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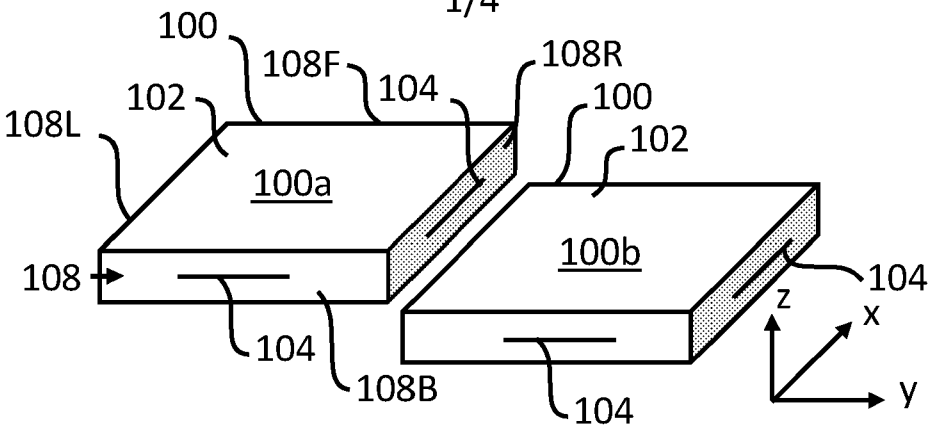


Fig 1a

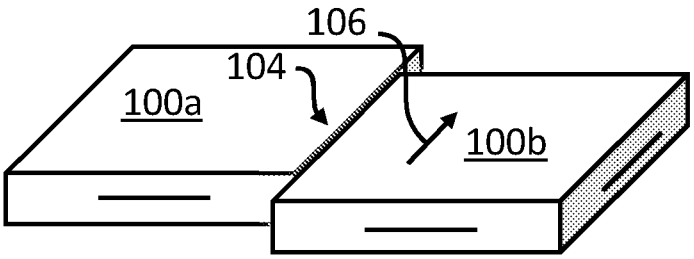


Fig 1b

14 12 20

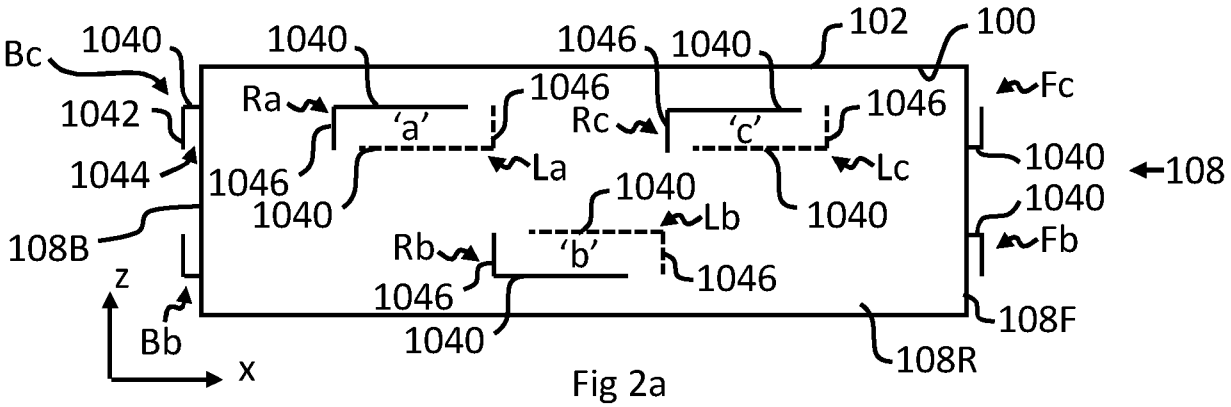


Fig 2a

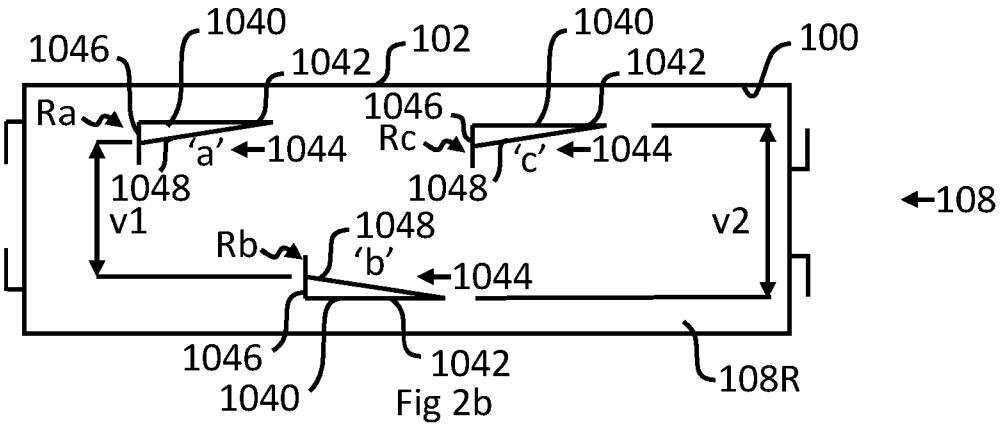
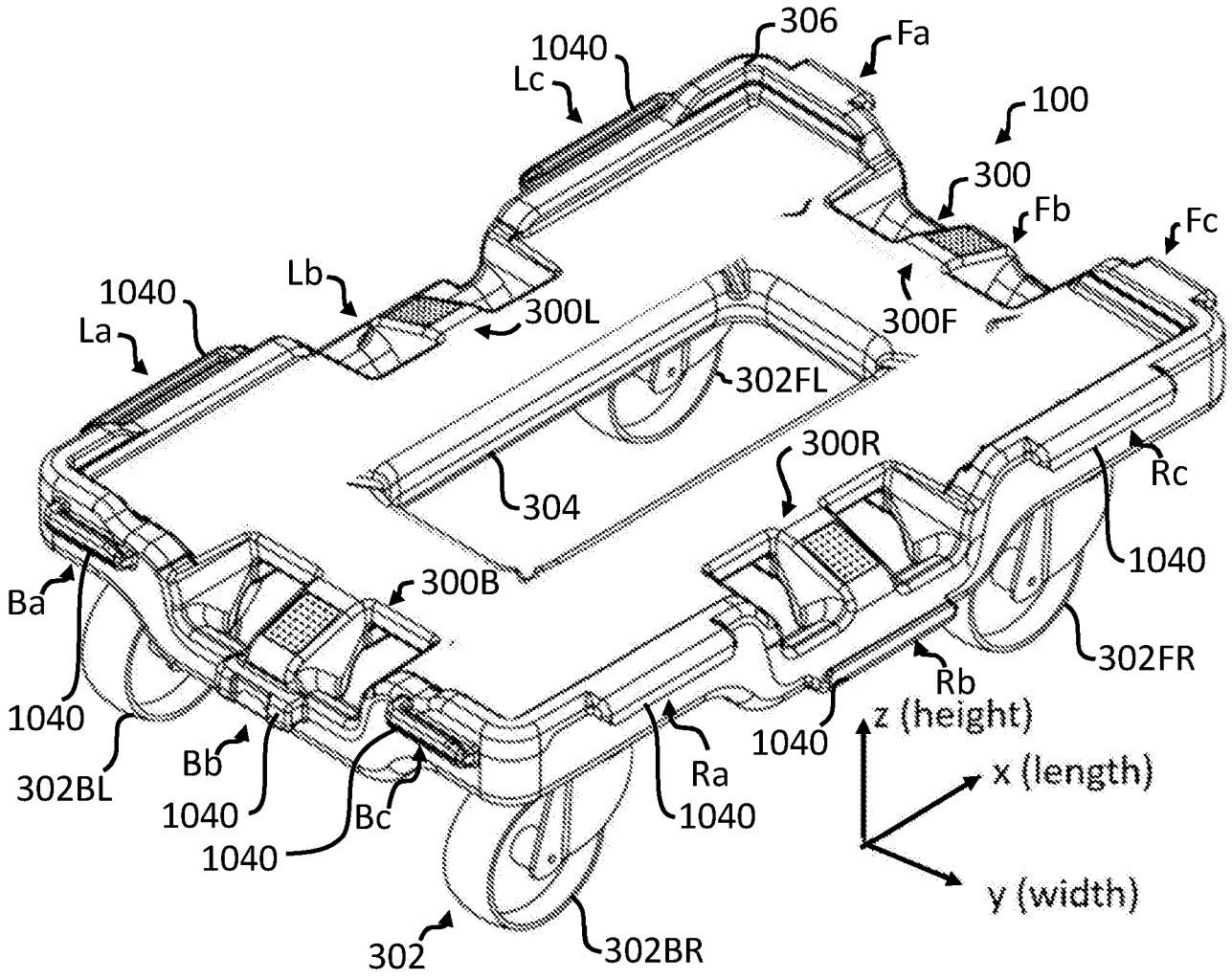


Fig 2b


306
Fa
1040
Lc
100
300
Fb
Fc
Lb
1040
La
300L
300F
302FL
300R
Rc
304
1040
300B
Ba
302FR
Rb
1040
z (height)
1040
302BL
Bb
Ra
x (length)
1040
1040
Bc
1040
y (width)
302
302BR

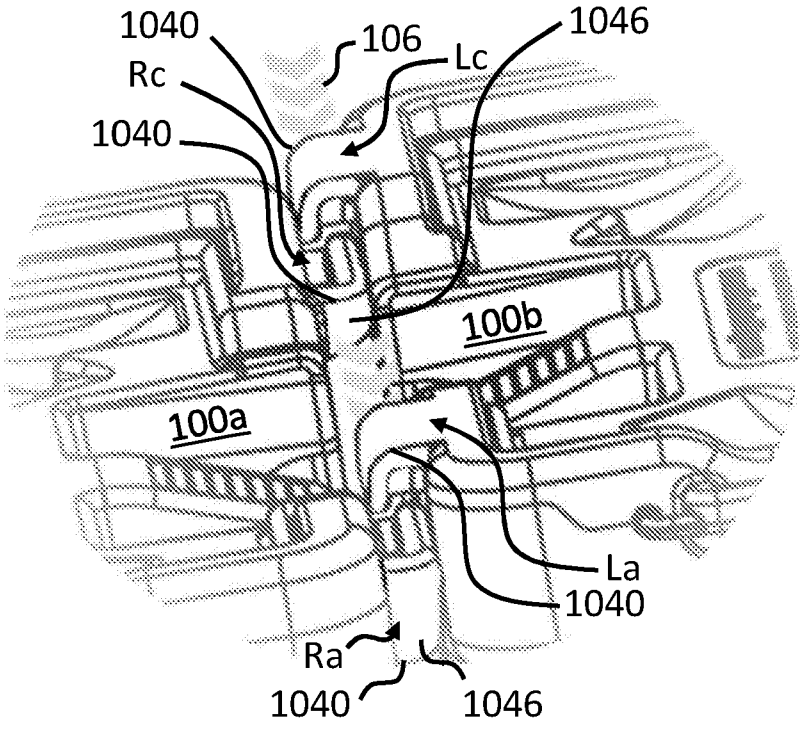

1040
106
Lc
1046
Rc
1040
100b
100a
La
1040
Ra
1040
1046

Fig 3

14 12 20

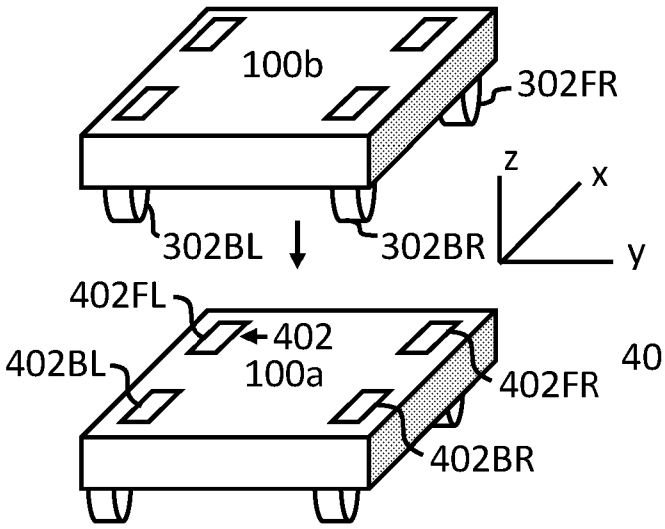


Fig 4a

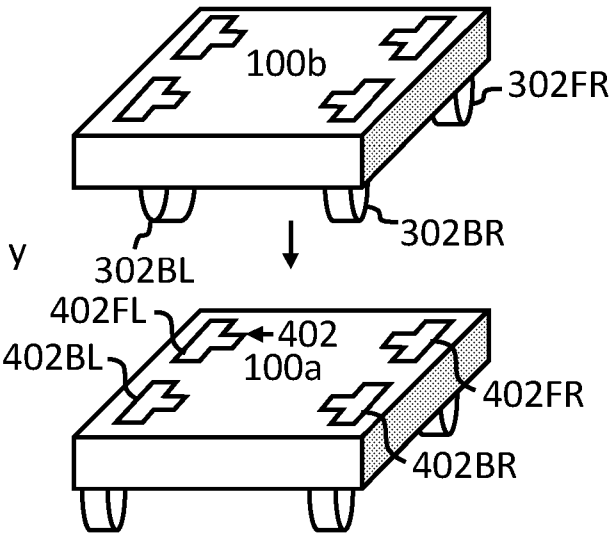


Fig 4b

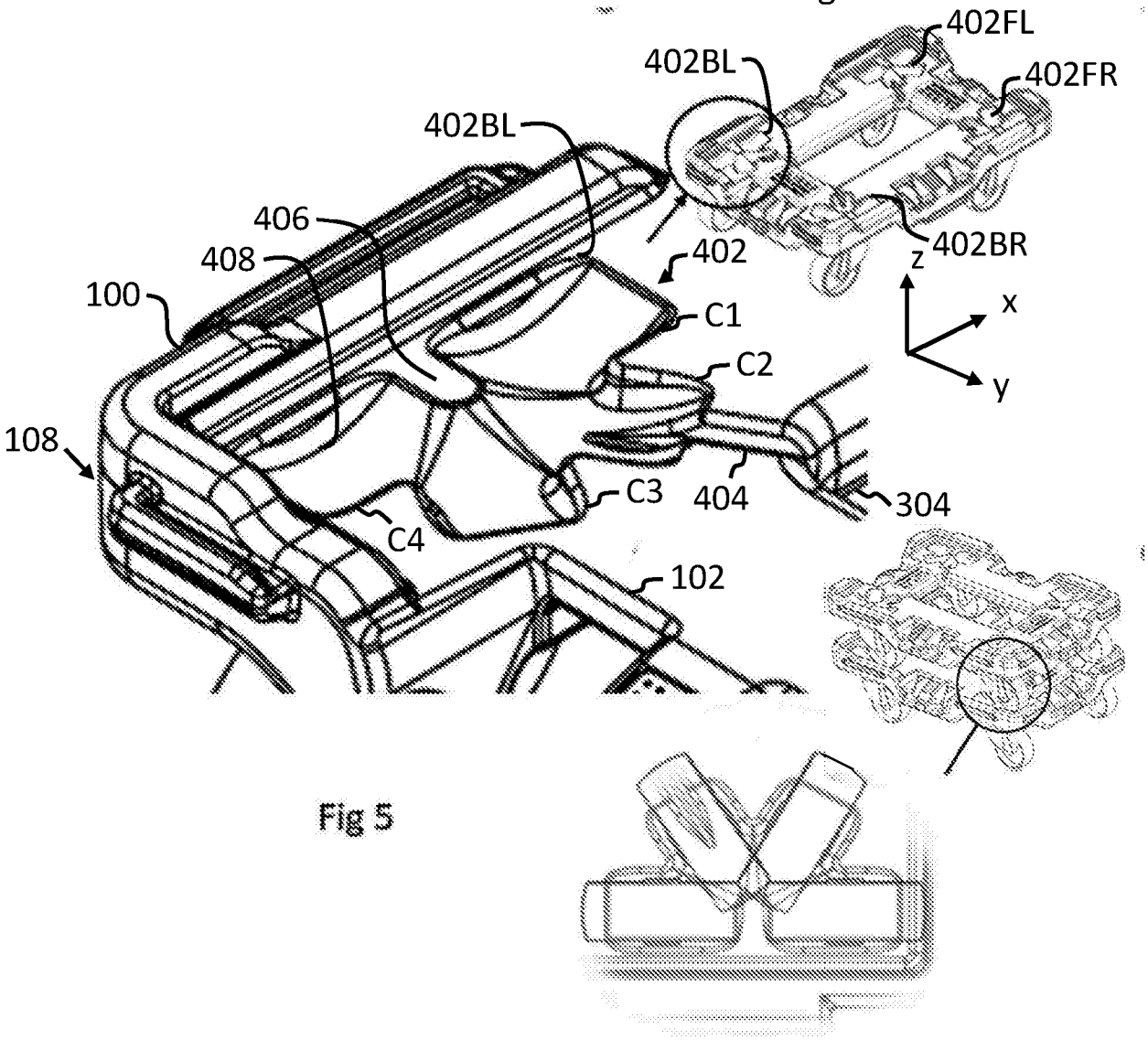


Fig 5

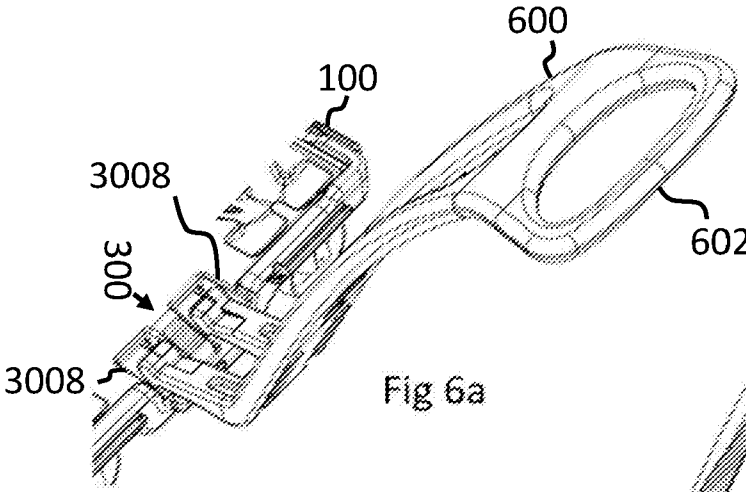


Fig 6a

Fig 6b

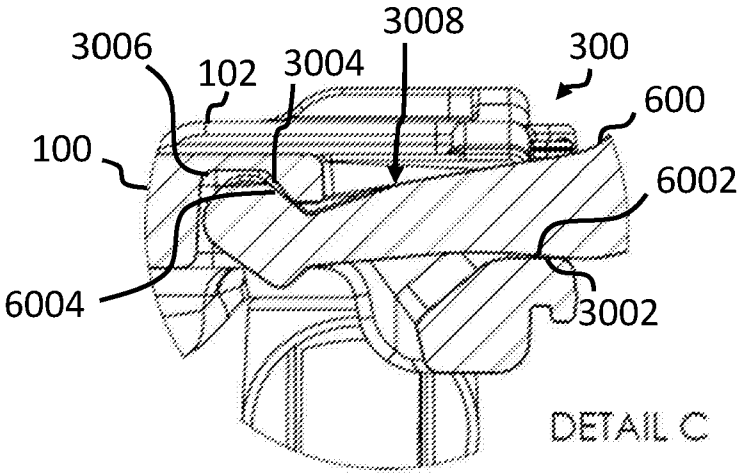


Fig 6c

STACKABLE TRANSPORT DOLLY

FIELD OF THE INVENTION

Embodiments of the present invention relate to a stackable material transportation apparatus. In particular, but not exclusively, they relate to a stackable transport dolly with restraining portions for casters.

BACKGROUND TO THE INVENTION

A transport dolly is a movable platform that fits entirely under heavy objects to hold them and make them easy to move. Dollies usually have no handles, although some dollies may have removable handles or lowerable handles. Dollies usually have no side rails, although some dollies may have a raised lip to help secure the objects. Dollies usually have four casters (castors) or other wheels and can be steered. Dollies are usually small and light enough to be maneuvered manually.

A problem with transport dollies is that they can be difficult to store. Dollies present a trip hazard when left out and/or can roll around when subject to external forces. Further, an operator will need to make many trips when they need to move a plurality of transport dollies into storage.

BRIEF DESCRIPTION OF VARIOUS EMBODIMENTS OF THE INVENTION

According to various, but not necessarily all, embodiments of the invention there is provided a stackable transport dolly comprising: a platform, for providing a deck for supporting materials to be transported; casters; and restraining portions configured to restrain casters of a second transport dolly, when stacked on the transport dolly, against at least orientation changes, wherein one or more of the restraining portions extends in a plurality of directions capable of restraining a caster of the stacked second transport dolly

at different orientations corresponding to respective ones of the plurality of directions, wherein the plurality of directions comprises at least four directions, wherein one or more of the restraining portions comprises a plurality of channels, the channels extending in different ones of the plurality of directions, and wherein angles between the plurality of directions comprises at least one acute angle.

An advantage is improved ease of use, because the dollies are much less sensitive to misalignment of casters. Another advantage is ease of manufacture, as channels can be formed as part of a same manufacturing step (e.g. moulding) that creates the platform.

In some, but not necessarily all examples the restraining portions are configured to restrain the casters of the second transport dolly against translation. An advantage is that dollies can be stored more securely.

In some, but not necessarily all examples the platform comprises the restraining portions. An advantage is that the dolly is more compact because the restraining portions may not protrude beyond the edges of the platform.

In some, but not necessarily all examples the channels diverge from a point substantially coaxial with an axis of orientation of one of the casters. An advantage is ease of use, because while the second dolly is being positioned above the dolly, a change of caster orientation does change a required horizontal relative positioning of the second dolly.

In some, but not necessarily all examples the channels are recessed into the platform (below deck level). An advantage is improved load stability, because medium-sized loads are more likely to stay flat than if the restraining portions were to protrude above deck-level.

In some, but not necessarily all examples the channels comprise sloped sidewalls. An advantage is stability and ease of use, because the sloped sidewalls guide casters into the required positions and/or orientations, and are even less sensitive to misalignment of casters.

In some, but not necessarily all examples the channels comprise a first channel extending in a first direction, wherein the sloped sidewalls of the first channel curve in a first direction about a horizontal axis nonparallel to the first direction, and/or wherein the sloped sidewalls of the first channel curve in a second direction about a horizontal axis substantially parallel to the first direction. An advantage is stability and ease of use, because the sloped sidewalls of one or more or each of the channels can guide casters against rolling or slipping out of a channel, and may guide casters in multiple directions.

In some, but not necessarily all examples the transport dolly comprises drain channels for draining liquid from the restraining portions. An advantage is improved durability because the casters, which may comprise ferrous hubs/wheels or other material that can oxidise, are less likely to sit in standing water, for example after rainfall.

In some, but not necessarily all examples the angular offset between a first one and a last one of the plurality of directions is approximately π radians. In some, but not necessarily all examples the directions are angularly offset from each other by approximately $\pi/3$ radians, on average. In some, but not necessarily all examples the directions are equally angularly offset. An advantage is improved ease of use, because the restraining portions are even less sensitive to misalignment of casters.

In some, but not necessarily all examples the transport dolly comprises four of the casters and four of the restraining portions.

In some, but not necessarily all examples the transport dolly comprises at least one handle cavity for receiving a removable handle, or wherein the transport dolly comprises a fixed handle. An advantage is ease of use.

In some, but not necessarily all examples the handle cavity comprises a bearing point at an underside of the platform, and a fulcrum point towards a horizontal periphery of the platform, wherein the bearing point and the fulcrum point are configured to cause the handle to function as a Class 1 lever when in use. An advantage is improved ease of use and flexibility, because the bearing point is close to the centre of mass at the centre of the platform, and because the below-deck location of the fulcrum point enables the handle to be removed without having to first remove loads. The Class 1 lever operation provides a mechanical advantage, because the fulcrum-to-handle length of the lever will be longer than the fulcrum-to-bearing point length.

In some, but not necessarily all examples the height of the platform of the transport dolly is less than 50 centimetres, which minimizes the distance objects have to be lifted onto the dolly. In some, but not necessarily all examples the transport dolly is nominally rated for hundreds of kilograms of load. In some, but not necessarily all examples the platform is an open deck platform, which reduces weight. In some, but not necessarily all examples the platform comprises a raised periphery, which helps to secure loads. In some, but not necessarily all examples the platform comprises polymeric material and/or weighs less than 10 kilograms, which makes the dolly easy to manually transport.

According to various, but not necessarily all, embodiments of the invention there is provided a system comprising the transport dolly and a removable handle.

According to various, but not necessarily all, embodiments of the invention there is provided a stackable material transportation apparatus comprising: a

platform, for providing a deck for supporting materials to be transported; casters; and restraining portions configured to restrain casters of a second material transportation apparatus, when stacked on the material transportation apparatus, against at least orientation changes.

According to various, but not necessarily all, embodiments of the invention there is provided a material transportation apparatus comprising one or more of the features other than restraining portions, described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of various examples of embodiments of the present invention reference will now be made by way of example only to the accompanying drawings in which:

Fig 1a, 1b schematically illustrates an example of a material transportation apparatus with interlocking means;

Fig 2a, 2b schematically illustrates examples of the interlocking means;

Fig 3 illustrates an example of a transport dolly with interlocking means;

Fig 4a, 4b illustrates examples of a material transportation apparatus with restraining portions for casters;

Fig 5 illustrates an example of the restraining portions; and

Fig 6a, 6b, 6c illustrates an example of a material transportation apparatus with a handle cavity, and an example of a handle.

DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS OF THE INVENTION

Fig 1a schematically illustrates a material transportation apparatus 100. Wheels are not shown. In an implementation, the material transportation apparatus 100 is a transport dolly (dolly). Fig 1a shows two dollies to be coupled, comprising a first dolly 100a and a second dolly 100b.

As illustrated, a dolly 100 comprises a platform 102. The platform provides a deck (upper surface) for supporting materials to be transported. The platform provides a substantially horizontal deck. Substantially horizontal means substantially in the x-y plane of a local coordinate system local to the dolly 100, as illustrated by the cartesian coordinate system in Fig 1a.

As illustrated, a dolly 100 comprises a number of sides 108. A dolly 100 may comprise four sides 108R, 108B, 108L, 108F as shown, defining a substantially rectangular platform. A dolly 100 could comprise a different number of sides in other implementations.

The illustrated sides 108 are side walls extending downwards from the platform 102. The sides 108 are distinguished from the platform by illustrated edges, but in other examples the platform could smoothly curve down to form a side 108, without a defined edge demarcating the platform from a side 108.

The sides 108 are marked front 'F', right 'R', back 'B' and left 'L' for ease of reference, however the distinctions between front, back, left and right may be arbitrary for a dolly 100 with casters. Alternatively, a dolly 100 may have a defined front, for example if it has a steering mechanism at one axle.

The first dolly 100a comprises first interlocking means 104. The second dolly 100b comprises corresponding second interlocking means 104 (not visible). Interlocking means 104 is shown at two sides 108 of the first dolly 100a, in this case the right side 108R and back side 108B, however interlocking means 104 may be provided to different and/or additional sides 108 depending on implementation.

Fig 1b shows connection of the first and second interlocking means 104 to create an interlocked coupling of the first and second dollies 100a, 100b to each other. The interlock is created by relative sliding of the first and second interlocking means 104 in a required direction. In some, but not necessarily all

examples the required direction is at least partially horizontal, represented by an arrow 106. Horizontal means in the x or y direction. In some, but not necessarily all examples the sliding direction is substantially horizontal, with no notable vertical component.

In some, but not necessarily all examples the first and second dollies 100a, 100b must be aligned prior to sliding. In Fig 1b, corresponding sides 108R, 108L of the first and second dollies 100a, 100b are brought close to each other, for example to abut, and may be substantially parallel to each other. Prior to sliding and interlocking, the first and second dollies 100a, 100b are initially positionally offset in the horizontal sliding direction (e.g. x-axis in this case). This aligns the first and second interlocking means 104. Then, the second dolly 100b is slid in the required direction to create the interlock. The coupling may be complete when there is no longer an x-axis offset between the second dolly 100b and the first dolly 100a.

In Figs 1a-1b, a third dolly (not shown) can then be attached to the first dolly 100a via coupling of the interconnecting means 104 at the front side of the third dolly and back side 108B of the first dolly 100a.

Fig 1a shows interlocking means 104 at just one central locking point location, to create the coupling. In some optional examples, described below, interlocking means 104 at multiple horizontally separated locking point locations (e.g. positions ‘a’, ‘b’, ‘c’ of Figs 2a-2b) at a given side 108 of a dolly 100 must be interlocked, to create the coupling.

Figs 2a and 2b schematically illustrate an example implementation of the interlocking means 104. The interlocking means 104 comprises horizontally elongated hooks 1040. In other examples, not described further, the interlocking means 104 may be a different plug-socket arrangement than a hook 1040, for example a socket may be a closed channel that a plug can only enter and leave by sliding in or out in the required direction.

In Figs 2a and 2b, but not necessarily all examples, it is assumed that multiple locking point locations are provided at each side 108 of the dolly 100, and interlocking means 104 is provided on multiple/all sides 108.

For consistency with Figs 1a and 1b, the visibly exposed side 108 is the right side 108R. Dashed lines represent corresponding interlocking means 104 of a second dolly (not shown) when coupled.

As illustrated, a hook 1040 comprises a curved hook body 1042 providing the function of a plug. The illustrated hook bodies 1042 protrude/stem away from the sides 108, and then curve up or down. A curved hook body 1042 defines an open channel 1044 partially enclosed by the curved hook body 1042. The open channel 1044 provides the function of a socket.

A hook body 1042 curves either upwards or downwards in the z-axis, based on the direction of curvature of the curved hook body 1042. If a hook body 1042 curves upwards in the vertical z-axis, the open channel 1044 of the hook 1040 is open from above. If a hook body 1042 curves downwards (towards wheels), the open channel 1044 of the hook 1040 is open from below.

When a hook body 1042 of a first hook 1040 of a first dolly 100a is inserted into the open channel 1044 of a second hook 1040 of a second dolly 100b, a coupling between the first and second dollies 100a, 100b is at least partially formed. The coupling may be an interference coupling in the horizontal direction perpendicular to the coupled side 108 (y-axis in Fig 2a), due to the overlap of the hook bodies 1042, and a frictional coupling in the other horizontal direction parallel to the coupled side 108 (x-axis in Fig 2a).

As illustrated, a hook 1040 may comprise an optional end cap 1046 at one lateral end, with the effect of creating an interference coupling in the direction parallel to the coupled side 108 (x-axis in Fig 2a). In other examples, the open

channels 1044 may be open at both lateral ends. However, the sliding connection will be monodirectional rather than bidirectional, as in the sliding will have to start from the second dolly 100b being positioned to a specific lateral (horizontally separated) side 108 of the hook 1040 not obstructed by an end cap 1046.

As illustrated, an interlock may be created by hook-to-hook engagement. However, in other implementations, the interlock may be created by hook-to-non-hook engagement, for example a hook body 1042 may engage with a non-hook channel such as a slot cut into the side 108.

Since a hook 1040 defines an open channel 1044 that is open from above or from below, Fig 2a and 2b illustrate a pattern of opposing hooks 1040 that provides a restraint against vertical hook disengagement, and increases frictional engagement. The restraint is particularly useful if coupled dollies are to be moved along uneven ground, otherwise z-axis translation, or rotation about the x-axis or y-axis, may lift hooks 1040 out of engagement.

Fig 2a illustrates a pattern of three hooks 1040 on the given side 108 (right side 108R in Fig 2a), at positions marked Ra, Rb, Rc, with the first letter identifying the side, and the last letter marking the position 'a', 'b', or 'c' in the pattern. The hooks 1040 on a given side 108 comprise up-curving hook(s) 1040 and down-curving hook(s) 1040. To form a proper coupling, all three hooks at positions Ra, Rb, Rc of the illustrated dolly 100 are coupled to hooks La, Lb, Lc at respective positions on a corresponding side 108L of a second dolly 100b, by the sliding in the required direction. A coupling can be achieved more securely with three hooks 1040 than with two hooks 1040. More than three hooks 1040 is also possible.

Hook positions 'a' and 'c' at one side of the dolly 100, such as the left side 108L, curve in one direction. Hook positions 'a' and 'c' at the opposite side of the dolly 100, such as the right side 108R, curve in the opposite direction. Therefore,

when the left and right sides 108L, 108R of two dollies 100 with this hook pattern are brought together, an up-hook 1040 engages with a down-hook 1040 at each position 'a', 'b', 'c'. This also applies to the front and back (rear) sides 108F, 108B.

Hook position 'b' curves in the opposite direction from hook positions 'a' and 'c'. Therefore, when all three hooks 1040 of the given side 108 are engaged, hook position 'b' provides an interference that prevents hooks 1040 at positions 'a' and 'c' from being lifted out, and hooks 1040 at positions 'a' and 'c' provide an interference that provides hooks 1040 at position 'b' from being lifted out.

Hook position 'b' is vertically offset from hook positions 'a' and 'c'. As illustrated, hook position 'b' may be below hook positions 'a' and 'c'. Alternatively, hook position 'b' may be above hook positions 'a' and 'c'.

Hook position 'b' is central, and hook positions 'a' and 'c' are lateral, i.e. horizontally offset to either side of position 'b'. Central does necessarily mean precisely central, but between the lateral positions 'a' and 'c'.

It would be appreciated that the pattern of hook directions could be different in other examples, such as up-up-down or down-up-up. The vertical offsets could be different, for example 'a' could be vertically offset from 'b' and 'c', or 'c' could be vertically offset from 'a' and 'b', or every position may be at a different vertical offset. However, the illustrated hook pattern is robust against all vertical misalignments including z-axis translation, rotation about the x-axis, and rotation about the y-axis.

Fig 2b is a variant of Fig 2a in which the interlocking means is configured to increase the self-coupling force (e.g. frictional force) by imposing a bias force. As illustrated, an up-hook channel 1044 and a down-hook channel 1044 may be vertically non-parallel to each other. An up-hook channel 1044 and a down-hook channel 1044 may be vertically convergent in the coupling sliding

direction. Fig 2b shows interior surfaces 1048 of stems of the hook bodies 1042, wherein interior refers to the channel-facing side of the hook body 1042. As illustrated, a vertical offset v2 from the interior surface 1048 at the entry-end of the open channel 1044 of position 'a', to the interior surface 1048 at the entry-end of the open channel 1044 of position 'b', is greater than a vertical offset v1 defined in the same way except at the end cap-ends. The geometries of the sloping interior surfaces 1048 are configured to create a vertical tension/compression bias force at each of the hook positions 'a', 'b', 'c' when the hooks 1040 are slid by the required amount, that increases frictional force.

Fig 3 illustrates an example implementation of the dolly 100.

As illustrated in Fig 3, wheels 302 of a dolly 100 may be casters. Swivel casters 302 are shown. Four swivel casters 302BL, 302BR, 302FR, 302FL are shown, one at each corner. The dolly 100 may be functional with three casters 302 or more than four casters 302. In other examples, the wheels may be non-casters, and a steering mechanism and/or axle may be provided.

As illustrated in Fig 3, the platform may be an open deck platform, comprising a central aperture 304. Alternatively, the platform may be a solid deck platform without an aperture, or an open frame comprising a frame members and an optional mesh.

As illustrated in Fig 3, the sides 108 may comprise a raised periphery 306, raised relative to the platform. The illustrated raised periphery 306 is a lip of a few mm or less than 10 centimetres. The sides 108 may extend above platform-level to form the lip. Alternatively, the raised periphery 306 may comprise a bar or mesh. In further alternatives, no raised periphery may be provided, or taller side walls may be provided to define a basket shape.

Fig 3 comprises the same hook pattern as Fig 2a and 2b. The detail-view in the lower corner of Fig 3 illustrates the horizontal sliding of the corresponding hooks

1040 to couple two dollies 100, with hook positions 'a' and 'c' clearly visible, the opposing hook directions clearly visible, and the end caps 1046 clearly visible.

Fig 3 illustrates that a y-axis width of a dolly 100 may be less than an x-axis length of a dolly 100, defining a rectangular platform. The platform area may be at least 0.15 square metres. The platform area may be less than 1 square metre.

Fig 3 illustrates handle cavities which are described later in relation to Figs 6a to 6c.

Figs 4a and 4b schematically illustrate examples of a stackable material transportation apparatus 100, e.g. dolly. In some, but not necessarily all examples the dolly 100 is the same as shown in Figs 1a to 3, adapted for stacking. Casters 302BR, 302BL, 302FR, 302FL are shown.

The platform of the first dolly 100a comprises restraining portions 402. A restraining portion is an element that restrains another element at a desired position and/or orientation. In this case, the restraining portions 402 are for restraining casters 302, when dollies 100 are being vertically stacked. The restraining portions 402 restrain casters 302 of the second dolly 100b at a predetermined orientation.

Fig 4a illustrates a first example of restraining portions 402. The platform of the second dolly 100b may also comprise restraining portions 402, for stacking dollies 100 more than two-high. The number of restraining portions 402 on a platform of a dolly 100 is the same as the number of casters 302 on the dolly 100. In Fig 4a, restraining portion 402BL is for caster 302BL, restraining portion 402BR is for caster 302BR, restraining portion 402FL is for caster 302FL, and restraining portion 402FR is for caster 302FR.

The exact structure of a restraining portion is not shown, but it could be either a recessed channel (see Fig 5) or it could protrude above the platform surface to define protruding channel walls.

In Fig 4a, the restraining portions 402 extend in only one direction. They extend in the x-direction. In other examples, they could extend in the y-direction. Therefore, before the second dolly 100b is lowered onto the first dolly 100a, the casters 302 of the second dolly 100b must be approximately in a parallel orientation to the orientation of the restraining portions 402, which is the x-direction in the illustration. This can be inconvenient, especially when swivel casters 302 are used which can easily change orientation due to slight tipping of the second dolly 100b during lowering. This can be even more inconvenient if the hub axis of a caster 302 is horizontally offset from an axis of orientation (z-axis) of the caster 302.

Fig 4b therefore illustrates improved restraining portions 402. The improved restraining portions 402 extend in a plurality of directions, so that a caster 302 can be accommodated at a plurality of different corresponding orientations. At least one of the directions is non-parallel. One of the directions is at least partially in the x-axis and another of the directions is at least partially in the y-axis. However, they do not have to be perpendicular as shown.

A restraining portion of Fig 4b may be useful for casters 302 with a hub axis offset from the axis of orientation. The restraining portions 402 extend in three directions from a point of intersection of the three-different paths, forming a T-shape. The point of intersection is coaxial with the axis of orientation of the caster 302 below that restraining portion. If the caster hub axis is not offset from the axis of orientation, an L-shape/V-shape may suffice.

Fig 5 illustrates an example structure of a restraining portion. The restraining portion comprises four directions from a point of intersection 406 coaxial with

the axis of orientation of the an underlying caster (not visible). More directions could be provided in other examples.

Fig 5 shows that the different directions of a restraining portion are provided by recessed channels C1, C2, C3, C4. The maximum depth of recess may be a value from the range 5% to 50% of the z-axis depth of the sides 108 of the dolly 100 (not including casters 302). A deeper recess is synonymous with an indentation.

As illustrated, neighbouring channels could be angularly offset by an acute angle. The illustrated channels C1-C4 are angularly offset from each other by approximately π/3 (60 circular degrees), on average. They may be equally angularly offset, in some implementations.

The angular offset between a first one C1 and a last one C4 of the illustrated channels is approximately π (180 circular degrees), useful for a small-area dolly with an open deck. Therefore, the first and last channels C1 and C4 may be substantially parallel to each other. In other examples, the angular offset may be greater or less, depending on dolly geometry and available space.

Fig 5 shows that one or more or each of the channels C1-C4 may comprise sloped sidewalls 408, rather than vertical-only sidewalls. Sloped sidewalls 408 act as guide surfaces to guide the casters 302 into a precise position and/or orientation as the second dolly is lowered, accommodating a large degree of orientation/position imprecision. Another way of accommodating a large degree of orientation/position imprecision would be to have wider channels with purely vertical side-walls, at the expense of allowing the casters 302 to rattle or move within the channels. However, the sloped guiding sidewalls 408 provide a more secure stack with reduced free play/lost motion.

Fig 5 illustrates that the sloped sidewalls 408 of a given channel C1, C2, C3 or C4 may curve in one or more directions.

For example, the sloped sidewalls 408 may curve in a first direction about a horizontal axis nonparallel (e.g. perpendicular as illustrated) to the direction of that channel. For example, channel C1 (and C4) is oriented in the x-axis and the curve in the first direction is about the y-axis. This curve helps misaligned casters 302 to roll forwards or backwards into a restrained position, and resists rolling back out of the channel.

Further, the sloped sidewalls 408 may curve in a second direction about a horizontal axis substantially parallel to the direction of that channel. This curve helps misaligned casters 302 to slide into the restrained position and maintain the required orientation. In channel C1 (and C4), the curve in the second direction is about the x-axis.

Fig 5 also illustrates that a dolly 100 may comprise drain channels 404 for draining liquid such as water from the restraining portions 402. A drain channel 404 is illustrated as an open channel but it could be a closed channel. As illustrated, a drain channel 404 may extend in a horizontal direction. The drain channel 404 may follow a down-slope, sloping downwards in the horizontal direction. In this example, a horizontal direction is parallel to a horizontal plane tangential to the bottoms of each of the casters 302. The drain channel 404 slopes downwards towards an edge of the platform. The illustrated edge is the edge of the central aperture 304, for an open deck arrangement. Alternatively, a drain channel 404 may drain towards a peripheral side 108 of the platform. An advantage of horizontal drain channels 404 rather than vertical drain channels is that when dollies are stacked, the water does not drain directly onto the underlying dolly.

Figs 6a, 6b, 6c illustrate an example of how a removable handle 600 may be implemented. The removable handle 600 has a horizontal extension and a vertical extension. The removable handle 600 may have a vertical extension of

at least 50cm or at least 1 metre, so that operators do not need to bend down to use the handle 600. The handle 600 comprises an optional hand grip 602.

The illustrated handle 600 comprises two parallel prongs, each of which couples to the dolly 100, however in other examples the handle 600 may comprise one prong or more than two prongs.

As illustrated, the handle 600 may comprise a bend 601 towards the dolly end (prong end) of the handle 600. Between the dolly end and the bend 601, the handle 600 extends primarily horizontally. Between the bend 601 and the hand grip 602, the handle 600 extends primarily vertically.

The dolly 100 comprises a handle cavity 300 for receiving the removable handle 600. The dolly 100 may comprise a handle cavity 300 at one side 108, or handle cavities 300 at each of a plurality of sides 108, or handle cavities 300 at all sides 108.

As illustrated, a handle cavity 300 may comprise covered portions 3006 that are covered from above by the underside of the platform. The number of covered portions 3006 of a handle cavity 300 corresponds to the number of prongs of the handle 600. A covered portion 3006 extends in the horizontal direction towards the centre of the platform, which is where the centre of mass is likely to be when carrying load. The covered portion 3006 does not extend as far as the centre of the platform. Therefore, the horizontal extension of a covered portion 3006 is less than half the width (or length) of the platform – significantly less in the case of Figs 6a-6c.

As illustrated, a handle cavity 300 may comprise recesses 3008 (indentations) for accessing the covered portions 3006. In Figs 6a-6c, but not necessarily all examples, the covered portion 3006 is accessible from a side 108 and from above, therefore the recesses 3008 are not covered by the platform. The recesses 3008 are formed by indentations in the platform, located towards the

periphery of the platform and between corners of the platform. The recesses 3008 extend over a portion of the platform area and extend over the side 108 of the dolly 100. The z-axis depth of each recess 3008 may be less than the total side depth.

As illustrated, a handle 600 may be implemented as a Class 1 lever. The fulcrum of a Class 1 lever is between the applied force and the load. This aids in vertically tilting a dolly 100.

As illustrated, a handle cavity 300 may comprise a fulcrum point 3002, which in the illustrations is defined by the lower surface of a recess 3008. Therefore, the fulcrum point 3002 is below platform-level. As illustrated, the handle cavity 300 may comprise a bearing point 3004 which is also below platform-level. In the illustration, the bearing point 3004 is defined by an upper surface of the covered portion 3006, at the underside of the platform. The upper surface of the covered portion 3006 may be curved to define a notch.

The handle 600 comprises a corresponding fulcrum portion 6002 and bearing portion 6004. The fulcrum portion 6002 is a portion of the lower surface of the handle 600 that abuts against the fulcrum point 3002, and the bearing portion 6004 is a portion of the upper surface of the handle 600 that abuts against the bearing point 3004. In the illustration, the fulcrum portion 6002 and bearing portion 6004 are after the bend 601, towards the dolly 100. The bearing portion 6004 may be at a tip region of the handle 600. Each prong may comprise a bearing portion 6004.

As illustrated, the horizontal distance from the fulcrum portion 6002 to the bearing portion 6004 may be less than the horizontal distance from the fulcrum portion 6002 to the hand grip 602, providing a mechanical advantage.

As illustrated, the handle 600 may comprise a notched upper surface to define the bearing portion 6004. The notched upper surface may interfere in the

horizontal direction with the notch in the covered portion 3006 of the handle cavity 300 of the dolly 100. This enables the dolly 100 to be pulled without extracting the handle 600. To extract the handle 600, the hand grip 602 may be tilted upwards about the fulcrum portion 6002, causing the bearing portion 6004 of the handle 600 to tilt downwards until it is no longer interfering with the notch of the covered portion 3006 of the handle cavity 300.

It would be appreciated that the handle cavity 300 could be implemented in other ways. For example, the recesses 3008 that are uncovered from above may be omitted, and the covered portions 3006 may be accessible from apertures in the sides 108 only.

Although embodiments of the present invention have been described in the preceding paragraphs with reference to various examples, it should be appreciated that modifications to the examples given can be made without departing from the scope of the invention as claimed. For example, references to a dolly 100 may be replaced with a reference to a material transportation apparatus.

Features described in the preceding description may be used in combinations other than the combinations explicitly described.

Although functions have been described with reference to certain features, those functions may be performable by other features whether described or not.

Although features have been described with reference to certain embodiments, those features may also be present in other embodiments whether described or not.

Whilst endeavoring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable

feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

I/we claim:

CLAIMS

1. A stackable transport dolly comprising:

a platform, for providing a deck for supporting materials to be transported;

casters; and

restraining portions configured to restrain casters of a second transport dolly, when stacked on the transport dolly, against at least orientation changes, wherein one or more of the restraining portions extends in a plurality of directions capable of restraining a caster of the stacked second transport dolly at different orientations corresponding to respective ones of the plurality of directions, wherein the plurality of directions comprises at least four directions, wherein one or more of the restraining portions comprises a plurality of channels, the channels extending in different ones of the plurality of directions, and wherein angles between the plurality of directions comprises at least one acute angle.

2. The transport dolly of claim 1, wherein the restraining portions are configured to restrain the casters of the second transport dolly against translation.

3. The transport dolly of claim 1 or 2, wherein the platform comprises the restraining portions.

4. The transport dolly of any preceding claim, wherein the channels diverge from a point substantially coaxial with an axis of orientation of one of the casters.

5. The transport dolly of any preceding claim, wherein the channels are recessed into the platform.

6. The transport dolly of any preceding claim, wherein the channels comprise sloped sidewalls.

7. The transport dolly of claim 6, wherein the channels comprise a first channel extending in a first direction, wherein the sloped sidewalls of the first channel curve in a first direction about a horizontal axis nonparallel to the first direction, and/or wherein the sloped sidewalls of the first channel curve in a second direction about a horizontal axis substantially parallel to the first direction.

8. The transport dolly of any preceding claim, wherein the transport dolly comprises drain channels for draining liquid from the restraining portions.

9. The transport dolly of any preceding claim, wherein the angular offset between a first one and a last one of the plurality of directions is approximately π radians.

10. The transport dolly of any preceding claim, wherein the directions are angularly offset from each other by approximately π/3 radians, on average.

11. The transport dolly of any preceding claim, wherein the directions are equally angularly offset.

12. The transport dolly of any preceding claim, comprising four of the casters and four of the restraining portions.

13. The transport dolly of any preceding claim, comprising at least one handle cavity for receiving a removable handle, or wherein the transport dolly comprises a fixed handle.

14. The transport dolly of claim 13, wherein the handle cavity comprises a bearing point at an underside of the platform, and a fulcrum point towards a

horizontal periphery of the platform, wherein the bearing point and the fulcrum point are configured to cause the handle to function as a Class 1 lever when in use.

15. The transport dolly of any preceding claim, wherein the height of the platform of the transport dolly is less than 50 centimetres.

16. The transport dolly of any preceding claim, wherein the transport dolly is nominally rated for hundreds of kilograms of load.

17. The transport dolly of any preceding claim, wherein the platform is an open deck platform.

18. The transport dolly of any preceding claim, wherein the platform comprises a raised periphery.

19. The transport dolly of any preceding claim, wherein the platform has a cargo area of at least 0.15 square metres.

20. The transport dolly of any preceding claim, wherein the platform comprises polymeric material and/or weighs less than 10 kilograms.

21. A system comprising the transport dolly and the removable handle of claim 13 or 14.