of the secondary packs 200. Furthermore, a stretch wrap 330 is arranged around the top protection sheet 320 and around the remaining portions of the secondary packs 200 which are outside of the top protection sheet 320. The stretch wrap 330 is also partly arranged around the pallet 300. Thereby, the secondary packs 200 are fastened to the pallet 300.

[0100] The invention has mainly been described above with reference to a few embodiments. However, as is readily appreciated by a person skilled in the art, other

embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended patent claims. For example, the order of the steps comprised in the method for providing the transport unit may be varied. Additionally, other means for protecting the secondary packs on the load carrier from being damaged known to the person skilled in the art may be used.

Claims

1. A transport unit comprising at least one secondary pack (200),
wherein the at least one secondary pack (200) comprises:

at least two primary packs (210), each comprising a plurality of compressible ceiling tiles (212) and a first securing member (260), and a second securing member (250),
the ceiling tiles (212) of each primary pack (210) being compressed along a compression axis (C) to a compressed state and secured in the compressed state by means of the first securing member (260),
wherein the at least two primary packs (210) are stacked along said compression axis (C), said second securing member (250) being arranged to at least partly enclose the at least two primary packs (210) in order to counteract an expansion of any of the at least two primary packs (210) from the compressed state in the event of failure of the first securing member (260) associated thereto.
2. A transport unit according to claim 1, wherein said second securing member (250) is a non-stretchable plastic film material.
3. A transport unit according to claim 2, wherein said plastic film material has a tensile strength in the range of 10 MPa (N/mm²) and 50 MPa.
4. A transport unit according to any of the preceding claims, wherein the compression axes (C) of each of said at least one secondary pack (200) are mutually parallel.
5. A transport unit according to any of the preceding claims, wherein said at least two primary packs (210) are bonded by means of an adhesive.
6. A transport unit according to any of the preceding claims, further comprising a load carrier (300) for supporting said at least one secondary pack (200), wherein said at least one secondary pack (200) is arranged on a planar load surface (302) of said load carrier (300).
7. A transport unit according to claim 6, in which the transport unit comprises two secondary packs (100), wherein the compression axes (C) of said secondary (200) packs are coplanar with said planar load surface (302).
8. A transport unit according to claim 7, wherein said secondary packs (200) are arranged on top of each other in a direction which is normal to said planar load surface (302).
9. A transport unit according to any of claims 6-8, wherein a length of said at least one secondary pack (200) is smaller than an extension of said planar load (302) surface for formation of an expansion zone (340).
10. A transport unit according to any of claims 6-9, wherein said at least one secondary pack (200) is fastened to said load carrier (300).
11. A transport unit according to any of the preceding claims, wherein the first securing member (260) of each primary pack (210) comprises a plastic wrapping arrangement which sealingly encloses said plurality of compressible ceiling tiles (212), said compressed state being obtained by means of a negative pressure within the plastic wrapping arrangement.
12. A transport unit according to any of the preceding claims, wherein said plurality of compressible ceiling tiles are compressed by means of a frame compression device, wherein the frame compression device comprises an upper and a lower frame, between which the plurality of ceiling tiles are arranged, wherein the first securing member (260) comprises a strap arrangement arranged around said upper and lower frames.
13. A transport unit according to any of the preceding claims, wherein said plurality of compressible ceiling tiles (212) comprises a top ceiling tile, a bottom ceiling tile, and at least one intermediate ceiling tile, wherein a front surface layer of each intermediate ceiling tile is facing a front surface layer of an adjacent ceiling tile.
14. A method for providing a transport unit (100) comprising:

providing at least one secondary pack (200), wherein the at least one secondary pack (200) comprises
at least two primary packs (210), each comprising a plurality of compressible ceiling tiles (212) and a first securing member (260), and

a second securing member (250),
the ceiling tiles (212) of each primary pack (210)
being compressed along a compression axis (C)
to a compressed state and secured in the com- 5
pressed state by means of the first securing
member (260),
wherein the at least two primary packs (210) are
stacked along said compression axis (C), and
said second securing member (250) being ar- 10
ranged to at least partly enclose the at least two
primary packs (210) in order to counteract an
expansion of any of the at least two primary
packs (210) from the compressed state in the
event of failure of the first securing member 15
(260) associated thereto,
providing a load carrier (300) for supporting said
at least one secondary pack (200), and
arranging said at least one secondary pack
(200) on a planar load surface (302) of said load 20
carrier (300).

15. A method for providing a transport unit (100) accord-
ing to claim 14, in which the step of providing at least
one secondary pack (200) comprises providing two 25
secondary packs (200), wherein the compression
axes (C) of said secondary packs (200) are arranged
mutually parallel and coplanar with said planar load
surface (302).

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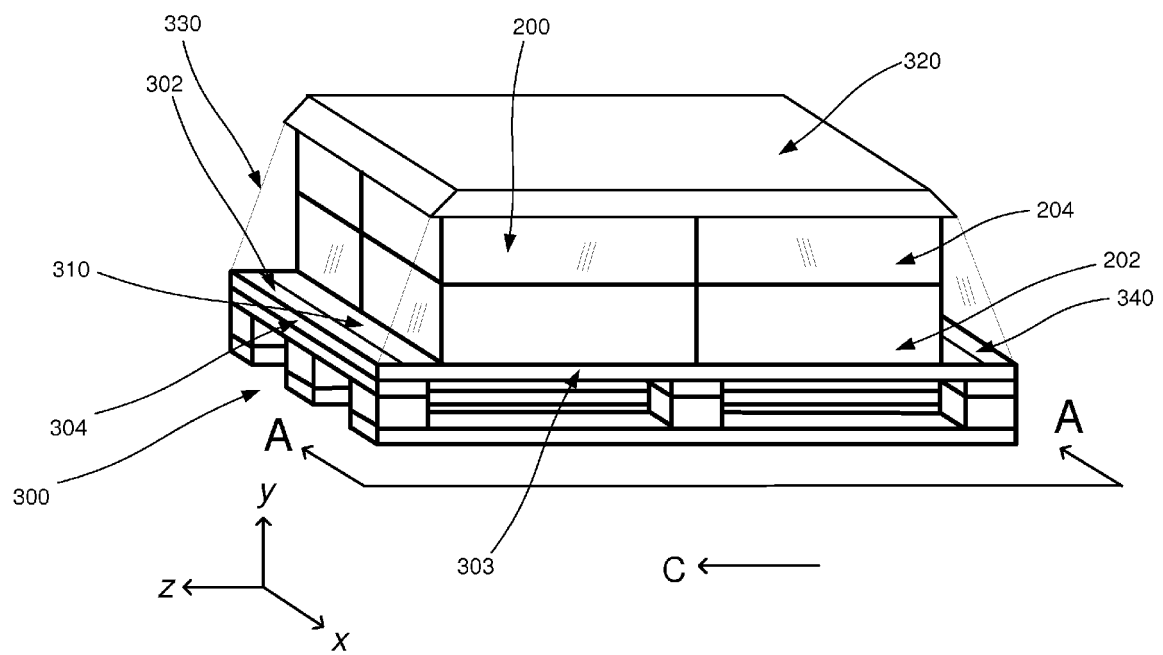


Fig 1

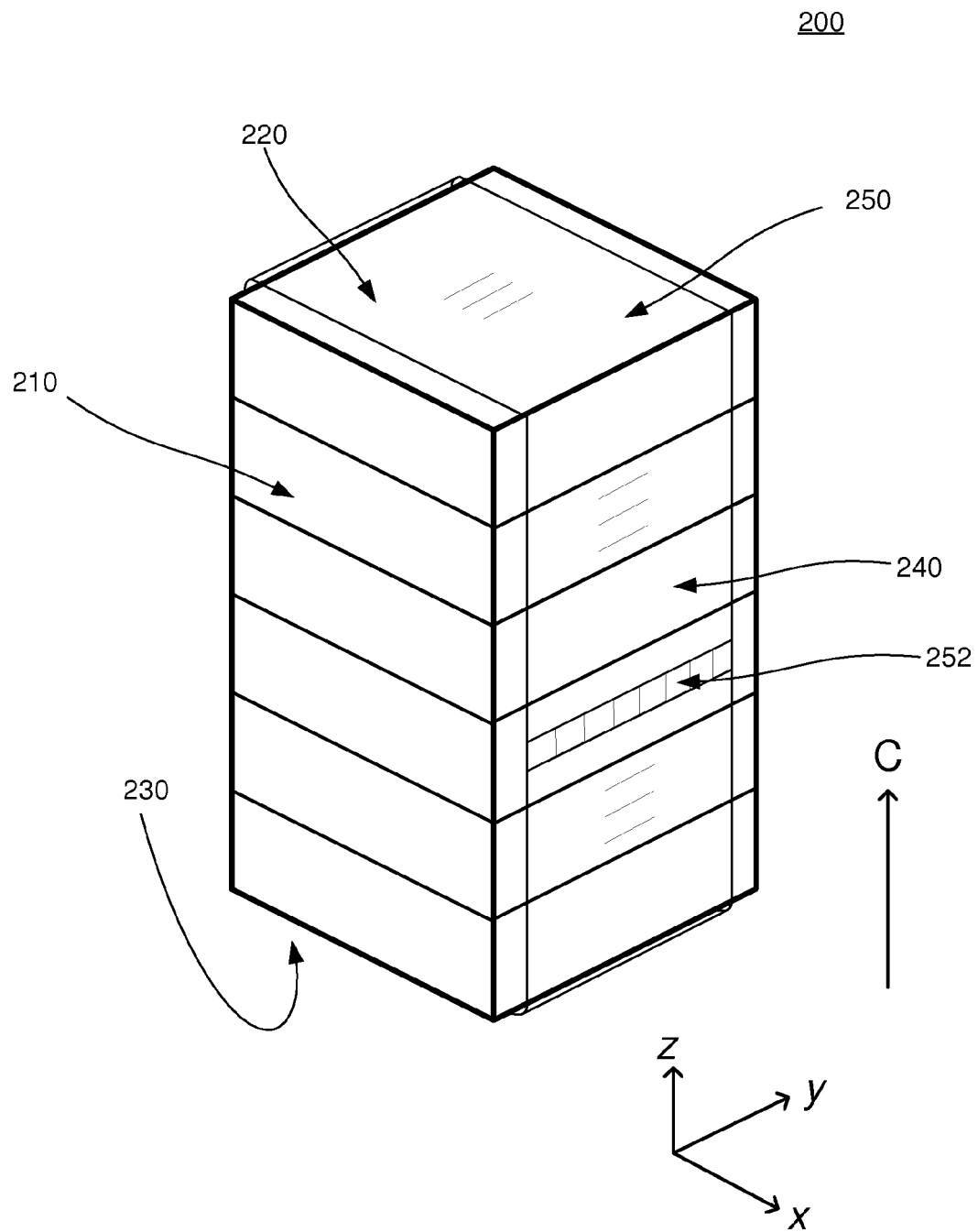


Fig 2

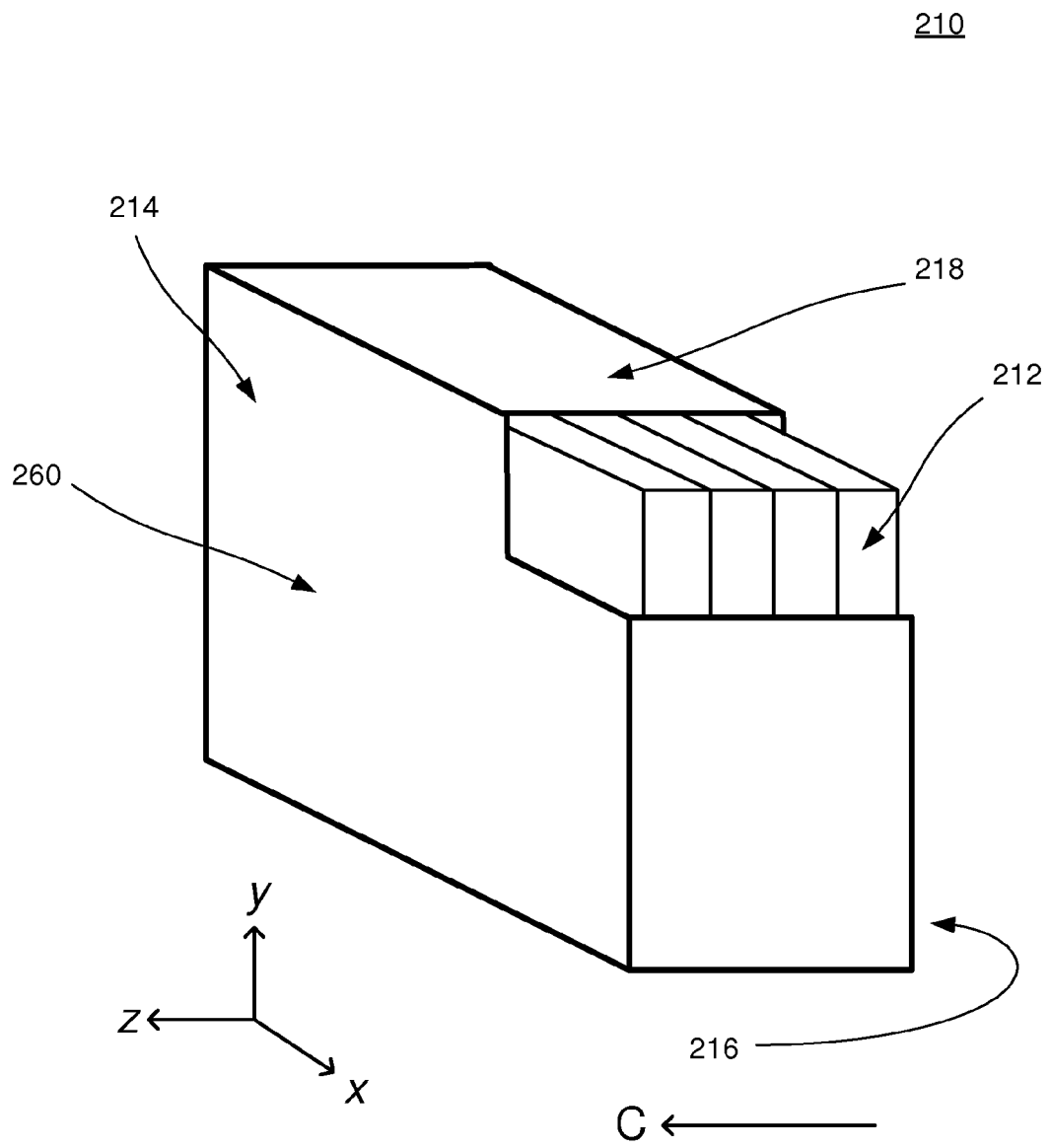


Fig 3

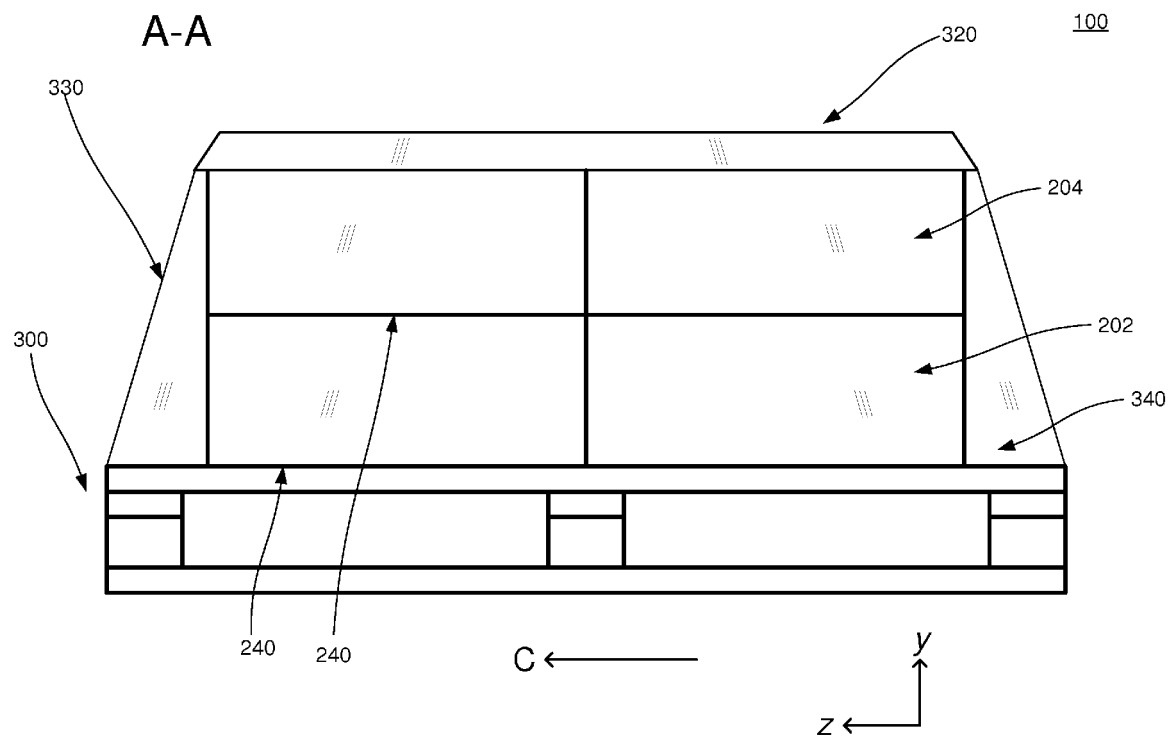


Fig 4

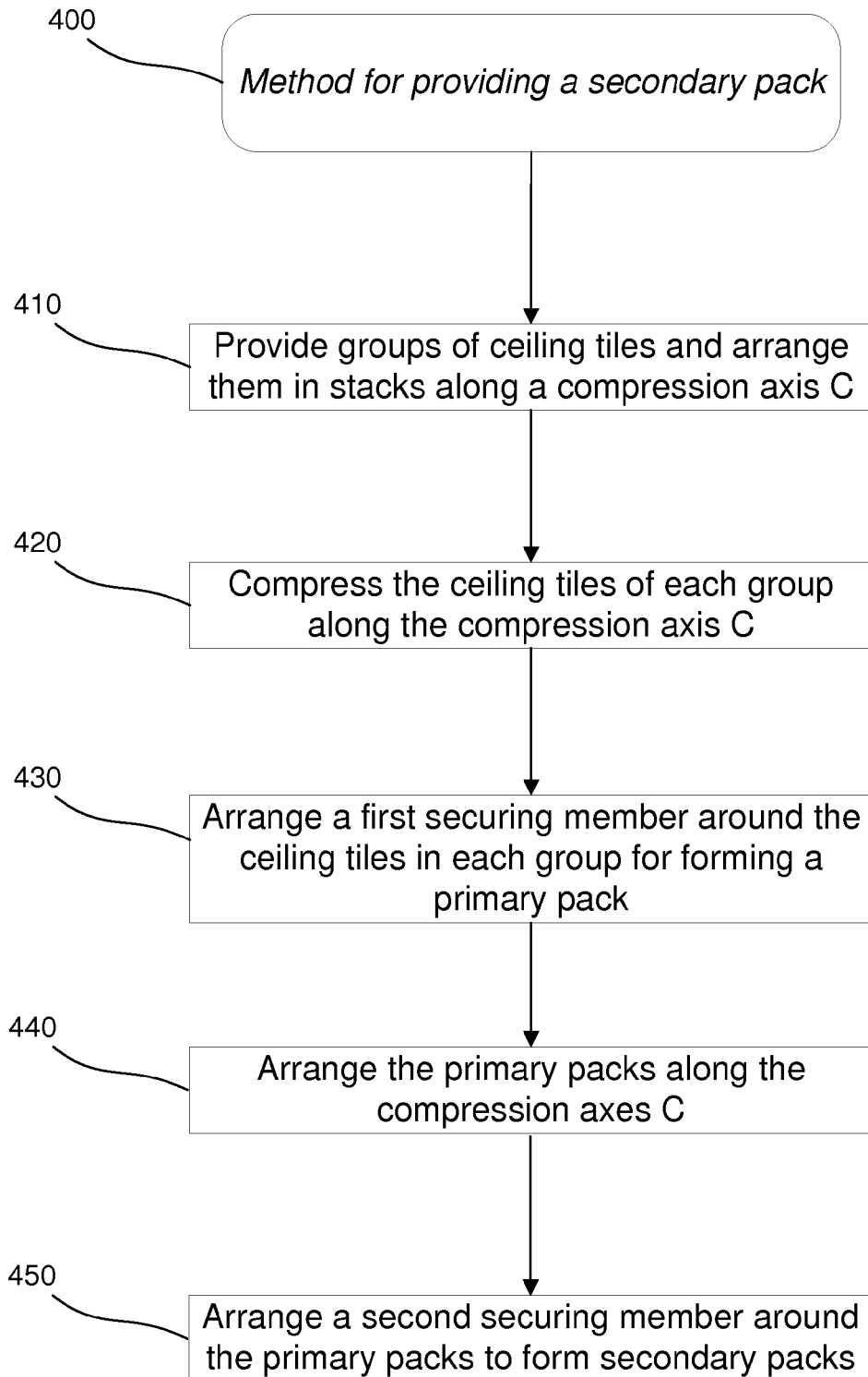


Fig 5

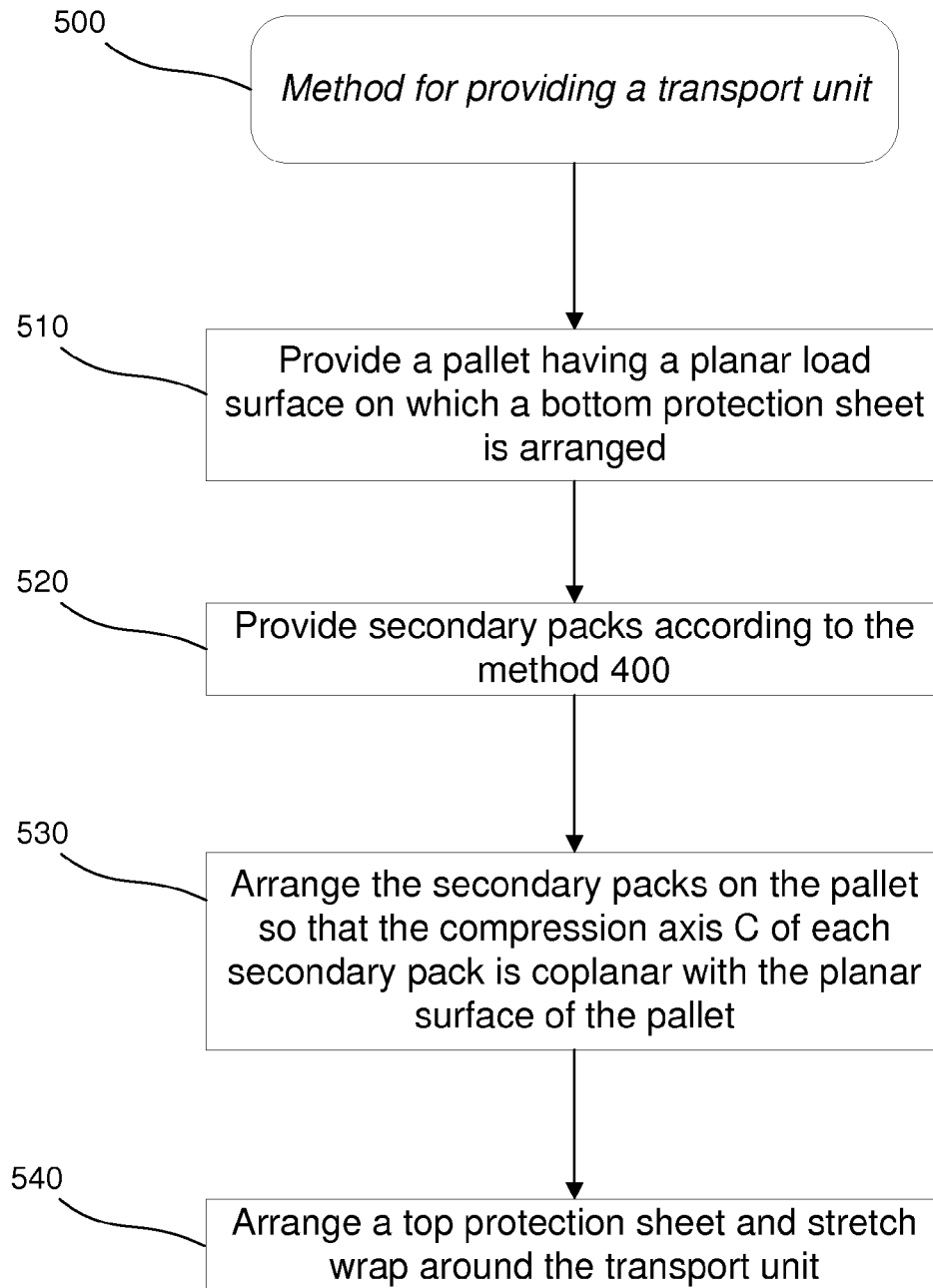


Fig 6



EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 266 843 A1 (ROCKWOOL MINERALWOLLE [DE]) 18 December 2002 (2002-12-18) * paragraph [0033] * * paragraph [0043] - paragraph [0057]; figures *	1,4-7, 10,13-15	INV. B65D71/00 B65D71/02 B65D85/16 B65D85/46 B65D85/62
X	US 6 026 957 A (BAUER RAINER RICHARD BERND [DE] ET AL) 22 February 2000 (2000-02-22) * column 3, line 33 - column 4, line 45; figures *	1,4,6-8, 11,14,15	
X,D	EP 2 460 738 A1 (SAINT GOBAIN ECOPHON AB [SE]) 6 June 2012 (2012-06-06) * paragraph [0073] - paragraph [0086]; figures 8-11 *	1-4, 6-11, 13-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65D
1 The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		2 February 2016	Newell, Philip
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)



Application Number

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-11, 13-15

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



LACK OF UNITY OF INVENTION
SHEET B

Application Number

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-11, 13-15

Transport unit comprising a secondary pack which, in turn, comprises multiple primary packs of compressed tiles held under compression by a first securing member; the secondary pack comprising a second securing member enclosing the multiple primary packs. Associated method of provision of such a unit.

2. claim: 12

A frame compression device for compressing a product, comprising upper and lower frame members; a strap application arrangement for applying a strap around the compressed product.

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

EP 15 18 1544

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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02-02-2016

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REFERENCES CITED IN THE DESCRIPTION

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- EP 2460738 A1 [0003]