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COMPLETE SPECIFICATION

(See section 10 and rule 13)

1. Title of the Invention

INTERMODAL DEVICES AND METHODS

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3. Preamble to the description

The following specification particularly describes the invention and the manner in which it is to be performed.

Field of the Invention

The invention relates to intermodal devices and systems including the modular arrangement of components for both standardization and customization of goods for transportation.

Background

In order to meet the economic criteria for the efficient transport of cargo, the associated intermodal devices must be standardized in size and shape. For large and bulk cargo, 20ft and 40ft containers are examples of standardisation, whereby shipping, trucks, cranes etc have all been developed around these standardized intermodal devices.

Whilst shipping containers are well suited for large cargo and bulk materials, the transport of smaller and/or more fragile are less well catered for. It follows that the smaller the component, the greater the variety in size ands shape. To this end, the principles of standardization are less easily attained.

It would therefore be advantageous if systems to provide for the standardization of such cargo.

Summary of Invention

In a first aspect the invention provides an intermodal assembly comprising a plurality of trays, each tray having a removable dividing assembly, said dividing assembly comprising; a pair of end panels, a plurality of dividing panels parallel to the end panels and a plurality of articulated panels perpendicular to the end and dividing panels; said panels interconnected to form an array of recesses to receive articles; wherein each articulated panel includes a plurality of spaced hinged portions; such that the dividing assembly is arranged to retract from an expanded position with the end panels distal from each other, for receiving the articles, to a retracted position such that the end panels are proximate to each other.

In a second aspect the invention provides an intermodal assembly comprising a plurality of trays, each tray having a removable dividing assembly, said dividing assembly comprising; a pair of end panels, a plurality of dividing panels parallel to the end panels and a plurality of articulated panels perpendicular to the end and dividing panels; said panels interconnected to form an array of recesses to receive articles; wherein the tray is formed from a folded sheet having unitary perimeter walls, said tray arranged to be selectively unfolded.

In a third aspect the invention provides an intermodal assembly comprising a plurality of trays, each tray having a removable dividing assembly, said dividing assembly

comprising; a pair of end panels, a plurality of dividing panels parallel to the end panels and a plurality of articulated panels perpendicular to the end and dividing panels; said panels interconnected to form an array of recesses to receive articles; wherein the tray includes unitary perimeter walls, said walls having handles for lifting each of said trays.

In a fourth aspect the invention provides a dividing assembly for an intermodal assembly comprising a plurality of trays, each tray into which the removable dividing assembly fits, said dividing assembly comprising; a pair of end panels, a plurality of dividing panels parallel to the end panels and a plurality of articulated panels perpendicular to the end and dividing panels; said panels interconnected to form an array of recesses to receive articles; wherein the tray includes unitary perimeter walls, said walls having handles for lifting each of said trays.

The invention, and its various aspects, relates to intermodal assemblies which meet the criteria of standardizing the conveyance of cargo whilst also being customizable to suit the requirements of different manufacturers in different industries. Whilst the intermodal assemblies according to the present invention are highly applicable to a range of different industries, those industries having direct and identifiable application for the intermodal assemblies include the transport of automotive and aviation components. It is also applicable to the electronics industry for both components as well as appliances. Further still, the intermodal assemblies are well suited for the transport of fruit and other grocery items.

In all cases the ability to customize to a particular size, and then standardize the intermodal assemblies for the customized size of cargo is a significant advantage conferred by the invention. The customized and standardized sizes may be subject to application and industry. For instance, for the transportation of apples the articles may be 75 mm in diameter, and so the tray may be arranged to carry 48 apples in an array of 8 by 6. With tolerance, the tray may measure 640 mm by 480 mm.

For larger articles, the size may not be the controlling issue, with weight of the overall tray being the guide. For instance, where the legislative requirements of a country limit the weight of an item to, say, 27 kg the trays including the articles may be limited to that weight which would control the number of articles to be carried by the ray; the dividing assembly may then be adjusted to accommodate apertures for that number of articles.

In various embodiments of the present invention, the base, and possibly the entire tray, may be injection moulded. In this case, forms of reinforcement may be added to the base to enhance strength. For instance, ribs along various portions may be added to increase flexural or shear force capacity of the base.

With reference to features associated with the articles being transported, an elastomeric sheet (such as neoprene) may be added to the base and/or to the panels of the dividing assembly, so as to provide a friction surface to mitigate movement of the contained

articles or provide cushioning against impact damage. For the transport of fruit, the base may include a plurality of holes so as to provide ventilation to the contained fruit.

In a fifth aspect, the invention provides an intermodal device comprising: a base; a perimetric rectangular frame; the frame comprising a first rail mounted to the base, a second rail in spaced relation to the first rail and a plurality of posts connecting the first and second rail; the posts being pivotally mounted to the first rail and in sliding engagement with the second rail; wherein the posts are arranged to slide along the second rail to a position parallel to the rails, the frame arranged to move from an expanded position to a collapsed position as a result of the movement of the posts.

In a sixth aspect, the invention provides an intermodal device comprising: a rectangular base; four walls arranged around the periphery of the base; each of said walls in pivotal engagement, so as to selectively fold inwards into a space defined by said walls.

In a seventh aspect, the invention provides a dividing assembly for an intermodal device, the dividing assembly comprising: a plurality of dividers, said dividers cooperatively assemblable to form the dividing assembly and selectively disassemblable; each of said dividers being collapsible, such that in the assembled form the dividing assembly is arranged to move from an expanded position to a collapsed position.

Brief Description of Drawings

It will be convenient to further describe the present invention with respect to the accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible and consequently, the particularity of the accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figure 1 is an isometric view of an intermodal assembly according to one embodiment of the present invention;

Figure 2 is an isometric view of the intermodal device of Figure 1;

Figure 3 is a plan view of a tray assembly according to one embodiment of the present invention;

Figures 4A and 4B are various views of a dividing assembly according to one embodiment of the present invention;

Figures 5A and 5B are various views of intermodal trays according to a further embodiment of the present invention;

Figure 6 is an isometric view of an intermodal device according to a further embodiment of the present invention;

Figures 7A to 7E are various views of a base plate assembly according to a further embodiment of the present invention;

Figures 8A to 8D are various views of a tray assembly according to a further embodiment of the present invention;

Figures 9A and 9B are various views of a tray assembly according to a still further embodiment of the present invention;

Figures 10A to 10D are elevation views of a dividing assembly according to a further embodiment of the present invention;

Figures 11A and 11B are elevation views of a tray assembly according to a further embodiment of the present invention;

Figures 12A and 12B are elevation views of a tray assembly according to a still further embodiment of the present invention.

Figures 13A to 13F are various views of an intermodal device according to a further embodiment of the present invention;

Figures 14A to 14C are sequential isometric views of a frame for an intermodal device according to a further embodiment of the present invention;

Figure 15 is an isometric view of an end wall of the frame of Figures 14A to 14C;

Figures 16A and 16B are sequential views of a dividing assembly according to a further embodiment of the present invention;

Figures 17A to 17C are isometric views of various components of a dividing assembly according to a further embodiment of the present invention;

Figures 18A and 18B are sequential isometric views of the male divider of Figure 17B;

Figures 19A and 19B are sequential isometric views of the female divider of Figure 17A;

Figure 20 is a detailed view of a dividing assembly according to one embodiment of the present invention.

Figures 21A and 21B are isometric views of a composite intermodal device according a further embodiment of the present invention;

Figures 22A and 22B are isometric and detailed views of connections for composite intermodal devices according to the present invention;

Figures 23A and 23B are various views of a release mechanism for a collapsible intermodal device according to a further embodiment of the present invention;

Figure 24 is an isometric and detailed view of a stacking arrangement for an intermodal device according to a further embodiment of the present invention;

Figure 25 is an isometric and detailed view of a connection arrangement for a dividing assembly according to a further embodiment of the present invention;

Figures 26A and 26B are isometric views of a container arrangement for an intermodal device according to a further embodiment of the present invention;

Figure 27 is an isometric view of an intermodal device according to a still further embodiment of the present invention;

Figures 28A to 28C are isometric sequential views of a collapsing process according to one embodiment of the present invention.

Detailed Description

A first embodiment of the present invention is shown in Figures 1 to 3, 4A, 4B, 5A and 5B and a second embodiment is shown in Figures 6 and 7A to 7C. Various other embodiments are shown in the remaining figures, which may be used with either the first or second embodiments,

Considering firstly the intermodal assembly 5, Figures to 3, 4A, 4B, 5A and 5B shows a standard container unit 10 houses a plurality of trays 20 all of which are size to fit within the container unit 10. Within each tray is a dividing assembly 15 defining an array of recesses for receiving articles for transport, as seen in Figure 3.

The dividing assembly comprises a pair of end panels 40 connected by a series of articulated panels 30. Each articulated panel including a plurality of hinges spaced from each other so as to allow the articulated panel to retract in a concertina fashion. Parallel to the end panels 40 are dividing panels 35. When assembled, and in an extended position with the end panels distal from each other, each of the recesses is arranged to receive product for transport to an end user. The assembly is subsequently sent back to the supplier of the intermodal device for re-use with the transport of a different cargo or range of articles. Alternatively, the intermodal device, including the trays and dividing assemblies may be sold to a supplier of the articles, and so in this instance the various components may be returned accordingly.

The spacing of the hinges is such so as to position a hinge from each articulated panel within each recess. It will be appreciated that the hinge may be a weakened portion of the panel, a portion of the panel having been shaped to fold more readily than other portions of the panel or a pinned assembly. To achieve this, the dividing assembly 15 is retracted so as to be collapsible along the articulated panels 30 so as to close each of the recesses into a package with the end panels brought into proximity to each other, with the entire dividing assembly not significantly larger than the two end panels 40. As shown in Figures 5A and 5B, the trays may be sized so as to fit conveniently within a container unit with the container unit sized to fit within a larger 20-foot or 40-foot container. The walls 47 of the trays 20 are of significant enough strength to withstand stacking of multiple trays and fit together in a manner so as to transfer the axial load through the walls to the tray underneath.

The trays 20 comprise sheets stamped with a pattern so as to form a tray shape having unitary perimeter walls. Consequently on returning the intermodal assembly to the origin, each tray can be flattened into its original single sheet by dis-assembling the tray into its constituent flat sheet. An example of such a flat sheet 120, 125 can be seen in Figure 8A.

Together with the load carrying capacity of the walls 47, the trays in various embodiments displayed collectively or individually, other features. For instance, in a further embodiment, a tray for the intermodal assembly may include projections 45

which engage with trays stacked above so as to prevent or hinder lateral movement of said trays. The trays may further include handles 50 to facilitate loading and unloading. Alternatively, the trays may receive attachable handles, such as rope handles.

The various components of the intermodal assembly according to this embodiment may be manufactured from a range of different materials. Given the lower load bearing capacity of this embodiment, the trays and various parts of the dividing assembly may comprise extruded propylene sheet or closed cell board, such as that commonly referred to as "corriboard". In the latter case, the benefit of increased flexural strength whilst reducing overall weight may add further advantage.

A second embodiment of the intermodal assembly is shown in Figures 6 and 7A to 7E. This embodiment of the intermodal assembly 55 is arranged for heavier loads and so uses a heavier grade tray 60 as compared to that of the previous embodiment. Here the tray 60 comprises a base plate 65 which, in this case, is injection molded from HDPE. Alternatively, the tray may be formed by other methods including blow moulding, spin moulding or the welding of simple sections to form complex shapes. The materials may also vary, such as polypropylene. Selectively mounted through lugs 80 and recesses 85 are walls 75 which include handles 100 in order to lift the tray 60. As mentioned, attachable handles may be provided, including rope or other soft handles.

In this embodiment the walls 75 include a slidable panel 95 which slides relative to connecting panels 90 to aid in the lifting of the tray 60 and to extend the height of the tray.

In a further embodiment, the base plate 65 includes elastic straps 105 which are arranged to stretch and engage distally placed recesses 110 which are shaped to engage the elastic strap 105. This has the advantage of tying down objects as shown in Figure 7C.

The tray 60 of this embodiment is also arranged to receive the dividing assemblies as previously described. Whereas the trays 15 of the first embodiment may be more suitable for smaller or lighter components, the heavier base plate 65 of this embodiment is more suited to heavier components and for instance may be suitable for the automotive or aviation industries where individual components may weigh several kilograms. In a further embodiment, the tray 60 may have a carrying capacity of up to 300 kg. By placing the dividing assemblies onto the base plate as the dividing assembly is non-structural all of the mass of the cargo is supporting by the stackable trays 60.

With reference to the stackability of the trays 60 as shown in Figure 7A, projections 102, 104 are arranged to engage base plates of stacked trays so as to prevent lateral movement and hold the stacked trays as a unit. The projections 102 in the side walls allow for stacking without the extending wall 95 with the projection 104 arranged for

stacking when the middle panel 95 is extended. As shown in Figures 7D and 7E, the base plate 65 may be used without the trays and so placing the dividing assembly 15 directly on the base plate. By using attachable handles, such as soft or rope handles, the base plate and dividing assemblies can be used as a single movable unit. In this instance, the end panels 40, 42 may be of sufficient strength so as to support stacked dividing assemblies 44, or stacked base plates.

In a further embodiment, the base plates may include laterally positioned engagement portions, such as interconnecting lugs and recesses, so as to join multiple base plates into a single larger base plate.

Figures 8A to 8D show an alternative arrangement of the tray of the first embodiment. As seen in Figure 8A, two trays 120, 125 have been dismantled and lie as two flat sheets overlapping 132 so as to align apertures 130. In Figure 8B the trays are re-assembled so as to connect the two trays into one long tray so as to accommodate two dividing assemblies. The two trays are connected not just through the combined aperture 130 but using connectors 140, 145 to assist in binding. It will be appreciated that similar features may be provided so as to re-assemble the sheets along the long edge or the short edge of the respective sheets.

Figures 8C and 8D show a further embodiment of the above joining 142 of trays 138, 136. In this embodiment, the join 142 is achieved through interconnecting 144 portions

146, 147 of the trays so form a reliable joint 142, which may also be selectively disassembled so to create a full tray. Whilst in this embodiment an end to end join is made, a side by side joint may also be made, so as to make the joined tray wider rather than longer.

It will further be appreciated that more than two tray sheets can be joined to form a single tray. In an alternative embodiment, four sheets may be joined end to end and side by side to form a single tray twice the length and twice the width of any of the individual trays.

Figures 9A and 9B show a further embodiment whereby the trays 148, 150 are nestable 155. As shown, in particular, in Figure 9B in this embodiment the trays have inclined walls 160, 165 so as to facilitate nesting. This has the advantage of being able to return the intermodal assemblies to the origin without disassembling the trays. It will be appreciated that depending on the type of material, damage may occur to the tray each time it is disassembled. By providing a nesting embodiment this may increase the longevity of each tray. In a further embodiment, the trays may not be able to be disassembled but are injected molded or blow molded so as to retain their shape. In this embodiment having the inclined walls 160, 165 to facilitate nesting may be particularly advantageous.

Further to the embodiment of Figure 8A and 8B whereby trays are connected so as to increase their size, so too can the individual components of dividing assembly. Figures 10A to 10D show generalized views of the end panel, dividing panel and articulated panel.

In Figures 10A and 10B, each dividing or articulated panel includes projections 190, 195 and apertures 180, 185 in respective panels 170, 175. By engaging 200 the panels 170, 175, the respective projections may be inserted into the respective apertures so as to form a joint 205 extending the length of the panels. In this way, larger dividing assemblies can be created so as to fit with trays of a non-standard size or in the case of Figures 8A and 8B, trays which have been increased in size.

In Figures 10C and 10D, the differing shape of the end panels 188, 192 allow for a modified form of connection 196, whereby the ends of the end panels 188, 192 are brought together 194 and overlapped. A connecting piece 198 may then be used to finish the connection 196. In an alternative embodiment, portions of the panels 188, 192 may be used to interconnect the panels, in a similar fashion to that shown for the tray sheets in Figures 8A to 8D.

Figures 11A and 11B show a further embodiment whereby the walls of a tray 210 are increased in height. Here the standard wall 215 of the tray 210 may include a folded portion 220. When an extension force 225 is applied, the new wall 215, 220 of the tray

210 is of an increased height and therefore is capable of restraining cargo larger than the conventional wall of a conventional tray. Thus, a tray 210 according to this embodiment has the capacity for standard cargo and thus fitting into standard dimensions or alternatively may be selectively extendable so as to accommodate cargo of a different size.

Figures 12A and 12B show an alternative arrangement for increasing the wall height. Here, a tray 230 has a standard wall 235. The intention is to increase the wall height by adding a further panel 240. By providing a plurality of rods or pins 255 spaced along the wall, the upper panel 240 can thread onto the lower panel 235 via the pins 255 so as to create a structurally stable wall for the tray 230.

Figures 13A to 13F show an intermodal device 260 according a further embodiment of the present invention. Here is shown a rectangular device 260 having a perimetric rectangular frame 265 for housing articles for transport. In the embodiment, the intermodal device 260 includes a cover 270 having lifting handles 275 which are articulated so as to fold into corresponding recesses 280. The cover 270 includes hinge components 295 to cooperate with hinge components 300 in the frame 265. In this embodiment, the hinge components 295, 300 are arranged to allow the cover 270 to open for receiving articles into the device 260. The hinge components 295, 300 may also allow for selective disengagement to allow removal of the cover 270 when not required. Figure 13E shows an alternative arrangement whereby the same intermodal

device 260 excludes the cover, which may be an optional when using the device. Figure 13F shows the same coverless device, in the collapsed position.

As shown in Figures 13A to 13F, within the frame 265 is located a selectively removable dividing assembly 290. It will be appreciated that a range of dividing assemblies could be used with the device 260 including the dividing assembly shown in Figure 3. Dividing assemblies, generally, may be collapsible, as is the assembly 290, but may also be fixed in construction and so may not be collapsible. In either case, the dividing assembly includes an array of rectangular storage recesses.

A feature of the intermodal device 260 is the ability of the frame 265 to articulate so as to collapse as shown in Figure 13C. It will be appreciated that the collapsed arrangement shown in Figure 13C may or may not include a dividing assembly which is also collapsible.

Figure 13D shows an exploded view of the intermodal device 260 whereby the cover 270 is shown in relation to the frame 265 which houses the dividing assembly 290. In this embodiment, the dividing assembly 290 comprises components 315 each of which fit within recesses 310 of the base 305 of the intermodal device 260.

To facilitate the tracking requirements for the intermodal device 260, a panel 285 includes a portion to fit an RFID tag. It will be appreciated that the panel 285 may

receive the RFID in an adhesive engagement. Alternatively, the RFID tag may be permanently sealed to the panel 285. It will further be appreciated that the panel 285 may include other means of identification including bar codes, QR codes, powered RFID, GPS and other media both scannable and emitting. In its basic form the frame according to the present invention may include only a top rail, bottom rail and a pair of posts at each corner.

Figures 14A to 14C show the functional arrangement of the frame 265. The frame 265 according to this embodiment, however, comprises two end walls 344 connected by two side walls 342. Each of the walls 342, 344 include a top (or second) rail 320, a bottom (or first) rail 330 and an intermediate (or third) rail 325. At each corner of the frame 265 are located a pair of posts 335. The posts provide structural integrity to the intermodal device by transmitting load applied to the top/second rail 320 to the bottom/first rail 330 and consequently the base. This permits the intermodal device to resist significant applied loads which may result from stacking. For example, an intermodal device as shown in Figures 13A to 13D may have a capacity of 22 kilograms and be designed to stack up to 7 layers in the loaded condition. Accordingly, a bottom most intermodal device may need to resist up to 144 kilograms in this loaded condition. For the purposes of example, an intermodal device according to the present invention may have a length of approximately 700mm and a width of approximately 500mm. It will also be appreciated that different dimensions and weight capacities are possible and still fall within the scope of the present invention.

Returning to Figures 14A to 14C, between each corner are pairs of oblique members 340 with each pair having a first member projecting from the bottom rail to the intermediate rail and a second member projecting from the intermediate rail to the top rail. The oblique members in sliding engagement with the intermediate, or third, rail in the fully extended position shown in Figure 14A, the oblique members 340 are inclined to the parallel rails 320, 325, 330. As the frame 265 collapses, as shown in Figure 14B, the oblique members 340 decrease in the angle relative to the parallel rails. Eventually the oblique members are substantially parallel once the collapsed position as shown in 14C is achieved.

The posts 335 at each corner in the fully extended position of Figure 14A, are a vertical and so at right angles to the parallel rails 320, 325, 330, but as the frame 265 collapses 355, the posts 335 become inclined to a position parallel to the rails by shifting 345 along a slotted hole (not shown) in the top rail. This gradual inclination by the posts 335 is permitted through the pivotal connection of the posts 335 to the bottom rail 330 and the sliding engagement with the top, or second, rail in this case through a slotted engagement with the slotted hole in the top rail 320 permitting the top section of the posts 335 to shift 345 along the top rail 320. As the oblique members 340 shift 350 and posts 335 also shifts 345, the frame 265 consequentially collapses 355 to the collapsed position shown in Figure 14C.

Figure 15 shows an end wall 344 as described in Figures 14A to 14C. Here, the end wall 344 is in the extended position with the slotted holes 334 permitting the shift 350 of the oblique members 340. Further, the slotted hole 332 in the top rail 320 which permits the posts 335 to shift 345 as it pivots about the pivotal connection 331 in the bottom rail 330.

To prevent premature collapse of the frame, the posts 335 may be selectively locked in place by a locking device. Various methods of locking may be achieved including a spring loaded pin located proximate to the respective post. Alternatively, if the various rails are biased to the extended position by a spring or similar in the frame, then the posts 335 may consequently be biased to a vertical position. Further still, the slotted hole 332 may have an extended recess which engages the posts 335 in the vertical position.

The locking arrangement as shown in Figure 15 is different again in which a rod 326 located within the top rail 320 is operated by a spring loaded release 328. The rod includes lugs, at either end of the rod and so located adjacent to each post, which are rotated into a locking position by a spring. Thus on activating the release 328 the rod is rotated to rotate the lugs to allow movement of the posts 335. On activating the release 328 the rod is biased to rotate back to the original position placing the lugs in an interference fit blocking the posts from sliding 345 along the slotted hole. Thus, the

frame remains in the expanded position until the release 328 rotates the lugs to a position to permit the posts 335 to move along the slotted hole 332.

Figures 16A and 16B show an alternative dividing assembly 315. The dividing assembly 315 comprises components 360, 365 which are inter-connected to form rectangular arrays of varying shapes. In the example shown in Figure 16A, the grid is an array of 8x6 square recesses. The modular nature of the components is such that the array size and shape can vary widely in order to accommodate different size freight. A characteristic of the dividing assembly 315, shown in Figure 16A and 16B, is the ability to compress 370, the assembly, in order to achieve a collapsed condition as shown in Figure 16B. The dividers are planar in shape, and each includes male or female connectors on a ridge on the upper edge of the divider. As shown in Figure 17C, a divider may also include both a male and female connector, which may be very useful as an intermediate connecting divider between the male and female dividers.

In concept, the dividing assembly according to the present invention may comprise a plurality of dividers, with each divider cooperatively assemblable with the other dividers to form the dividing assembly. The dividers are also selectively disassemblable, and so for a return journey carrying freight of one type, the dividers may be assembled into an array of a certain shape. On the return leg, the dividers may be disassembled, and re-assembled to form a dividing assembly of a very different configuration to accommodate freight of a different size.

Importantly, each of the dividers are collapsible (such as telescopic). In the assembled form, the dividing assembly is arranged to move from an expanded position to a collapsed position.

Figures 17A to 17C show 3 different types of components which may be used to form a dividing assembly similar to that shown in Figure 16A. The first variety is a female divider 365 shown in Figure 17A. This is a telescopic divider having a leaf spring 420 to bias the component 365 to the expanded condition. Figure 17B shows a male component 360 of similar telescopic construction. In one embodiment, the divider of Figure 17A and Figure 17B may be 3 inches in width at the base element. Figure 17C shows an infill component 362 again of telescopic construction and sized to provide a divider of intermediate dimensions so as to work with the components of Figures 17A and 17B. The infill component, which includes both male and female connectors may be 1 inch in width at the base element, and act as an intermediate divider to assemble a dividing assembly of a non-standard size.

Figures 18A and 18B show the operation of the male divider 360. As previously mentioned the divider 360 comprises a telescopic construction having elements 375 which are arranged to collapse 372 into the collapsed condition shown in Figure 18B.

The male divider 360 is characterized by a male connector 380 on a ridge of the divider arranged to engage the female connector shown in Figures 19A and 19B. The male divider 360 further includes an intermediate female connector 385 to allow for intermediate connections for non-standard sized freight.

Figures 19A and 19B include a female divider 365. Like the male divider having base connections 390, the female divider 365 includes projection 425 in the base so as to engage with apertures in the base of the intermodal device. The female connector 365 is telescopic in construction having elements 395 arranged to collapse 370 into the collapsed condition shown in Figure 19B. The female connector includes a leaf spring 420 for biasing the divider into the expanded position in Figure 19A.

The female divider 365 includes a plurality of female connectors 400, 405 in a ridge on the upper edge of the divider to engage with a plurality of male connectors. The female divider 365 further includes intermediate female connectors 415, similar to that of the male divider 360 for accommodating non-standard arrays to receive non-standard sized freight.

Figure 20 shows an example of a male 360 and female 365 divider assembled into a dividing assembly. The inter-connection of the male and female connectors highlight the versatility of the various components of the dividing assembly which form the intermediate connections also demonstrate the flexibility in producing an array of

different sizes and shapes. In one embodiment, the dividers may be connected so as to form an array of rectangular recesses, such as 8x6, 6x6 etc. The dividers may also be connected so as to form L-shaped recesses and U-shaped recesses.

A further adaptation of the intermodal device according to the present invention is the ability to expand the carrying capacity of the intermodal device in a modular fashion. Figure 21A shows a composite intermodal device 430 being twice the size of a conventional intermodal device. Here, two intermodal devices 435, 440 according to the present invention are connected along a longitudinal edge 445 so as to have a device double the width of a standard sized device. Figure 21B shows an alternative arrangement whereby two standard intermodal devices 450, 455 according to the present invention are joined along the lateral edge 460 to create a composite intermodal device 465 which is twice the length of the standard sized device.

Whilst the arrangements of Figures 21A and 21B show two devices being connected, it will be appreciated that multiple devices can be joined in the same manner, including an array of 2 x 2 devices to form a composite intermodal device 4 times larger than that of a convention device. Other possible arrangements including a 4 x 4 (or larger) arrangement, a 3 x 1 or 1 x 3, so as to make the composite device 3 (or more times) wider or 3 (or more) times longer. Other shapes may also be useful, for instance an L-shaped composite device.

Figures 22A and 22B show the connection details to construct the composite intermodal device 430. The example given in Figures 22A and 22B is for the joining along the longitudinal edge. It will be appreciated that the same type of attachment detail can be utilized so as to connect along the lateral edge, so as to construct the alternative composite device 465.

The conventional connection detail for the frame of an intermodal device according to the present invention is at the corners. As shown in Figure 22A the various rails 475, 480, 485 must be adapted so as to connect linearly rather than at the corner. By providing the insert 490 the rails are able to connect and function as single linear members. The loss of the second posts at the corner is replaced by the corresponding posts 470 of the joined intermodal device. At the base 465 of the composite intermodal device 430, the corresponding bases 495, 500 are connected, in this embodiment, by plugs 505 along the longitudinal interface. It will be appreciated that the number of plugs or dowels, and their corresponding size will be designed so as to accommodate any shear force that exists during the operation of the composite intermodal device 430.

As discussed, with reference to Figure 15, Figures 23A and 23B provide further detail as to a locking mechanism according to one embodiment of the present invention. Here, an end wall 510 includes a release 515 which comprises a button 520 connected 525 to a rod 535. At either end of the rod 535 are lugs 530 which are positioned adjacent to the corner posts. On depression 550 of the button 520 the connection 525 rotates 545 the

rod 535 so as to position the lug clear of the posts, and thus allow the posts to slide along the slot and consequently permitting the intermodal device to move from the expanded position to the collapsed position.

Figure 24 shows two intermodal devices 555, 560 stacked one upon the other. The detail shows the base 565 of the top device 555 interlocking with the top rail 570 of the lower device 560. The engagement between the base 565 and the top rail 570 show a low tolerance fit when placing the devices directly upon each other but an interference fit preventing lateral sliding of the devices relative to each other. Thus, once in the stacked position the stack tends to act as a single unit preventing damage through toppling of the stack.

As mentioned with reference to the dividing assembly, Figure 25 shows the connection detail between the components 575, 580 of the dividing assembly and the base 585. It can be seen that the components 575, 580 include projection 590, 595 which engage with apertures in the base so as to hold the dividers in place. It will be appreciated that a range of different connection details are possible with the press fit arrangement of Figure 25 being just one.

Figure 26A shows a container arrangement 600 whereby a plurality of intermodal devices 605 are stacked 610 into the containers ready for transport. It will be noted that in this embodiment the devices 605 are sized so as to fit to a high tolerance within the

container 600 further adding to the modularity of the system. In this case the devices 605 can fit 28 within the container 600, with the bottom most layer hidden below the ridge of the container.

Figure 26B shows the result of the return journey whereby the same container 600 now includes a stack 625 of collapsed devices 615. The engagement between the base and top rail exists in the collapsed condition also and thus a high stack 625 of the collapsed devices 615 is possible and thus resulting in a practical system of reuse of the devices providing both an environmental and economic advantage through reuse as well as efficient transport of the used devices 615.

Figure 27 shows an alternative intermodal device 630 having pivotally connected walls 635, 640, a clearance zone below the wall pivot and a base 650. The intermodal device 630 is arranged to receive dividing assemblies as previously described. The embodiment shown in Figure 27 includes the dividing assembly as described with reference to Figures 16A and 16B.

Figures 28A to 28C show the operation of the intermodal device 630 whereby when used together with the dividing assembly of Figure 16A, the dividing assembly is compressed 635 so as to collapse the dividing assembly into the clearance zone 645 within the intermodal device 630. The longitudinal pivotal walls 635 is then folded 660 inwards so as to lay flat upon the dividing assembly 610. Subsequently the end pivoted

wall 640 is folded inwards 665 so as to lay flat on the longitudinal folded wall. In this position the folded walls may be locked in place so as to maintain the dividing assembly in the collapsed position. It will be appreciated that the intermodal device may include a cover to overlay the intermodal device so as to protect the freight from dust, damage, moisture etc. In this case, an alternative arrangement may include the cover, which may be used if the dividing assembly 610 does not have an inherent capacity to remain in the collapsed position. Further still the dividing assembly 610 can remain in a collapsed position by strapping, taping or otherwise securing the intermodal device in the collapsed position. Further still the dividing assembly 610 may include members that loop over the components of the dividing assembly 610 and engage with the apertures in the base so as to hold the dividing assembly in the collapsed position.

WE CLAIM:

1. An intermodal assembly comprising a plurality of trays, each tray having a removable dividing assembly, said dividing assembly comprising;

a pair of end panels, a plurality of dividing panels parallel to the end panels and a plurality of articulated panels perpendicular to the end and dividing panels;

said panels interconnected to form an array of recesses to receive articles;

wherein each articulated panel includes a plurality of spaced hinged portions; ;

such that the dividing assembly is arranged to retract from an expanded position with the end panels distal from each other, for receiving the articles, to a retracted position such that the end panels are proximate to each other.

2. An intermodal device comprising

a base;

a perimetric rectangular frame;

the frame comprising a first rail mounted to the base, a second rail in spaced relation to the first rail and a plurality of posts connecting the first and second rail;

the posts being pivotally mounted to the first rail and in sliding engagement with the second rail;

wherein the posts are arranged to slide along the second rail to a position parallel to the rails, the frame arranged to move from an expanded position to a collapsed position as a result of the movement of the posts.

3. The intermodal device according to claim 2, wherein the post moves from a position at right angles to the first and second rails to the position parallel to the rails

4. The intermodal device according to claim 2, further including:

a third rail intermediate the first and second rail, and;

a plurality of oblique members arranged in pairs;

such that a first oblique member projects from the first rail to the third rail and a second oblique member projects from the second rail to the third rail, said oblique members in sliding engagement with the third rail and pivotally mounted to the respective first and second rails.

5. The intermodal device according to any one of claims 2, further including a locking device associated with each post, said locking device arranged to lock the post in the right angle position;

the locking device selectively releasable from a locked position to a release position such that the posts are movable to the parallel position, the locking device resiliently biased to the locked position.

6. The intermodal device according to any one of claims 2, wherein the sliding engagement between the post and the second rail includes a slotted hole in the second rail into which the post is coupled.

7. The intermodal device according to any one of claims 2, wherein the intermodal device is arranged to receive a dividing assembly having an array of rectangular storage recesses.

8. The intermodal device according to claim 7, further including a cover in hinged engagement with the second rail and arranged to cover the dividing assembly.

9. The intermodal device according to any one of claims 2, wherein the first rail includes projections on a base of the first rail arranged to cooperatively engage with projections on the second rail so as to prevent lateral movement of the intermodal assemblies when stacked.

10. The intermodal device according to any one of claims 2, wherein the perimetric frame is arranged to be selectively disassembled into four walls.

11. The intermodal device according to claim 10, further including connecting holes along at least one side of said base, said holes arranged to receive a dowel so as to connect the intermodal device to a second intermodal device.

12. An intermodal device comprising:

a rectangular base;

four walls arranged around the periphery of the base;

each of said walls in pivotal engagement, so as to selectively fold inwards into a space defined by said walls.

13. The intermodal device according to claim 12, wherein said walls are pivotally connected to a perimetric wall mounted to said base, such that on folding inwards, the base, perimetric wall and folded walls define a clearance zone.

14. The intermodal device according to claim 12, wherein said intermodal device is arranged to receive a collapsible dividing assembly.

15. The intermodal device according to claim 14, wherein the intermodal device is arranged to contain said collapsible dividing assembly in the clearance zone.

16. A dividing assembly for an intermodal device, the dividing assembly comprising:

a plurality of dividers, said dividers cooperatively assemblable to form the dividing assembly and selectively disassemblable; each of said dividers being telescopic, such that in the assembled form the dividing assembly is arranged to move from an expanded position to a collapsed position.

17. The dividing assembly according to claim 16, wherein each divider is telescopic.

18. The dividing assembly according to claim 16, wherein each divider includes a male connector and/or female connector so as to be assembled and disassembled.

19. The dividing assembly according to any one of claims 16, wherein said dividers arranged to be assembled into an assembly having an array of recesses.

20. The dividing assembly according to any one of claims 16, wherein each divider includes a either a male connector, a female connector or both a female and male connector.

21. The dividing assembly according to claim 20, wherein either the male or female divider includes a spring, said spring arranged to bias the divider into the expanded position.

22. The dividing assembly according to claim 21, wherein the female divider includes the spring.

23. The dividing assembly according to any one of claims 16, wherein the dividers are planar components.

24. The dividing assembly according to any one of claims 18, wherein the male and female connectors are located on a ridge, said ridge positioned such that when the dividing assembly is in use, the ridge is on an upper edge of the divider.

25. The dividing assembly according to any one of claims 16, wherein the dividers include projections in a base of the divider, said projections arranged engage corresponding apertures in a base on the intermodal device.

Dated this 30th day of January, 2018

MOHAN DEWAN
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APPLICANT'S PATENT ATTORNEY

TO,
THE CONTROLLER OF PATENTS
THE PATENT OFFICE, AT MUMBAI

ABSTRACT

INTERMODAL DEVICES AND METHODS

An intermodal device comprising: a base; a perimetric rectangular frame; the frame comprising a first rail mounted to the base, a second rail in spaced relation to the first rail and a plurality of posts connecting the first and second rail; the posts being pivotally mounted to the first rail and in sliding engagement with the second rail; wherein the posts are arranged to slide along the second rail from a position at right angles to the first and second rails to a position parallel to the rails, the frame arranged to move from an expanded position to a collapsed position as a result of the movement of the posts.

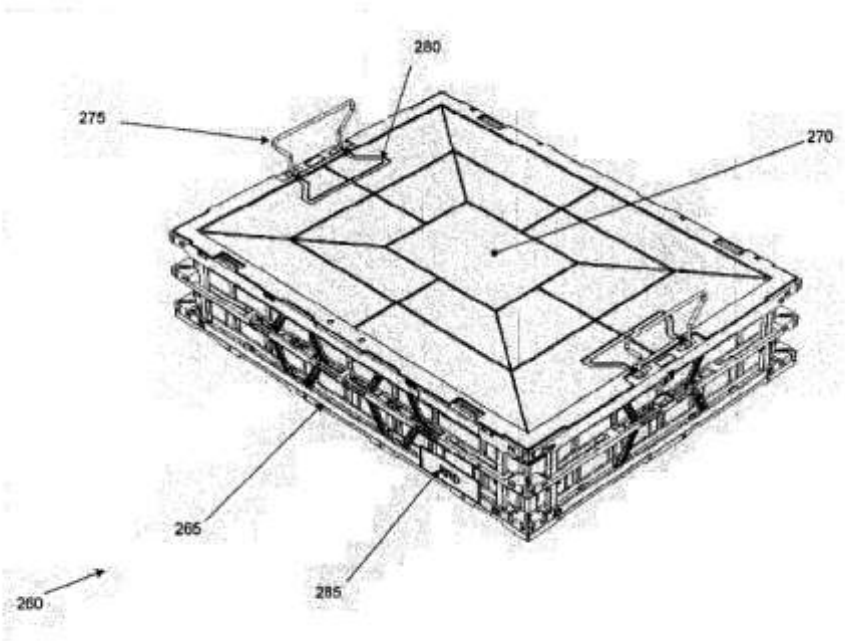

Figure 13A