(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 May 2009 (07.05.2009)

PCT

(10) International Publication Number
WO 2009/056925 A2

(51) International Patent Classification: Not classified

(21) International Application Number:
PCT/IB2008/002546

(22) International Filing Date:
29 September 2008 (29.09.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/985,202 3 November 2007 (03.11.2007) US
12/202,235 30 August 2008 (30.08.2008) US

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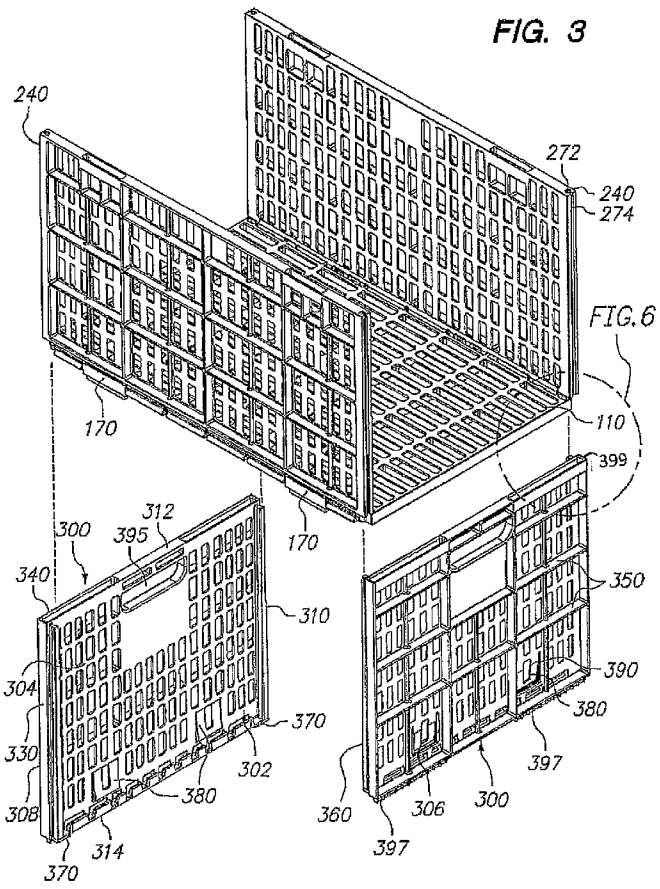
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

(54) **Title:** ARTICULATE COLLAPSIBLE MODULAR CONTAINER

FIG. 3



(57) **Abstract:** An articulate modular collapsible storage container according to one embodiment includes a base plate and a pair of side panels that are detachably and pivotally coupled to the base plate along the sides thereof. The side panels are pivotal between an unlocked position where the side panels can be freely removed and a locked position where the side panels are coupled to the base plate. The container also includes a pair of end panels that are slidingly coupled to the side panels when the side panels are in the locked position. The end panels and side panels form upright walls of the container, and the end panels are slidingly disengageable from the side panels to allow the side panels to pivot to the unlocked position, thereby allowing disassembly of the container.

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ARTICULATE COLLAPSIBLE MODULAR CONTAINER

Cross Reference to Related Application

The present application claims the benefit of U.S. patent application serial No. 60/985,202, filed November 3, 2007, which is hereby incorporated by reference in its entirety.

Technical Field

The present invention relates to boxes and storage containers in general and in particular, to modular collapsible boxes which are articulately assembled from loose panels.

Background

There are considerable needs for all different types of storage and transport containers used for logistic transport and storage of a variety of goods and items. At the present time, many boxes or containers used in the transport of goods, including staple goods, are made from plastic or another type of material and have fixed or rigid structures and it is not possible to disassemble them. To a lesser extent, these structures can be folded or unfolded. Containers in the form of a carton that is formed of a paper material are provided with folds that permit them on the one

hand to be unfolded to a defined body, yet the containers cannot be assembled by their parts. In addition, due to the characteristics of the materials used to make these containers, only dry goods can be stored therein and the material deteriorates rapidly while aging, thus becoming useless in a relatively short time.

Two of the more common storage containers are container crates and boxes. Conventional boxes are typically made of either metal, wood, plastic or cardboard and their common feature is usually that these structures have been designed for a single assembly event or cycle after which the structures retain their form for a prolonged period. For the majority of container types, a benefit of reduced cost of ownership can be derived from their efficient re-use. Another type of container that is available is a modular collapsible box which enables multiple assembly, disassembly and re-assembly cycles. Such containers have been developed and deployed in order to save storage or transport space when empty. Generally, conventional modular collapsible boxes that are publicly available can be grouped into two types, namely, (1) foldable and un-foldable boxes that have holding and locking details; and (2) articulately assembled boxes joined by add-on parts.

There are a number of deficiencies that are associated with conventional containers of the non-collapsible type. In particular, non-collapsible containers require the same storage space for empty and for full containers. Also, non-collapsible containers dictate inefficient transport of empty containers on packing supply runs and on return trips, thereby narrowing the opportunities for economical re-use of packaging which is desirable from environmental considerations.

Collapsible containers have their own associated disadvantages in that these types of containers are complex and typically require additional connecting parts or complex configurations each of which incurs extra manufacturing cost. Moreover, prior art collapsible containers are limited in their load carrying capacity. Typically, the connecting parts determine the load carrying capacity of the assembly. The connection areas of prior art collapsible containers are typically critical to the overall configuration and damage to these connection areas when they are exposed can well render the entire container useless. The container therefore must be discarded and replaced which adds to the overall cost.

Summary

An articulate modular collapsible storage container according to one embodiment includes a base plate and a pair of side panels that are detachably and pivotally coupled to the base plate along the sides thereof. The side panels are pivotal between an unlocked position where the side panels can be freely removed and a locked position where the side panels are coupled to the base plate. The container also includes a pair of end panels that are slidingly coupled to the side panels when the side panels are in the locked position. The end panels and side panels form upright walls of the container, and the end panels are slidingly disengageable from the side panels to allow the side panels to pivot to the unlocked position, thereby allowing disassembly of the container.

A method of constructing an articulate modular collapsible container that is formed of a base plate, a pair of side panels and a pair of end panels, includes the steps of: attaching the side panels to opposing sides of the base plate such that the side panels can pivot between an unlocked position where the side panels can be freely removed from the base plate and a locked position in which the side panels are in an upright position; and slidingly mating first locking members that are formed as part of the end panels with second locking members that are formed at ends of the two opposing upright side panels resulting in the end panels being securely attached to the side panels and the side panels and end panels define four upright walls of the container that are disposed around the base plate.

These and other aspects, features and advantages shall be apparent from the accompanying Drawings and description of certain embodiments of the invention.

Brief Description of the Drawings

Fig. 1 is a top, side and end perspective view of an articulate collapsible modular container according to one embodiment;

Fig. 2 is a top, side and end perspective view of a base plate and side walls of the container of Fig. 1;'

Fig. 3 is an exploded top, side and end perspective view of a pair of end walls for coupling with the side walls and base plate;

Fig. 4 is a cross-sectional view taken along the line 4-4 of Fig. 1;

Fig. 5 is a close-up perspective view of an identified portion of Fig. 2;

Fig. 6 is a close-up perspective view of an identified portion of Fig. 3; and

Fig. 7 is a top perspective view of a corner of a base plate.

Detailed Description of Certain Embodiments of the Invention

In a first embodiment of the present invention, an articulate modular collapsible container 100 (e.g., a crate) is provided and illustrated in Figs. 1-7. The container 100 is formed of a number of different components that are coupled together to form the assembled container 100 shown in Fig. 1. More specifically, the container 100 is formed of a base plate 110, a pair of side walls or panels 200 and a pair of end walls or panels 300 that when all coupled to one another form a container 100 that is open along one side and defines an internal compartment or cavity 102 for receiving and storing one or more objects. In other words, the container 100 is made up of a number of loose panels that are assembled together to form a box type container. It will also be appreciated that while the container 100 of Figs. 1-7 does not include a top cover, the use of a top cover (panel) is optional, thereby allowing a user to construct a completely closed box type

container. As described in detail below, one of the features of the container 100 of the present invention is that is modular and easily collapsible in nature and the panels are assembled to one another in a simple yet highly effective manner that does not require any additional components or special tools. The container 100 can be easily disassembled for compact storage until further use.

The base plate 110 has a support surface 112 that includes a first surface or face 114 that in this case represents a floor (bottom external surface) of the assembled container 100 and an opposite second surface or face 116 (which is the bottom interior surface of the assembled container 100). The base plate 110 further includes a first end 118 and an opposite second end 120, as well as a pair of opposing sides 122, 124. The shape and dimensions of the base plate 110 can vary depending upon the particular application. In the illustrated embodiment, the base plate 110 has a rectangular shape with a length of the ends 118, 120 being less than a length of the sides 122, 124. In the illustrated embodiment, the base plate 110 is not a continuous solid structure but instead, the base plate 110 has a grid or grate-like structure that includes a number of through openings or slots (eyelets) 130 that pass therethrough.

At the ends 118, 120, the base plate 110 is defined by a pair of end walls 140 and at the sides 122, 124, the base plate 110 is defined by a pair of side walls 150. The support surface 112 is joined to upper edges of the side and end walls 140, 150 and therefore, when the base plate 110 is laid on a flat surface, the support surface 112 is elevated therefrom as a result of the side and end walls 140, 150. The base plate 110 further includes a plurality of support members (e.g.,

transverse beams or stiffener ribs) 160 that extend across between either the two side walls 140 and/or the two end walls 150. For example, in the illustrated embodiment, there is a plurality of support members (ribs) 160 that extend between the side walls 140 and are integrally connected to the second surface 116 of the support surface 112. Support members 160 can also extend between and be integrally connected with end walls 150 in which case the support members 160 extending between the side walls 140 and the ones extending between the end walls 150 intersect. In any event, the support members 160 do not extend across any of the openings or slots 130 formed in the support surface 112. In this manner, an open grid-like and relatively rigid structure is formed with the slots 130 being formed in rows and columns.

The support members 160 serve to structurally reinforce the entire base plate 110 and allow the support surface 112 to be a load bearing surface since the support members 160 which structurally connect the support surface 112 to the side and or end walls 140, 150. The support members 160 serve as stiffener ribs which aid in withstanding loads, mainly bending loads.

The base plate 110 also can include a number of other structural support members. For example, the base plate 110 can include a plurality of feet- like support tabs 170 that are formed along the sides 114, 116 of the base plate 110. These parts serve as mating parts to opposite cavities 179 in another box in order to enable accurate and stable stacking of multiple boxes one on top of the other. In the illustrated embodiment, there are two support tabs or feet 170 formed in spaced relation along each side 114, 116. Unlike the slots 130, the support tab 170 does not include a through opening but it is positioned in the same row and column format

as the slots 130 and therefore, there are slots 130 surrounding the support tab 170. The two support tabs 170 are formed proximate the ends 118, 120 of the base plate 110 and in particular, there is one slot 130 between the support tab 170 and end 118 and one slot 130 between the other support tab 170 and end 120, with a plurality of slots 130 being formed between the two support tabs 170.

The support tab 170 has a lower portion 172 that extends below a bottom edge of the side wall 140 and therefore, the lower portion 172 defines a foot on which the base plate 140 can be supported. As shown in the cross-sectional view of Fig. 4, the lower portion 172 is in the form of a tapered portion that has a bottom wall 174 that can act as a ground contacting surface when the base plate 110 is laid on the ground. The support tabs are formed with tapered walls to enable accurate blind mating with matching cavities 179 in the upper tip lip of another box which is positioned under the current box.

In addition, each corner of the base plate 110 can include a keyed opening 180 as shown in Fig. 7. The keyed opening 180 is open along one end 118, 120 of the base plate 110 and is closed along the side 114, 116. The keyed opening 180 has a central portion 182 that in the illustrated embodiment has a square shape and a slot 184 that opens into the central portion 182. The slot 184 is formed along the end 118, 120.

It will be appreciated that the base plate 110 can be formed as a single integral part. For example, the base plate 110 can be formed as a single molded plastic part. It will be further appreciated that the base plate 110 can be formed as a molded plastic part of essentially unitary

thickness which enables the use of economic flat molds without protrusions which would otherwise have required substantial increasing of the volume of the mold material.

The side wall or panel 200 is designed to engagingly mate with the base plate 110 and in particular, the side wall 200 pivotally mates with the base plate 110 such that the side panel 200 can pivot between a generally horizontal position and a generally vertical position relate to the base plate 110 and as shown in Fig. 2.

The side panel 200 has a support surface 202 that includes a first surface or face 204 that in this case represents an inner side wall of the assembled container 100 and an opposite second surface or face 206 that represents an outer side wall. The first surface 204 is preferably a smooth, planar surface. The side panel 200 further includes a first end 208 and an opposite second end 210, as well as a pair of opposing sides 212, 214. The shape and dimensions of the side panel 200 can vary depending upon the particular application. In the illustrated embodiment, the side panel 200 has a rectangular shape with a length of the ends 208, 210 being less than a length of the sides 212, 214. In the illustrated embodiment and similar to the base plate 110, the side panel 200 is not a continuous solid structure but instead, the side panel 200 has a grid or grate-like structure that includes a number of through openings or slots 220 that pass therethrough.

At the ends 208, 210, the side panel 200 is defined by a pair of end walls or edges 230 and at the sides 212, 214, the side panel 200 is defined by a pair of side walls or edges 240. The support surface 202 is joined to edges of the side and end walls 230, 240. The end and side walls

230, 240 thus define a perimeter of the side panel 200 with the grid-like arrangement of openings 220 being formed therebetween. As shown in Fig. 2, the side panel 200 further includes a plurality of support member (e.g., transverse beams which serve as stiffener ribs) 250 that extend between either the two side walls 230 and/or the two end walls 240. For example, in the illustrated embodiment, there is a plurality of support members (ribs) 250 that extend between the side walls 230 and end walls 240 and are integrally connected to the second surface 206 of the support surface 202. In any event, the support members 250 do not extend across any of the openings or slots 220 formed in the support surface 202. In this manner, an open grid-like structure is formed with the slots 220 being formed in rows and columns. When the container 100 is assembled, the support members 250 face outwardly.

The support members 250 serve to structurally reinforce the entire side panel 200 in case the support surface 202 becomes a load bearing surface, mainly by negotiating bending loads. It will be appreciated that the support members 250 that extend between the side walls 230 can be different from the support members 250 that extend between the end walls 240. In addition, most of the slots 220 can have a uniform shape and size; however, there can be some slots 220 that have a different shape and size.

The side panel 200 includes several features that permit it to be securely assembled to the other components of the container 100 and in particular to the base plate 110 and to the end panels 300. For example, the side panel 200 includes a plurality of hook members 260 that allow the side panel 200 to be coupled to the base plate 110 in a pivotal manner. The hook members

260 are formed along one side wall 230 of the side panel 200 and extend outwardly therefrom. As best shown in Fig. 5, the hook members 260 have an arcuate or hook shape. The hook member 260 is generally C-shaped or U-shaped or even L-shaped such that an opening or space 262 is formed between a free end 264 of the hook member 260 and the side wall 230 from which the hook member 260 extends. The hook member 260 is thus integrally attached to the side wall 230 at an end opposite the free end 264. The opening or space 262 is formed in a direction away from the first face (inner face) 204 of the support surface 202. In other words, the hook member 260 curves outwardly away from the side wall or edge 230 and then down toward the second surface 206 of the support surface 202.

The hook members 260 are strategically and purposely formed at locations that align with and match up with openings (reinforced receptacles/eyelets) 131 of the base plate 110 when the side panel 200 and base plate 110 are mated together. This allows each hook member 260 to be received into a corresponding opening 131. Accordingly, the hook member 260 is sized to be received into the opening 131. The width of the hook member 260 is thus at least slightly less than the width of the opening 131.

Since the support tab 170 does not have an opening through which the hook member 260 can extend, there is no corresponding hook member 260 along the section of the side panel 200 that matches up wit the support tab 170 when the side panel 200 and base plate 110 are coupled to one another. As shown in Figs. 2 and 5, the hook members 260 are arranged in clusters at spaced intervals along the side wall 230. For example, there is a first single hook member 260

that is positioned near one corner of the side panel 200 near one end wall 240 and similarly, there is a second single hook member 260 that is positioned near another corner near the opposite end wall 240 and at the other end of the same side wall 230. In between these two single hook members 260, there is a plurality of hook members 260 that form a single group. The hook members 260 are all axially aligned and are spaced along the side wall 230 with gaps 265 being formed between adjacent hook members 260. For example, there can be four hook members 260 formed along the side wall 230 with gaps 265 formed therebetween. The gaps or slots 265 between adjacent hook members 260 permit the individual hook members 260 to be received into individual openings 131. Since each opening 131 is defined by end walls that separate one opening 131 from the adjacent one, the slot 265 has dimensions complementary to the end wall to permit two adjacent hook members 260 to be received into two adjacent openings or slots 131.

As shown in Fig. 1, each opening 131 formed along the side wall of the base plate 110 receives one hook member 260 and the two support tabs 170 formed along the side wall do not receive any hook members 260. In other words, there are no empty openings 131 formed along the side wall of the base plate 110 when the container 100 is assembled.

As best shown in Figs. 3 and 6, each of the end walls 230 of the side panel 200 also includes a keyed channel or locking groove 270. In particular, the locking channel 270 extends along the length of the end wall 230 from one end to the other end and the same for end wall 210. The locking channel 270 has a shape that is complementary to the keyed opening 180 and more specifically, when the side panel 200 is placed in a vertical position as shown in Figs. 3 and 6,

the keyed opening 180 is axially aligned with the locking channel 270. As a result, the locking channel 270 is open along one side of the side panel 200 and is closed along the other sides. Each side panel 200 has two channels 270 one end walls 230 and 210.

In other words, the keyed locking channel 270 has a central portion 272 that in the illustrated embodiment has a square shape and a slot 274 that opens into the central portion 272. The slot 274 is thus open along a face that faces outwardly away from the side panel 200. As a result, the assembled container 100 has four locking channels 270 that are located in the four corners of the container 100 with each side panel 200 containing two locking channels 270. The locking channels 270 are open at least at its bottom end and preferably at both ends and therefore, a complementary shaped object can be received in the locking channel 270 and can slidingly travel therein along the length of the channel 270 which represent a vertical height of the side panel 200 when it is placed in its assembled position of Fig. 1.

It will be appreciated that the side panel 200 can be formed as a single integral part. For example, the side panel 200 can be formed as a single molded plastic part. It will be further appreciated that the side panel 200 can be formed as a molded plastic part of essentially unitary thickness which enables the use of economic flat molds without protrusions which would otherwise have required substantial increasing of the volume of the mold material.

While not shown, the side panels 200 an include a pair of enlarged openings that represent handle openings to allow a person to grasp and pickup the assembled container 100.

The end walls or panels 300 complete the container 100 and when coupled to side panels 200 and the base plate 110, the end panels 300 close off the ends of the container 100 and create the box-like structure of the container 100 that is open along one face. The end panel 300 has a support surface 302 that includes a first surface or face 304 that in this case represents an inner side wall of the assembled container 100 and an opposite second surface or face 306 that represents an outer side wall. The end panel 300 further includes a first end 308 and an opposite second end 310, as well as a pair of opposing sides 312, 314. The shape and dimensions of the end panel 300 can vary depending upon the particular application. In the illustrated embodiment, the end panel 300 has a rectangular shape with a length of the ends 308, 310 being less than a length of the sides 312, 314. In the illustrated embodiment and similar to both the base plate 110 and the side panel 200, the end panel 300 is not a continuous solid structure but instead, the end panel 300 has a grid or grate-like structure that includes a number of through openings or slots 320 that pass therethrough.

At the ends 308, 310, the end panel 300 is defined by a pair of end walls or edges 330 and at the sides 312, 314, the end panel 300 is defined by a pair of side walls or edges 340. The support surface 302 is joined to edges of the side and end walls 330, 340. The end and side walls 330, 340 thus define a perimeter of the end panel 300 with the grid-like arrangement of openings 320 being formed therebetween. As shown in Figs. 1 and 3, the end panel 300 further includes a plurality of support member (e.g., transverse beams which serve as stiffener ribs) 350 that extend between either the two side walls 330 and/or the two end walls 340. For example, in the illustrated embodiment, there is a plurality of support members (ribs) 350 that extend between

the side walls 330 and end walls 340 and are integrally connected to the second surface 306 of the support surface 302. In any event, the support members 350 do not extend across any of the openings or slots 320 formed in the support surface 302. In this manner, an open grid-like structure is formed with the slots 320 being formed in rows and columns. When the container 100 is assembled, the support members 350 face outwardly to allow the smooth first face to face inward.

The support members 350 serve to structurally reinforce the entire end panel 300 in case the support surface 302 becomes a load bearing surface mainly by opposing bending loads. It will be appreciated that the support members 350 that extend between the side walls 330 can be different from the support members 350 that extend between the end walls 340. In addition, most of the slots 320 can have a uniform shape and size; however, there can be some slots 320 that have a different shape and size.

It will be appreciated that the end panel 300 can be formed as a single integral part. For example, the end panel 300 can be formed as a single molded plastic part. It will be further appreciated that the end panel 300 can be formed as a molded plastic part of essentially unitary thickness which enables the use of economic flat molds without protrusions which would otherwise have required substantial increasing of the volume of the mold material.

The end walls 300 also include a pair of locking members 360 in the form of locking rails that are complementary to the locking channel 270 of the side panels 200 and keyed opening 180 and therefore, the locking rails 360 can be received therein and slidingly travel therein. As best

shown in Figs. 3 and 6, the locking member 360 is in the form of a protrusion that extends outwardly from the first face (inner face) 304 of the support surface 302 of the end panel 300. The locking rails 360 are formed at or proximate the ends of the end panel 300.

The locking rail 360 includes a body 362 and a neck portion 364 that connects the body 362 to the end panel 300. The neck portion 364 has dimensions (width) that are less than the dimensions (width) of the body 362. In the illustrated embodiment, the body 362 has a generally rectangular cross-sectional shape and the neck portion 364 has a generally square cross-sectional shape. The body 362 has a shape that is complementary to the shapes of the central portion 182 of the keyed opening 180 in the embodiment where the base plate 110 includes the keyed opening 180 and the central portion 272 of the locking channel 270 such that the body 362 can be received within the portions 182, 272 and ride therein within the axially aligned channel. When the base plate 110 does not include the keyed opening 180, there is an empty space in the corners of the base plate 110 where the bottom of the locking channel 270 can be accessed. The body 362 therefore can have dimensions that are slightly less than the dimensions of the central portions 182, 272 so that a snug fit results. The neck portion 364 is sized to be received within the slots 184 and 274. Thus, when the locking rail 360 is received within the neck portion 364 extends through one of the slots 184, 274 depending upon the position of the end panel 300. This keying between the end panel 300 and the side panel 200 and the base plate 110 locates and aligns the end panel 300 relative to the other panels and securely locks all panels together. The fit between the locking rail and the locking openings is such that the rail can only enter the locking openings when it is in one position and once the locking rail is located in the locking

openings or slots, the degree of movement, other than vertical, between the end panel and side panel is minimal.

It will therefore be understood that the locking rail is a male locking feature and the locking openings is a female locking feature that is complementary to the male locking feature. In order to have a robust design, the length of the locking rail is only slightly less than the length of the locking channel or opening in the side panels 200 so that substantially the entire length of the locking channel contains the locking rail seated in place.

The locking rails 360 are vertical rails that extend at least substantially the height of the end panel 300. When the locking rail 360 is received in the keyed opening 180 and the locking channel 270, the rail 360 is fully captured and contained and cannot be removed therefrom by lateral movement of the locking rail 360.

In addition, it will be appreciated that the locking rail 360 can have a tapered body in that the dimensions of the body 362 vary along the length of the locking rail 360. The tapered body of the locking rail 360 is a load bearing feature to permit the container 100 to effectively bear loads. For example, the locking rail 360 can have an outward taper such that the top of the locking rail 360 has a smaller cross-section than the bottom of the locking rail 360. When locking rail 360 has a tapered construction, the complementary channel 270 also has a tapered construction that allows the locking rail 360 to mate with the channel 270 and slidingly travel therein for at least a prescribed distance.

The end panel 300 also can include a stop or support tab 370 that is designed to carry load by limiting the degree of travel of the end panel 300 relative to the side panels 200 when the panels of the container 100 are assembled as described below. The stop or support tab 370 is simply an enlarged area of material that surrounds the locking rail 360 at one end thereof. The stop 370 can thus be in the form of a flange or fin that extends outwardly (e.g., perpendicularly) from the first face 304 of the support surface 302. The locking rail 360 extends upwardly from the support tab 370 and therefore, when the end panel 300 is assembled to the other parts, the support tab 370 represents the bottommost part of the end panel 300 and in fact, represents the bottommost part of the entire container 100. The stop or support tab 370 can be formed in the same molding operation that forms the locking rail 360.

The end panel 300 can also include one or more flexible tab portions 380 that are formed along the support surface 302 thereof. The flexible tab portions 380 serve as locking parts and each tab portions 380 is defined in a cell that is defined along the support surface of the end panel 300. A cell is defined between vertical and horizontal structural members that intersect one another to define a contained area whose perimeter is defined by the vertical and horizontal members. As shown in the figures, the cells of the panels that are used to make the container 100 are typically either rectangular or square shaped. The tab portion 380 is fully contained with a cell and is formed by a through opening or slot 390 that is formed in the support surface 302. In the illustrated embodiment, the slot 390 has a U-shape and the tab 380 therefore also has a U-shape defined between the slot 390.

The formation of the slot 390 creates a flexible tab 380 in that if a force is applied on the tab against the support surface 302 (e.g., a force perpendicular to the second surface 306 of the support surface 302), the tab 380 can flex inwardly toward the first surface 304 of the support surface 302 and toward the interior compartment of the container 100 when the container is fully assembled.

In yet another embodiment, the end panel 300 is constructed to slide upwards relative to the side panels and base plate 110 only in part of its length. For example, two different types of engagement can be provided so that the end panel 300 can only partially travel within and along a length of the complementary locking channel. To accomplish this, for example, a comb-type engagement can be combined with a sliding engagement resulting in the end panel 300 sliding upward only in part of its length.

The end panels 300 can also include a handle 395 that is formed along or near a top edge of the end panel 300. The handle 395 can simply be in the form of an opening or slot that allows a person to easily grasp and lift and move the container 100. Preferably, the handle will pull a wall have a male mating rail.

Each panel 300 can include at least one feature that permits stacking of multiple containers 100 and in particular, each end panel 300 can include one or more cavities 399 that are similar to cavities 179 in that they receive complementary mating parts in another container 100 in order to enable accurate and stable stacking of multiple containers 100 one on top of the other.

The bottom edge of the end panel 300 defines the ground contacting points or sections of the end panels 300 when the container 100 is assembled as shown in Figs. 1 and 4. The bottom edge of the end panel 300 also defines mating parts for enabling the stacking of containers. For example, the bottom edge of the end panel 300 includes ribs or feet 397. In the illustrated embodiment, each end panel 300 includes a first set of ribs 397 and a second set of ribs 397, which enable blind mating with opposite cavities 399 in another container in order to achieve precise and stable stacking of a plurality of containers. The first set of ribs 397 is formed in one bottom corner of the end panel 300 and the second set of ribs 397 is formed in the other bottom corner of the end panel 300. Between the two sets of ribs 397, there is a central space where there are no ribs. The ribs 397 thus provide stability to the entire container 100 since each corner of the container 100 is supported. When the panels are assembled, the ribs 397 are located below the bottommost portions of the other panels.

The assembly of the container 100 is now described in detail. As shown in Figs. 2 and 5, the first step for assembling the container 100 involves mating the two side panels 200 with the base plate 110. With the base plate 110 positioned so that the first surface 114 of the support surface 112 facing upward, one side panel 200 is positioned adjacent the base plate 110 with the first surface 204 of the support surface 202 facing upward. The side panel 200 is positioned so that the hook members 260 face one side wall 150 of the base plate 110. The hook members 260 are aligned with corresponding openings (reinforced eyelets) 131 of the base plate 110 and then each hook member 260 is inserted into one opening 131. This is preferably accomplished by positioning the hook members over the openings and pressing the wall down. This results in the

side panel 200 being pivotally coupled to the base plate 110 and the side panel 200 is positioned adjacent the base plate 110 and lying in a horizontal direction. In this initial locking (coupling) position, the base plate 110 and side panel can lie substantially in the same plane with both first surfaces facing upward. The process is repeated for the other side panel 200 resulting in the two side panels 200 and the base plate 110 assuming a horizontal position.

Next, each of the side panels 200 is pivoted 90 degrees until the side panels 200 are upright relative to the base plate 110. In other words, the side panels 200 are perpendicular to the base plate 110. The pivoting of the side panels 200 is possible since the hook members 260 can freely pivot within the openings 131. When the side panels 200 are initially in the horizontal position, the hook members 260 open downwardly; however, as the side panels 200 pivot upwardly, the hook opening likewise pivots. In fact, the side wall 150 of the base plate 110 is captured within the opening of the hook member 260, thereby securely coupling the side panel 200 to the base plate 110. It will be understood that in this vertical position, the side panels 200 can freely pivot relative to the base plate 110. Optionally, locking tabs associated with the hook members 260 can be used to keep the walls upright during assembly. For example, any number of different locking mechanism can be used, including mechanical and interference type locking mechanisms.

However, when the side panels 200 are pivoted to the vertical position (90 degree position), they can not easily be removed from the base plate 110 unless they are pivoted back to or substantially to the horizontal position that allows the hook member 260 to be lifted out of the

base plate eyelet 131. In other words, in the vertical position, the curved body of the hook member 260 can not be lifted out of the base plate 110 since the side wall of the base plate 110 is disposed within the space formed by the hook member 260. As can be seen in the Figures, the hook member 260 can only be inserted and rotated when it is inserted from into the top of the eyelet 131. Only in this orientation where the side panel 200 is essentially horizontal to the base plate 110 can the hook member 260 be easily lifted out of the eyelet 131 and thus this is the unlocked position. As the side panel 200 is pivoted, the free edge of the hook member 260 pivots underneath the side edge 124 of the base plate 110 and can no longer be lifted up and out of the eyelet 131.

In the vertical position (90 degree position), the locking channel 270 is axially aligned with the keyed opening 180.

The next assembly step is to mate the end panels 300 with the base plate 110 and the side panels 200 as shown in Figs. 3 and 6. The end panels 300 are first oriented so that the first surfaces 304 face inwardly and therefore, the locking rails 360 face inwardly toward the ends of the side panels 200. With the side panels 200 maintaining their vertical orientations (90 degrees), the locking rails 360 are first introduced into the keyed opening 180 by inserting the body 362 into the central portion 182 and the neck portion 364 into the slot 184. The end panel 300 is then continually moved upward in a vertical direction causing the locking rail 360 to slide into the locking channel 270 of the side panels 200. In particular and since the keyed opening 180 and channel 270 are axially aligned, the body 362 slides into the central portion 272 and the neck

portion 364 slides into the slot 274. The end panel 300 is continually moved upward to cause the locking rails 360 to ride in the channels 270 until the tapered channel rail parts are fully inter-matched or until the stop (support tab 370) contacts an underside of the base plate 110 when the keyed opening 180 is present, thereby preventing the end panel 300 from moving any more in the vertical direction (upward). In the embodiment where no keyed opening 180 is present in the base plate 110, the stop 370 contacts the underside of the side panel 200 and vertical movement of the end panels is limited.

In the embodiment where the engagement mating is accomplished by only partial upward slide travel of the locking rail 360 of the end panel 300 within and along a length of the complementary locking groove channel 270 of the side panel 200, the bottom part of the rail of the end wall contacts the underside of the side panel duct before vertical movement of the end panels is performed.

The handle opening 395 facilitates the movement of the end panel 300 in the vertical direction since the user can simply grasp and pull the end panel 300 upward with the locking rails 360 riding within the locking channels 270.

The process is repeated at the opposite end of the container 100 and the second end panel 300 is coupled to the side panels 200 and base plate 110. This results in both end panels 300 being attached to the side panels 200 and securely to the base plate 110 as well. Once the end panels 300 are in the engaged upright position, the full height of the container 100 is realized around the entire perimeter. In other words, the top edge of the side panels 200 and end panels

300 are aligned with one another. The reception of the end panels 300 in the side panels 200 results in all walls being held and maintained in an upright position.

To disassembly the assembled container 100, the user simply lifts the container 100 when it is empty and then pulls down the end walls 300 resulting in the locking rails 360 slidingly traveling out of the channels 270, thereby releasing the side panels 200 which can then be pivoted to an open position and the side panels 200 can be removed. This allows easy storage of the parts once disassembled.

The container 100 according to the present invention achieves the following objectives and provides the following advantages, including the following: (1) the container saves storage space; (2) enables economical manufacturing of plastic containers by being assembled from smaller parts which use efficient small and simpler molds to form the parts; (3) enables efficient transport of empty containers on packing supply run and on return trips; (4) the container broadens the opportunities for re-use of packaging, thus gaining environmental benefits; (5) it enables simple and straightforward assembly of containers from a minimal number of parts; (6) the container can be unassembled for compact storage till further use; (7) no extra connectors are required; (8) the container can be assembled by hand – no special tools are required for the assembly; and (9) typically, the walls are equipped with connecting parts which are included in the same level of the wall – no protrusions are required. In addition, the load bearing capacity of the container is achieved at the same time geometric direction of assembly and consequently, the loading of the container when used will not tend to dismantle the assembly. The container will

not yield to load till the structural limit load which is determined by fracture mechanics of the material and design.

In addition, structural load-bearing capacity is enhanced by the creation of a multitude of shear-sections, such as the eyelets and hooks and by the tapered geometry of the locking channels and rails.

It will be appreciated that the interconnection of the walls (panels) and the assembly method is based on sliding and mating parts and is performed by sliding the walls (end panels) from the underside in an upward direction opposite to the strain induced when later loading the container 100 with contents.

It should be noted that in the specification of the present invention and the claims thereof, the "horizontal" plane is to be construed as being at least substantially equivalent to the plane of the base plane. The "vertical" direction is to be construed as being a direction that is at least substantially perpendicular to the base plane. "Upward" and "upright" are to be constructed as being the direction that at least substantially points along the perpendicular to the base plate while moving from the exterior to the interior of the container. It should be appreciated that during assembly or usage, the base plate can assume various position and therefore, the terms "horizontal," "vertical," "upright," and "upward" are to be viewed relative thereto.

While the invention has been described in connection with certain embodiments thereof, the invention is capable of being practiced in other forms and using other materials and

structures. Accordingly, the invention is defined by the recitations in the claims appended hereto and equivalents thereof.

WHAT IS CLAIMED IS:

1. An articulate modular collapsible storage container comprising:

a base plate having a pair of opposite ends and a pair of opposite sides;

a pair of side panels that are detachably and pivotally coupled to the base plate along the sides thereof, the side panels being pivotal between an unlocked position where the side panels can be freely removed and a locked position where the side panels are coupled to the base plate; and

a pair of end panels that are slidingly coupled to the side panels when the side panels are in the locked position, the end panels and side panels forming upright walls of the container, and wherein the end panels are slidingly disengageable from the side panels to allow the side panels to pivot to the unlocked position, thereby allowing disassembly of the container.

2. The container of claim 1, wherein the base plate, side panels and end panels are loose panels having three different construction types.

3. The container of claim 1, wherein the base plate has a grate construction defined by a plurality of openings formed therethrough, wherein a first row of openings is formed along one side of the base plate and a second row of openings is formed along the opposite side of the base

plate, the side panels including a plurality of hook members formed along one side thereof that are received in corresponding openings of the base plate to allow pivoting of the side panel.

4. The container of claim 3, wherein in the unlocked position, the base plate and side panel are at least substantially contained in a horizontal plane and the locked position at least includes when the side panels are substantially perpendicular to the base plate.

5. The container of claim 1, wherein the side walls have one of male locking members and female locking members and the end walls have one of female locking members and male locking members, the male and female locking members being complementary to one another and permit sliding engagement therebetween resulting in the side walls being locked in upright positions.

6. The container of claim 1, wherein ends of the side panel include a female locking member that extends along at least part of the length thereof and ends of the end panel include a complementary male locking member that extends at least along part of the length thereof, the male locking member being slidingly receiving within the female locking member when the side panel is in an upright position.

7. The container of claim 1, wherein ends of the side panel include a male locking member that extends along at least part of the length thereof and ends of the end panel include a complementary female locking member that extends at least along part of the length thereof, the male locking member being slidingly receiving within the female locking member when the side panel is in an upright position.

8. The container of claim 6, wherein the end panel includes a stop member that is located at a bottom end of the male locking member, the stop member limiting the vertical travel of the male locking member in the female locking member when it comes into contact with a fixed structure.

9. The container of claim 1, wherein a stop member seats against an underside of the base plate when the end panel reaches its full vertical travel.

10. The container of claim 8, wherein the stop member seats against one end of the end wall of the side panel when the end panel reaches its full vertical height.

11. The container of claim 6, wherein the female locking member is a locking channel that includes an open slot for receiving a portion of the male locking member which is in the form of a protrusion extending outwardly from the end panel, the protrusion having a neck portion that is disposed within the slot, the protrusion slidingly traveling within the locking channel.

12. The container of claim 7, wherein the female locking member is a locking channel that includes an open slot for receiving a portion of the male locking member which is in the form of a protrusion extending outwardly from the side panel, the protrusion having a neck portion that is disposed within the slot, the protrusion slidingly traveling within the locking channel.

13. The container of claim 1, wherein bottom edges of the end panels include ground contacting members on which the container sits when fully assembled and permits convenient stacking of multiple containers.

14. The container of claim 6, wherein the male locking member comprises a locking rail that has a tapered body and the complementary female locking member comprises a locking

channel that has a complementary locking channel that has a tapered construction that allows the locking rail to mate with the locking channel and slidingly travel therein for at least a prescribed distance.

15. The container of claim 14, wherein the locking rail has an outward taper such that a top of the locking rail has a smaller cross-section than a bottom of the locking rail.

16. The container of claim 7, wherein the male locking member comprises a locking rail that has a tapered body and the complementary female locking member comprises a locking channel that has a complementary locking channel that has a tapered construction that allows the locking rail to mate with the locking channel and slidingly travel therein for at least a prescribed distance.

17. An articulate modular collapsible storage container comprising:

a base plate having a pair of opposite end and a pair of opposite sides;

a pair of side panels that are detachably and pivotally coupled to the base plate along the sides thereof, the side panels being pivotal between an unlocked position where the side

panels can be freely removed from the base plate and a locked position where the side panels are coupled to the base plate and are in an upright position; and

a pair of end panels that include having first locking members that are coupled to second locking members that are formed at ends of the side panels by moving the end panels in a first direction into engagement with the upright side panels, the end panels and side panels forming four upright walls of the container that extend around a perimeter of the base plate, the end panels being freely disengageable from the side panels by moving the end panels in an opposite second direction until the first locking members are free of the second locking members and the side panels can pivot to the unlocked position, thereby allowing disassembly of the container.

18. A method of constructing an articulate modular collapsible container that is formed of a base plate, a pair of side panels and a pair of end panels, comprising the steps of:

attaching the side panels to opposing sides of the base plate such that the side panels can pivot between an unlocked position where the side panels can be freely removed from the base plate and a locked position in which the side panels are in an upright position; and

slidingly mating first locking members that are formed as part of the end panels with second locking members that are formed at ends of the two opposing upright side panels

resulting in the end panels being securely attached to the side panels and the side panels and end panels define four upright walls of the container that are disposed around the base plate.

19. The method of claim 18, wherein the step of attaching the side panels to the base plate comprises the steps of:

inserting hook members formed along one side of the side panel into a row of openings formed along the side of the base plate, the hook members pivoting within the opening as the side panel is moved to an upright vertical position relative to the base plate, wherein in the upright vertical position, the side panel is lockingly attached to the base plate.

20. The method of claim 18, wherein the step of slidingly mating the end panels to the side panels comprises the step of:

positioning at least part of the end panel below the base plate and below the side panel and aligning the first locking member that comprises a male locking member with the second locking member that is in the form of a female locking member; and

inserting one male locking member into one corresponding female locking member and moving the end panel upward causing the male locking member to travel within the female locking member until the end panel reaches an end of travel.

21. The method of claim 18, wherein the end panel includes a pair of stop tabs located at bottoms of the male locking members, the end of travel of the end panel being when the stop tabs contact one of the base plate and the side panels.

22. The method of claim 18, wherein the pair of male locking members is insertable into the female locking members only when the side panels are disposed substantially perpendicular to the base plate.

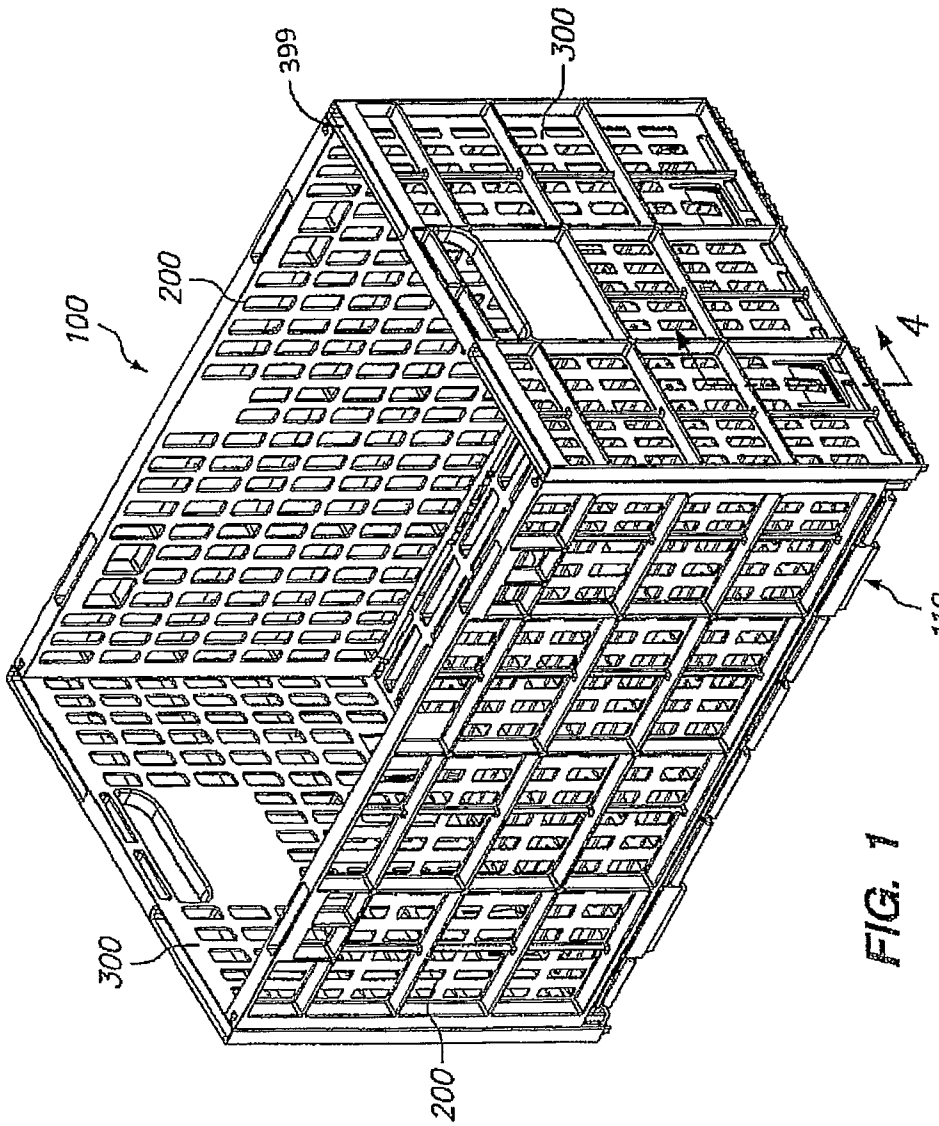

FIG. 1

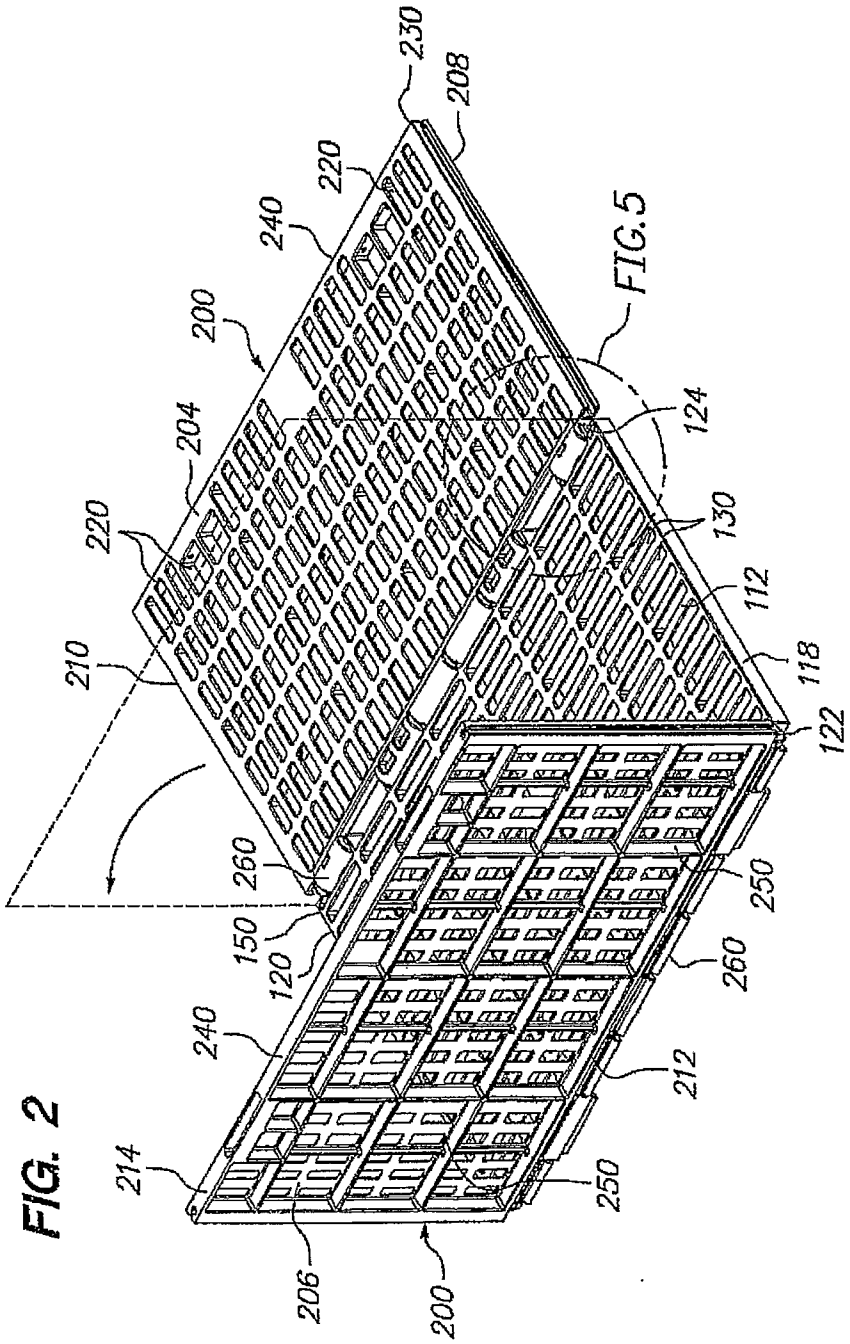
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FIG. 2
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FIG. 3

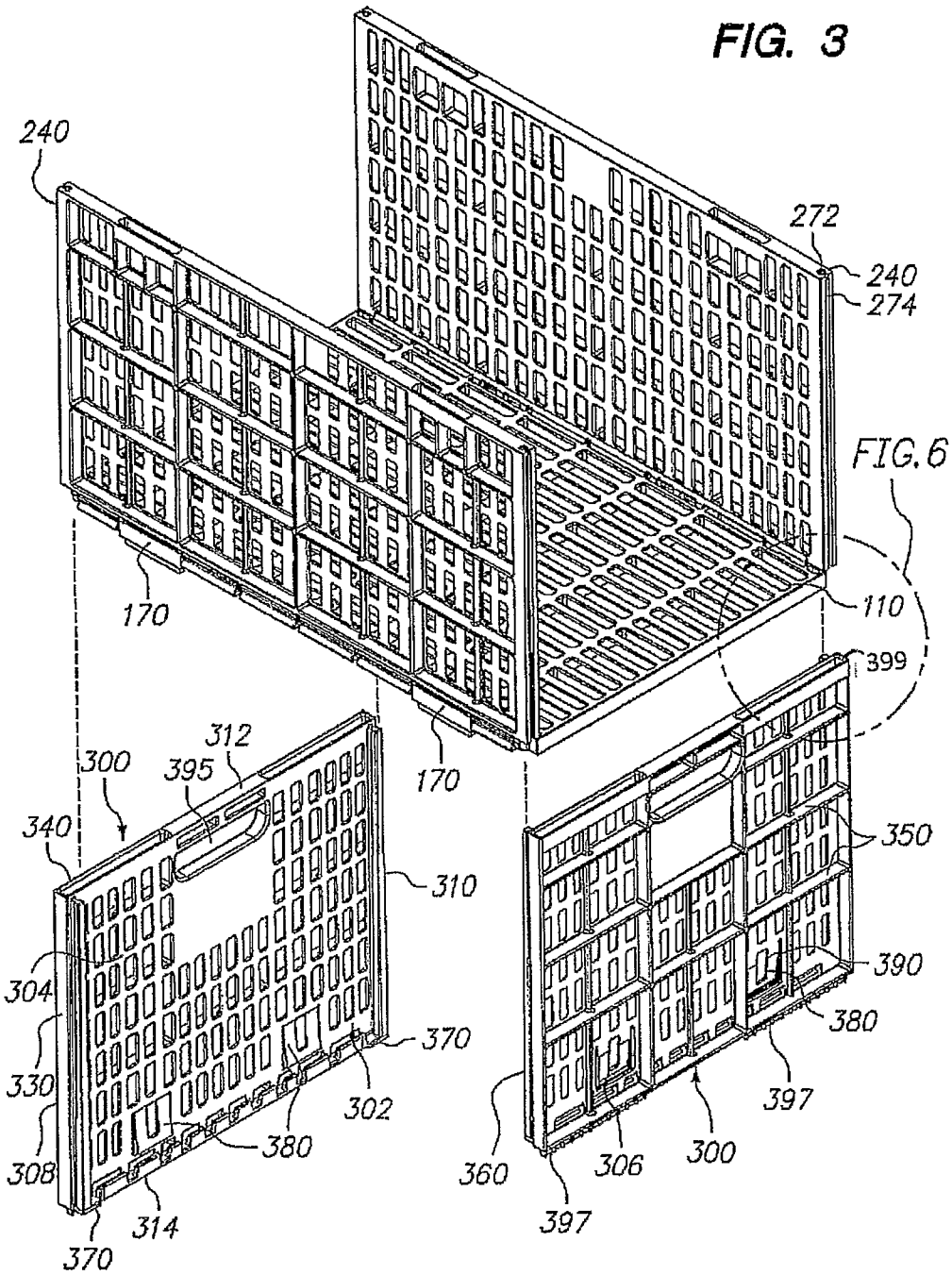
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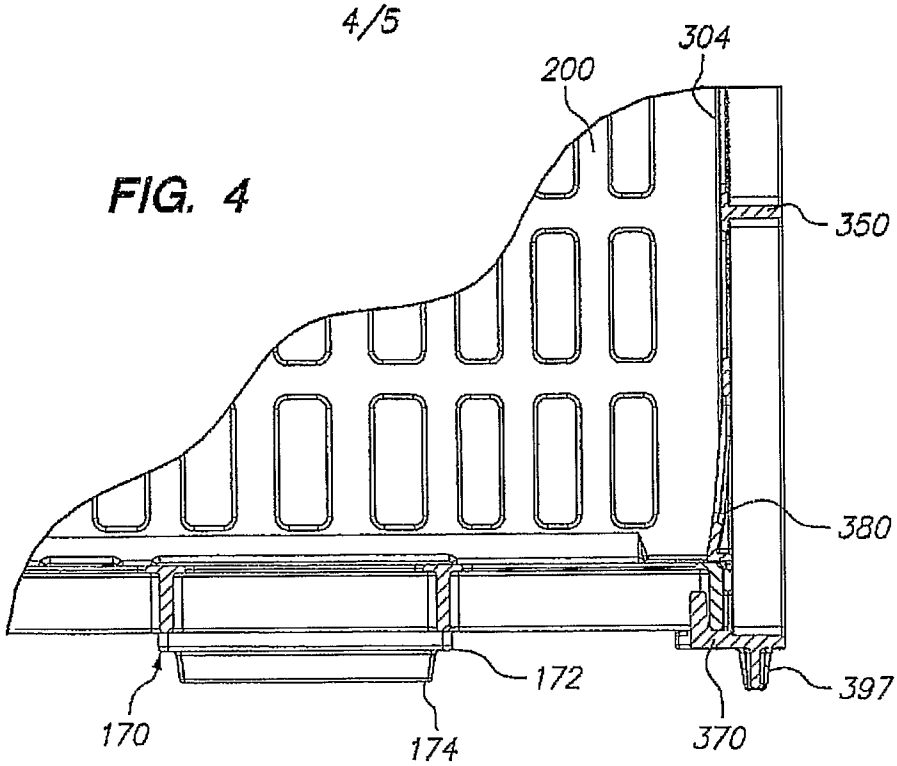
FIG. 4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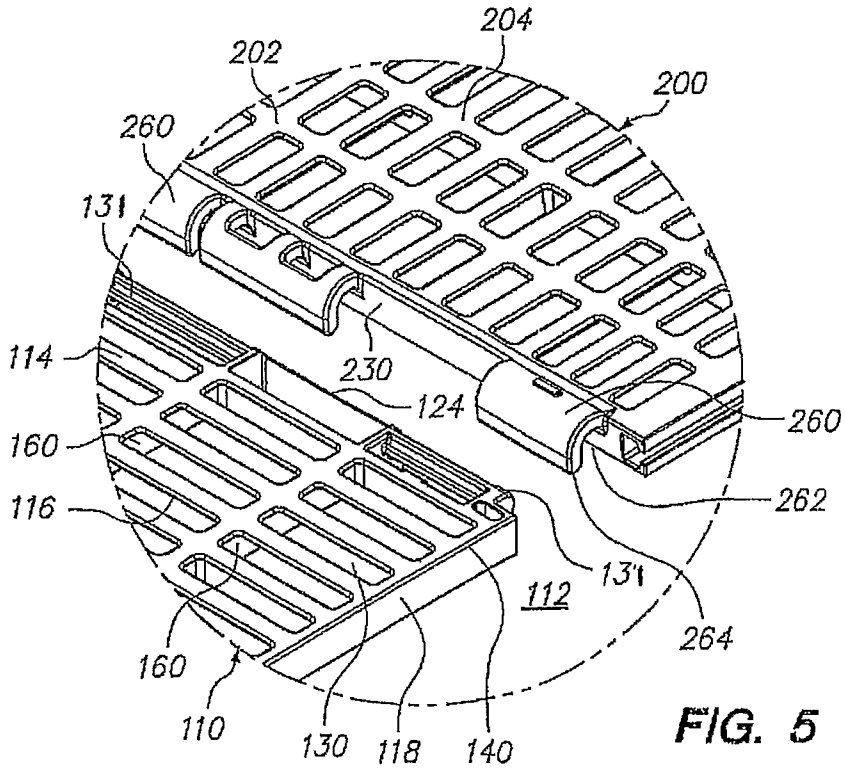
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FIG. 5

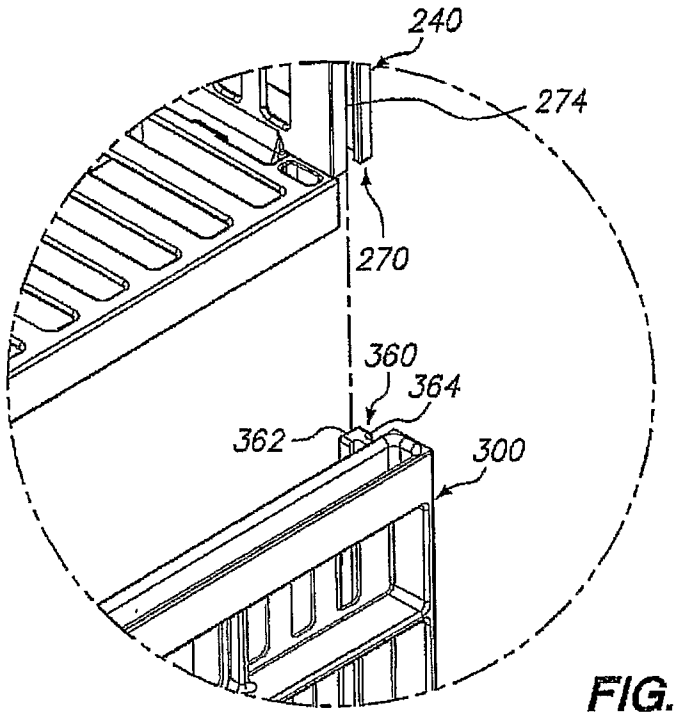

FIG. 6

FIG. 7