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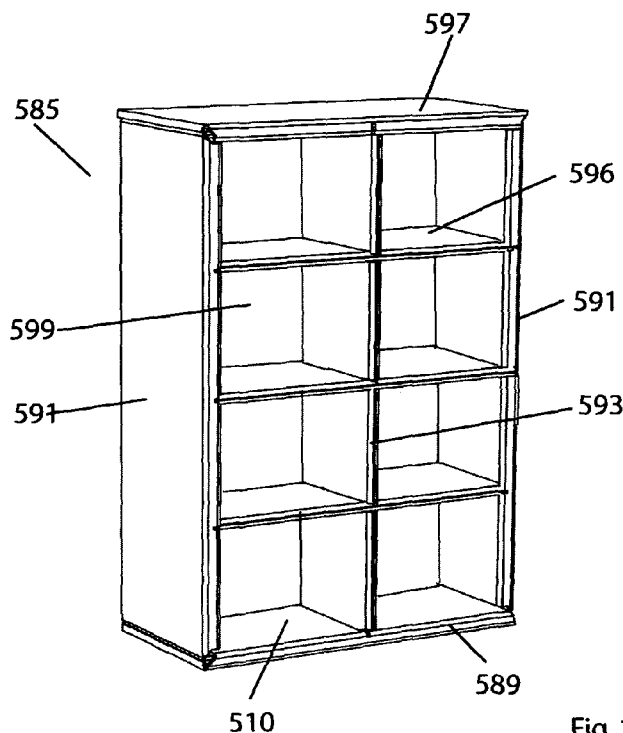


Fig. 19

(57) Abstract: In one aspect, the present invention is directed to a three-dimensional article produced from sheet material, comprising a frame unit having a plurality of outer sides made of sheet material each having a different angular disposition, wherein first and second longitudinal ends of the frame unit are interconnected by means of a female fastener embedded in the first end and of a male fastener introduced through the second end and coupled with said female fastener.

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**A THREE-DIMENSIONAL ARTICLE PRODUCED FROM SHEET
MATERIAL**

Field of the Invention

The present invention relates to the field of assembly kits. More particularly, the invention relates to three-dimensional articles produced from flat sheet material such as cardboard sheets. The invention is particularly useful for producing various articles of children furniture, and is therefore described below with respect to such an application.

Background of the Invention

Cardboard sheets (e.g. corrugated cardboard sheets), widely used in constructing inexpensive, light-weight containers, have also been used for constructing various articles of furniture, particularly for children, and have also been supplied in kit form for this purpose. Examples of such cardboard kits are described in U.S. Pat. Nos. 4,067,615, 4,934,756 and 6,083,580. However, such kits for making three-dimensional articles, particularly articles of children furniture, have not found widespread use because of the difficulty in producing kits that can be supplied in a compact flat condition for shipping, handling or storage, to be assembled into a three-dimensional article having dimensional stability and structural rigidity, and yet provide a pleasing appearance.

It is an object of the present invention to provide three-dimensional articles produced from sheet material such as cardboard having important advantages particularly with respect to foldability into a compact flat form for storage, shipping or handling as well as dimensional stability and structural rigidity when assembled in the three-dimensional article, and also to provide a pleasing appearance in the assembled article.

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It is an additional object of the present invention to provide a kit for use in producing three-dimensional articles from flat sheet material.

Other objects and advantages of the invention will become apparent as the description proceeds.

Summary of the Invention

The present invention provides a three-dimensional article produced from sheet material, comprising a frame unit having a plurality of outer sides made of sheet material each of which having a different angular disposition, wherein first and second longitudinal ends of said frame unit are interconnected by means of a female fastener embedded in said first end and of a male fastener introduced through said second end and coupled with said female fastener.

The first end of the frame unit comprises a side flap formed with at least one aperture, said side flap being folded and affixed to a base portion of a frame unit side such that the female fastener placed on a predetermined region of said base region is embedded within said side flap while being accessible to the male fastener by means of a corresponding aperture. The second end of the frame unit comprises a side flap formed with at least one aperture, said side flap of the second end remaining in an opened position while its at least one aperture is aligned with the at least one aperture of the folded side flap of the first end and a male fastener introduced through an aperture of the second end is coupled with a corresponding embedded female faster, whereby to form a reinforced connection.

The reinforced connection protrudes from the inner side of the frame unit, to allow the frame unit to be positioned flush with a wall of a room within which it is positioned.

In one aspect, the frame unit comprises a plurality of exterior members, each of which being interconnected by means of a reinforced connection. By virtue of the reinforced connections, none of the edges of an exterior member are visible in an assembled three-dimensional article, to provide an esthetically pleasing appearance. Other advantages of concealing the edges of the exterior members are an increased resistance to humidity or water that tends to penetrate through cut edges, an increased resistance to fire that tends to first ignite the exposed edges of the sheet material, and preventing injury to children by the sharp edges of the sheet material.

In one aspect, at least one expanded stabilizing element is frictionally engaged with inner faces of the frame unit, for increasing the structural strength of the three-dimensional article.

The three-dimensional article is selected from the group consisting of cabinet, table, storage box, wheeled storage box stool, doll house, chair, trunk, bench, wine holder, and file holder.

The present invention is also directed to a kit for assembling a three-dimensional article, comprising a plurality of separate or separable members made from sheet material and set in a flat condition, including one or more first members configured with a side flap in which is embedded at least one accessible female fasteners, one or more second members configured with a side flap in an opened position formed with at least one aperture, and one or more stabilizing elements, wherein a male fastener introduced through an aperture of the opened side flap of a second member is coupleable with a corresponding and aligned embedded female faster of a first member, so that when a plurality of said first and second members are serially interconnected such that each of which has a different angular disposition a frame unit is formed, said one or more stabilizing elements frictionally engageable with inner faces of said frame unit.

The fabrication of members with folded, and at times adhesively affixed, side flaps and inward flaps increases the rigidity of the members during storage and shipping, thereby preventing the formation of a convex base portion which would make the assembly of a three-dimensional article a more difficult operation.

Brief Description of the Drawings

In the drawings:

- Fig. 1 is a top perspective view of precut sheet material, for fabricating an exterior member of a three-dimensional article, according to one embodiment of the present invention;
- Fig. 2 is a top perspective view of the sheet material of Fig. 1, showing the placement of female fasteners thereon and the folding of flaps thereof;
- Fig. 3 is a top perspective view of a fabricated exterior member produced from the sheet material of Fig. 1;
- Figs. 4 and 5 are top perspective views of the interconnection of the exterior member of Fig. 3 and another exterior member;
- Fig. 6 illustrates the setting of four interconnected exterior members to different angular dispositions;
- Fig. 7 is a perspective view from the inward side of a frame unit assembled from the members of Fig. 6;
- Fig. 8 is a perspective view from the inward side of the frame unit of Fig. 7, showing the opening of inward flap second portions;
- Fig. 9 is a perspective view from the outward side of the frame unit of Fig. 7, showing the introduction of a folded insert within the interior thereof;
- Fig. 10 is a perspective view from the outward side of the frame unit of Fig. 7, showing the proximity of the insert of Fig. 9 to a reinforced connection after having introduced within the frame unit;

- Fig. 11 is a fragmented cross sectional view of the insert of Fig. 9 in contact with the inward flap second portions of Fig. 8, cut about plane A-A of Fig. 10;
- Figs. 12 and 13 perspective view from the outward side of the frame unit of Fig. 10, showing the introduction therein of a stabilizing element;
- Figs. 14 and 15 are perspective views from the outward side of the frame unit of Fig. 13, showing the introduction therein of a shelf element that interconnects with the stabilizing element of Fig. 13;
- Fig. 16 is perspective view from the outward side of the frame unit of Fig. 13, showing the inward folding of frame unit extension to secure the insert of Fig. 9 and to conceal the reinforced connection of Fig. 10;
- Fig. 17 is a perspective view from the outward side of the frame unit of Fig. 16, showing the introduction therein of an additional shelf element that interconnects with the stabilizing element of Fig. 13;
- Fig. 18 is a perspective view from the outward side of the frame unit of Fig. 17, showing the inward folding of a frame unit extension into a corresponding cell;
- Fig. 19 is a perspective view from the front of a fully assembled cabinet;
- Fig. 20 is a top view of a kit comprising a plurality of members for assembling a stool;
- Fig. 21 is a top perspective view of the inner face of a fabricated exterior member frame unit for assembling a stool;
- Fig. 22 is a top perspective view of a frame unit being assembled in a substantially flat condition from the member of Fig. 21;
- Fig. 23 is a top perspective view of the frame unit of Fig. 22, showing a bottom cover affixed thereto;
- Fig. 24 is a top perspective view of the frame unit of Fig. 23, showing the bottom cover in a flat and folded condition;
- Fig. 25 is a side perspective view of the frame unit and bottom cover of Fig. 23 in an expanded condition, showing side flaps of the bottom cover being introduced within the interior of the frame unit;

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- Fig. 26 is a top perspective view of the interior of the frame unit of Fig. 25, showing flaps of the frame unit being adhesively affixed to flaps of the bottom cover;
- Fig. 27 is a top perspective view of the interior of the frame unit of Fig. 26, showing a reinforcement being introduced into the interior of the frame unit;
- Fig. 28 is a side perspective view of the frame unit of Fig. 27, showing interconnected stabilizing elements being introduced into the interior of the frame unit;
- Fig. 29 is a side perspective view of a stabilized frame unit, showing a top cover being secured thereto;
- Fig. 30 is a side perspective view of a fully assembled stool;
- Fig. 31 is a top perspective view of a shelf element, according to an embodiment of the invention;
- Fig. 32 is a perspective view from the outward side of a spine member, according to an embodiment of the invention;
- Fig. 33A is a perspective view from the inward side of an appendage of the shelf element of Fig. 31 as it protrudes through a slit formed in the back of the spine member of Fig. 32;
- Figs. 33B and 33C are perspective views from the inward side of the appendage of Fig. 33A, showing the appendage as it is folded onto the back of the spine member and a clip being inserted in the slit and being secured to the appendage;
- Fig. 34 is a top perspective view of a fully assembled wheeled storage box, according to another embodiment of the invention;
- Fig. 35 is a bottom perspective view of the frame unit of the storage box of Fig. 34, showing the engagement of an axle carrying plate therewith;
- Fig. 36 is a side perspective view from the bottom of the storage box of Fig. 35, showing the coupling of a caster wheel to each axle;
- Fig. 37 is a top perspective view of the inner face of interconnected exterior members for assembling a table;

- Fig. 38 is a perspective view from the inward side of the interior of a frame unit assembled from the members of Fig. 37;
- Fig. 39 is a perspective view from the inward side of the interior of the frame unit of Fig. 38, showing a flap of two divider elements being interconnected;
- Fig. 40 is a perspective view from the inward side of the interior of the frame unit of Fig. 39, showing a flap of two other divider elements being interconnected;
- Fig. 41A is a top perspective view of a three portioned stabilizer element in flat condition;
- Fig. 41B is a perspective view from the side of the stabilizer element of Fig. 41A in an expanded condition;
- Fig. 42 is a perspective view from the side of the frame unit of Fig. 40, showing the expanded stabilizer unit of Fig. 41B being introduced in its interior;
- Fig. 43 is a perspective view from the side of the frame unit of Fig. 42, showing a cover unit being secured thereto; and
- Fig. 44 is a perspective view from the side of a fully assembled table.

Detailed Description of Preferred Embodiments

The present invention is a novel three-dimensional article comprising a plurality of interconnected members, each of which is made from sheet material such as corrugated cardboard or plastic. The plurality of members, which are preferably provided in kit form, are initially positioned in a flat condition for increased compactness during storage and transportation and are then expanded during assembly. Two adjacent exterior members are interconnected by concealable embedded fasteners so that, in addition to an improved esthetic appearance, the fasteners do not protrude the outer face of a member, thereby allowing the assembled article to be positioned flush with a wall of a room in which it is disposed.

Figs. 1-5 illustrate the interconnection of two exterior members by means of male and female rivets, according to one embodiment of the present invention. It will be

appreciated that any other suitable fastener well known to those skilled in the art may be employed.

Fig. 1 illustrates an exterior member 510 prior to being fabricated at a factory. Exterior member 510, as well as the other members of a given three-dimensional article (hereinafter "article" for brevity), is made of sheet material which is precut according to a predetermined configuration and is formed with a predetermined arrangement of fold lines to enable the member to be expanded from a flat condition to an expanded three-dimensional condition.

As shown, the inner side of exterior member 510 has a rectangular base portion 505, each edge of which bordering a corresponding fold line 506a-d, side flaps 507a and 507b extending transversally from fold lines 506b and 506c, respectively, inward flap 507c extending from fold line 506d, and spaced substantially rectangular extensions 509a and 509b extending from fold line 506a. Base portion 505 is the portion of an exterior member that is visible when the three-dimensional article is fully assembled, e.g. a wall of a cabinet. The flaps are accessible to the inner side of the exterior member, but not to the outer side thereof, as shown in Fig. 7.

As referred to herein, the term "outwardly" means in a direction towards a user who is to access the assembled article, with respect to the disposition of the element of the instantaneous stage of assembly. Thus when exterior member 510 is employed in a cabinet 585, and the cabinet is fully assembled as shown in Fig. 19, its outward edge 589 is the bottommost viewable edge of the cabinet facing the room in which the cabinet is located. However, when exterior member 510 has not yet been fabricated, edge 503 of extensions 509a and 509b distant from fold line 506a is the outward edge. Conversely, an "inward" direction is opposite to the "outward" direction, namely away from a user who is to access the assembled article.

The term "outer" means the side of the member facing the room, generally one that is visible when the article is fully assembled. The term "inner" means the side of the member facing away from the room, generally one that is not visible when the article is fully assembled.

Each side flap of exterior member 510 has a short edge 514 substantially collinear with fold line 506a, a relatively long edge 515 substantially perpendicular to edge 514, and an oblique edge 516 extending from edge 515 to fold line 506d. Two apertures 519 equally spaced from the corresponding fold line are bored in each side flap. Inward flap 507c has an intermediate fold line 508 substantially parallel to fold line 506d, dividing the inward flap into a first portion 521 abutting fold line 506d and a second portion 522. While edges 524 of first portion 521 are oblique with respect to fold line 506d and extend from fold line 506b of a corresponding side flap, edges 525 of second portion 522 are perpendicular to fold line 506d, extending from a corresponding oblique edge 524 and transversally spaced from a corresponding side flap fold line 506b.

When in the flat condition, extensions 509a and 509b are spaced by a rectangular void area 501, and a cut line 502 bordering abutting portions of the adjacent extension extends perpendicularly from fold line 506a to void area 501. A substantially rectangular projection 504 slightly protrudes from outward straight edge 503 of each extension, and is relatively close to void area 501.

Base portion 505 is provided with four marked regions 513 equally spaced from a corresponding aperture 519 arranged such that two marked regions are proximate to fold line 506b and two marked regions are proximate to fold line 506c. A female rivet 511 is placed on each marked region 513 such that the hollow stem of the rivet is facing upwardly.

In Fig. 2, side flaps 507a and 507b are folded and adhesively affixed to base portion 505 in such a way that the stem of each female rivet 511 is received in a corresponding aperture 519. Bottom flap 507c is then folded along fold line 506d while first portion 521 is adhesively affixed to base portion 505. A fabricated exterior member 510 is illustrated in Fig. 3, whereby two female rivets 511 are embedded in a corresponding side flap and an oblique edge of inward flap first portion 521 abuts an oblique edge of a corresponding side flap 507a.

Fig. 4 illustrates an exterior member 520 which has four equally sized and spaced extensions 529 and which is configured similarly as exterior member 510, with the exception of its inward flap 537c provided with first portion 531 and second portion 532 having collinear edges 534 and 535, respectively, substantially perpendicular to fold line 506d.

Exterior member 520 is shown to be interconnected with the fabricated member 510. While side flaps 537a and 537b of member 520 are opened, the two apertures 523 bored in side flap 537a are aligned with the two female rivets 511, respectively, embedded in side flap 507b of exterior member 510. A male rivet 526 is then introduced in a corresponding aperture 523 and fastened with a corresponding female rivet 511, so that side flap 537a of member 520 overlies side flap 507b of member 510 while members 510 and 520 are interconnected to form a reinforced connection 527, as shown in Fig. 5. In this fashion, a plurality of exterior members may be serially interconnected without interfering with an adjacent bottom flap outer portion, yet a first exterior member may be angularly disposed with respect to a second exterior member in order to assemble a given three-dimensional article without unduly straining the fold line between the first and second interconnected members.

It will be appreciated that all exterior members of a frame unit may comprise a first side flap in which female rivets are embedded and a second side flap, through the

apertures formed therein male apertures may be introduced and coupled with the embedded rivets of the first side flap of an adjacent exterior member.

Figs. 6-19 illustrate the assembly of a cabinet 585, which may be quickly and effortlessly carried out at the home or workplace of a user.

In Fig. 6, serially interconnected exterior members 510, 520, 530 and 540 are angularly displaced one to the other. Member 530 is identical to member 510, and member 540 is identical to member 520. When each pair of adjacent exterior members are mutually perpendicular as shown in Fig. 7, first member 510 and last member 540 are interconnected by means of male rivets 526 to form a frame unit 545.

In Fig. 8, the inward flap second portion of each of exterior members 510, 520, 530 and 540 is opened until it is substantially perpendicular to the corresponding base portion 505. Inward flap second portion 522 of members 510 and 530 are first opened, and then inward flap second portion 532 of members 520 and 540 are then opened so that each end of a second portion 532 will be restrained by a corresponding end of a second portion 522 perpendicular thereto.

As shown in Fig. 9, an insert 542 serving as a back of the cabinet is inwardly introduced into frame unit 545, i.e. in the direction from extensions 509 to the inward flap first portions. In the flat condition, rectangular central portion 541 of insert 542 and the four peripheral elements 544 extending from a corresponding edge thereof are coplanar. Central portion 541 is formed with a plurality of rectangular apertures 549, each set of spaced apertures adjoining the fold line between the central portion 541 and the corresponding peripheral element 544. The number of apertures 549 of a set which adjoins a given fold line between central portion 41 and the corresponding peripheral element 544 is equal to the number of extensions 509 that are provided at the same side of frame unit 545. Prior to being introduced into frame unit 545, the

four peripheral elements 544 of insert 542 are folded such that they are substantially perpendicular to, and extend outwardly from central portion 541 and that a corner opening 547 is formed between two adjacent peripheral elements.

Fig. 10 illustrates the folded insert 542 after it has been introduced into frame unit 545, showing two peripheral elements 44 of the insert that abut, or are slightly spaced from, the inward end of a corresponding reinforced connection 527 of the frame unit. The perimeter of central portion 541 of insert 542 is sized to be essentially equal to the perimeter of frame unit 545 as defined by the spacing between the base portion 505 of opposite exterior members.

As shown in Fig. 11, a reinforcement 546 is adhesively affixed to the base portion 505 of the exterior members, e.g. members 510 and 530, so as to be outwardly spaced from the opened inward flap second portions, e.g. second portions 522. The interspace between a reinforcement 546 and an inward flap second portion serves to properly position insert 542 after it has been introduced into the frame unit. While insert 542 is being introduced into the frame unit, each peripheral element 544 slidingly contacts a corresponding reinforcement 546 until central portion 541 contacts the four inward flap second portions, whereupon each peripheral element 544 is received in a corresponding interspace between a reinforcement 546 and an inward flap second portion and is able to contact base portion 505.

Fig. 12 illustrates a stabilizing element 555 that serves as the spine of the cabinet. Stabilizing element 555 is adapted to be in frictional engagement with exterior members 510 and 530 and for providing structural stability to the cabinet. Stabilizing element 555 comprises web 552, which is formed with a plurality of equally spaced and mutually parallel notches 554, and with flanges 556 and 557 provided at each end of web 552. As stabilizing element 555 is configured similarly to an I-beam, it has a relatively high strength to weight ratio. Notches 554 are outwardly extending, being

formed only in an outward region of stabilizing element 555. When stabilizing element 555 is in the flat condition, two portions of each of flanges 556 and 557 are in abutting relation with each other, extending continuously from web 52, or alternatively, abut web 552. When the flange portions are expanded, they are adapted to be perpendicular to web 552. The length of stabilizing element 555 from flange 556 to flange 557 is essentially equal to the spacing between base portion 505 of member 530 to the base portion of member 510.

In Fig. 13, stabilizing element 555 is introduced into the interior of frame unit 545 until web 552 contacts central portion 541 of the insert and flanges 556 and 557 frictionally engage base portion 505 of members 530 and 510, respectively.

Referring to Figs. 14-17, web 565 of shelf element 562, which serves as a shelf of the assembled cabinet and is configured similarly as stabilizing element 555 but having a shorter web, is formed with a single notch. When shelf element 562 is oriented such that its notch is inwardly extending, the notch of shelf element 562 is interconnected with the central notch 554 of stabilizing element 555, as shown in Fig. 14. The length of shelf element 562 from flange 566 to flange 567 is essentially equal to the spacing between base portion 505 of member 520 to the base portion of member 540. Shelf element 562 is then introduced into the interior of the frame unit, as shown in Fig. 15, until web 565 contacts central portion 541 of the insert and flanges 566 and 567 frictionally engage base portion 505 of members 540 and 520, respectively. Extensions 509a and 509b of each of members 510 and 530 are then inwardly folded until the rectangular projections 504 are engaged with the corresponding apertures 549 of the insert, thereby concealing the corresponding reinforced connection 527, as shown in Fig. 16, as well as urging a peripheral element of the insert to contact a corresponding base portion in the manner illustrated in Fig. 11 and contacting a corresponding flange portion of stabilizing element 555. Two other shelf elements 572 are similarly interconnected with stabilizing element 555, as shown in Fig. 17.

As shown in Fig. 18, eight cells 582 are defined by the various interconnected members in the volume between a first exterior member and between a shelf element and between a second exterior member that is perpendicular to the first exterior member and the spine. The four extensions 529 of each of exterior members 520 and 540 are inwardly folded within a corresponding cell until contacting a corresponding flange portion and each rectangular projection 504 is engaged with a corresponding aperture 59 formed within the central portion of the insert.

A fully assembled cabinet 85 is illustrated in Fig. 19. Cabinet 585 is shown to have two outer walls 591, spine 593 parallel to outer walls 591, four shelves 596 perpendicular to walls 591, top 597, and back 599. Cabinet 585 may be placed in abutting relation with a wall by means of the inward flap first portions 521, 531 (Figs. 4, 7, and 11) extending along the inward perimeter of the cabinet, and may be hung on a wall by suitable means attached to, or protruding from, the inner face of back 599. Alternatively, cabinet 585 is sufficiently sturdy to be placed in the middle of a room without being supported by a wall.

As cabinet 585 has been assembled by means of embedded fasteners, reinforced connections, and inwardly folded extensions that conceal the reinforced connections, as described hereinabove, the fasteners do not inwardly protrude from back 99, and therefore cabinet 85 may be placed flush with a wall. Outer walls 91 and back 99 are presented with an esthetically pleasing appearance since the fasteners are not noticeable.

The interconnection of spine 593 and shelves 96 increases the load bearing capacity and compressive strength of cabinet 585. The pressing action of an inwardly folded extension 29 onto a corresponding portion of shelf element flange 567 (Figs. 14 and 18) increases the shear strength of shelves 596, i.e. preventing vertical displacement

of a shelf 596 relative to an outer wall 591. Such an arrangement is suitable for a cabinet of relatively small dimensions, e.g. a cabinet perimeter of 70 x 35, suitable for retaining small objects such as compact discs.

When cabinet 585 has significantly larger dimensions and is therefore suitable for retaining larger and heavier objects, shelf element 690 illustrated in Fig. 31 may be employed. Shelf element 690 comprises two U-shaped appendages 691 that protrude from inward edge 693 of shelf 694, notch 692 for interconnection with the spine, which may be stabilizing element 555 of Fig. 12, or spine member 695 illustrated in Fig. 32 that also comprises an integral back 685 and contact elements 687 for abutting walls of the cabinet and for increasing its load bearing capacity, flange portions 696 bored with at least one aperture 697, so that when expanded, each flange portion 697 can be fastened to an outer wall of the cabinet. Appendages 691 are configured such that their closed end faces inwardly and their legs extending from the closed end extend to inward edge 693.

As shown in Fig. 33A, a slit 689 is formed in back 685 of the cabinet. Into each slit 689 is introduced a corresponding appendage 691, so that two appendages for each shelf element that is employed inwardly protrudes from back 685.

After appendage 691 is folded so as to contact back 685, as shown in Fig. 33B, a clip 680, which may also be made of sheet material, is inserted into slit 689. Clip 680 has two parallel portions 682 and 684, and a portion 686 that extends between the two parallel portions. Portion 682, which may be longer than portion 684, is inserted within slit 689, so that when abutting the inner face of back 685 and lowered, portion 684 engages appendage 691 and presses the same towards back 685, as shown in Fig. 33C.

The back of the cabinet may be fixedly attached to the frame unit since spine member 695 shown in Fig. 32 has an integral back 685 and contact elements 687 that may be interconnected with side walls of the cabinet by fasteners inserted through corresponding apertures 688. The frame unit may be frame unit 545 shown in Fig. 7, or one wherein one or more extensions have expandable flange portions that can be fastened to a contact element 687 for added strength. As back 685 is fixedly attached to the frame unit and shelf elements 690 shown in Fig. 31 are attached to back 685 by means of corresponding clips 680 and add further stability to the cabinet by being interconnected with spine member 695, a cabinet therefore has a significantly improved load bearing capacity.

In the embodiment of Fig. 34, a wheeled storage box 645 is produced from a frame unit 650, e.g. a rectangular frame unit, and from an insert 642, in a similar fashion as the assembly method of frame unit 545 illustrated in Figs. 1-11 and 15, although the exterior members of frame unit 650 are each provided with a single extension 649.

As shown in Fig. 35, a plate 660, e.g. a substantially rectangular plate, for supporting a plurality of caster wheels is attached to the underside of the central portion of insert 642. The dimensions of the visible periphery of plate 660, as defined by edges 661 and 664, are essentially identical to those of the central portion of insert 642. A plurality of apertures 668, e.g. four, are formed in plate 660, and are aligned with a corresponding number of apertures 648 formed in the central portion of insert 642 by means of a rectangular projection 663 protruding from each visible edge 661 of plate 660 and a similarly shaped aperture 653 for receiving a corresponding projection 663 formed in each inward flap first portion 656. Insert 642 and plate 660 are interconnected by means of male and female fasteners, each of which being introduced in one of the pair of aligned apertures 648 and 663.

Plate 660 may be three-layered, whereby a thin metallic layer is sandwiched between, and affixed to, e.g. adhesively affixed to, two layers made of sheet material. A plurality of downwardly extending axles 662, e.g. five axles, are welded to the metallic layer and the bottom sheet material layer, which may be suitably formed with a set of openings, is fitted over the axles. The metallic layer may be separated into distinct regions, e.g. four regions, so that plate 660 may be folded when all the members of the article are set in the flat condition for compact storage and shipping. The metallic layer is generally not sandwiched within projection 663, to provide sufficient flexibility to allow engagement with corresponding apertures 653.

As shown in Fig. 36, a caster wheel 658, or any other type of wheel, is coupled to a corresponding axle 662.

In the embodiment of Figs. 37-44, a table 645 is produced from a frame unit 630, e.g. a rectangular frame unit, two exterior members of which being provided with divider elements.

As shown in Fig. 37, an unassembled frame unit 630 comprises interconnected exterior members 632, 634, 636, and 638. Each of members 632 and 636 has two opened side flaps 631 bored with four apertures for the introduction therethrough of corresponding male fasteners, and inward flap 633 and outward flap 635 adhesively affixed to base portion 637 and extending between the two side flaps.

Each of members 634 and 638 has two side flaps 639 in which are embedded female fasteners to be coupled with a corresponding male fastener, a U-shaped base portion 641, two divider elements 640 stacked in a flat condition and overlying the centrally located, rectangular open region of base portion 641, and an outward flap 646 extending between the two side flaps 639. U-shaped base portion 641 may be made of two layers that are adhesively affixed together, and may be provided with border flaps

that border the open region. The exterior member may also have spaced inward flaps 643 and 644 that extend between a border flap and a corresponding side flap 639.

A corner reinforcement may be affixed to base portion 641 proximate to each side flap 639 and outward flap 646, to help position a divider element 640 as it is affixed to the base portion. A divider element 640 has two opposed opened side flaps 647 and 649, side flap 647 of one divider element being adhesively affixed to one border element and side flap 649 of the other divider element being adhesively affixed to a second border element. The connection between one of the divider side flaps and a border element may be reinforced by fasteners. A notch 665 (Fig. 40) may be provided between a divider element and the corresponding unattached divider side flap.

After frame unit 630 is assembled, as shown in Figs. 38 and 39, the inner divider element 640a of each of members 634 and 638 is folded so as to be substantially parallel to base portion 637 of member 636. That is, inner divider element 640a1 of member 634 is folded about its side flap 649 and inner divider element 640a2 of member 638 is folded about its side flap 647. The unattached divider side flaps 647-1 and 649-2 are folded so as to be perpendicular to the corresponding divider element and facing base portion 637 of member 636, and are then connected together by fasteners 511 and 526. A rectangular shaped interior 627 is defined by the base portion of members 634 and 638, base portion 637 of member 636, and coplanar divider elements 640a1 and 640a2.

As shown in Fig. 40, the inner divider element 640b of each of members 634 and 638 is folded so as to be substantially parallel to base portion 637 of member 632, thereby exposing an open region 629. That is, inner divider element 640b1 of member 634 is folded about its side flap 647 and inner divider element 640b2 of member 638 is folded about its side flap 647. The unattached divider side flaps 649-1 and 647-2 are

folded so as to be perpendicular to the corresponding divider element and facing base portion 637 of member 632, and are then connected together by fasteners, thereby defining a rectangular interior 628. A void area 651 is produced in the interspace between the folded divider elements 640b1 and 650b2 and between the folded divider elements 640a1 and 650a2 shown in Fig. 39.

A stabilizer element 655, which may be folded during shipping and storage, is illustrated in Fig. 41A. Stabilizer element 655 comprises a thickened middle portion 654 and two expandable side portions 657 and 659, and is formed with a notch 666 along the interface 671 of middle portion 654 and each of side portions 657 and 659. A notch 666 is formed in each interface 671 from inward edge 667, and optionally outward edge 669, of stabilizer element 655 to an intermediate portion thereof. In Fig. 41B, stabilizer element 655 is expanded so that layers 657a and 657b, as well as layers 659a and 659b, are separated from each other.

As shown in Fig. 42, assembled frame unit 630 is set to an upright position and then stabilizer element 655 is brought in frictional engagement therewith. Expanded side portions 657 and 659 of stabilizer element 655 are introduced into side cavities 627 and 628, respectively, of frame unit 630 and middle portion 654 is introduced into central cavity 629. To effect the frictional engagement, a notch 666 (Fig. 41a) of stabilizer element 655 is interconnected with a corresponding notch 665 (Fig. 40) of frame unit 630 while each middle portion interface 671 is received in a corresponding void area 651 (Fig. 40). The width of a stabilizer element side portion is selected so that distal edge 672 of a side portion layer frictionally engages a corresponding corner 673 between base portions 637 and 641. The length of notches 665 and 666 is selected so that inward edges 667 and 676 of stabilizer element 655 and frame unit 639, respectively, will be aligned when stabilizer element 655 is fully introduced into the interior of frame unit 630, as shown in Fig. 43.

In Fig. 43, a cover unit 675 is secured to the stabilized frame unit 677. Cover unit 675 comprises a reinforcement that is adhesively affixed to a central portion of a sheet in a flat condition, and a two portioned extension extending from each edge of the base portion. A distal portion of one extension is folded onto its corresponding proximal portion. The length of the extension is configured to be longer than the length of the intended cover unit wall, so that the end portions of the double thickness extension can be folded perpendicularly to the intended cover unit wall and be adhesively affixed as a reinforcement to a second intended cover unit wall.

Fig. 44 illustrates the fully assembled table 665. Table 665 is sufficiently sturdy so that a user can write on cover unit 675 without experiencing any wobbling motion caused by stabilized frame unit 677. The legs of the user are positioned within open region 629.

In another embodiment of the invention, Figs. 20-25 illustrate the assembly of a hexagonal stool 625.

As shown in Fig. 20, the members for assembling the stool, as well as the members of any other embodiment of the invention, may be provided in a kit 610. For increased compactness during storage and shipping, members 605, 612a-b, 617a-b, 621, and 624 are in a flat condition, and for clarity are shown to be separated one from the other. It will be appreciated, however, that the members are stacked one on the other or placed in abutting relation one next to the other when included in kit 610. For additional compactness, an enlarged severable member containing two or more of members 612a-b and 617a-b may be provided.

In this embodiment, frame unit 605 comprises a single exterior member having side flap 607 at one longitudinal end in which are embedded female fasteners 513, and an opened side flap 606 provided with apertures 608 through which corresponding male

fasteners may be introduced. Frame unit 605 is formed with parallel fold lines 603a-f to provide sides 604a-f, respectively, that can be set at a different angular disposition. Fold line 603f is interposed between side 604f and side flap 606. While sides 604c and 604f are provided with a rectangular flap 609 at their outward and inward edge, side 604a is provided with trapezoidal inward and outward flaps 608. Sides 604b, 604d, and 604e are provided with inward flaps 614 having one edge 611 that is oblique to the fold lines and one edge that is parallel to the fold lines. Sides 604b and 604e are provided with an outward flap 615 having a recessed portion 613. When two oblique edges 611 are facing each other, the two corresponding sides can be completely folded, for compactness during shipping and storage.

Fig. 22 illustrates a male fastener being introduced through an aperture of side flaps 606 and 607 during the assembly of frame unit 605.

In Fig. 23, hexagonal bottom cover 621 is shown to be attached to frame unit 605. Bottom cover has six symmetrically disposed trapezoidal side flaps 619a-f that extend from hexagonal base portion 623 and that are foldable along a corresponding fold line 622. Side flap 619a is adhesively affixed to inward flap 609 of side 604f. A fold line 626 extending between flaps 619b, 619c, 619e, and 619f allows bottom cover 621 to be folded and disposed within the interior of a frame unit 605 in a flat condition, as shown in Fig. 24.

Fig. 25 shows frame unit 605 and bottom cover 621 in an expanded condition. Side flaps 619b and 619f, for example, are shown to be introduced into the interior of frame unit 605.

As shown in Fig. 26, the side flaps 619b-f are then folded onto base portion 623 of the bottom cover. The inward flaps of frame unit 605, e.g. the illustrated flaps 609 and 614 of sides 604b and 604c, respectively, are provided with a peelable protective

layer 616, which when peeled, reveals an adhesive layer 602. The inward flaps of frame unit 605 are then folded so that each adhesive layer 602 is affixed to a corresponding folded side flap of the bottom cover.

In Fig. 27, hexagonal reinforcement 624 is introduced into the interior of frame unit 605 and placed on base portion 623 of the bottom cover.

In Fig. 28, stabilizer elements 612a and 612b are interconnected and introduced into the interior of frame unit 605, to frictionally engage corresponding sides of the frame unit. As shown in Fig. 29, opposed stabilizer elements 617a and 617b are then introduced into the interior of frame unit 605 so as to frictionally engage a junction of stabilizer elements 612a and 612b and an interface of two frame unit sides. A top cover 681 is then secured to the stabilized frame unit such that recessed portion 683 of top cover 681 is aligned with recessed portion 613 of the frame unit, to produce a fully assembled stool 635, as shown in Fig. 30. Stool 635 is sufficiently structurally strong to support an adult person when standing thereon.

While some embodiments of the invention have been described by way of illustration, it will be apparent that the invention can be carried out with many modifications, variations and adaptations, and with the use of numerous equivalents or alternative solutions that are within the scope of persons skilled in the art, without departing from the spirit of the invention or exceeding the scope of the claims.

CLAIMS

1. A three-dimensional article produced from sheet material, comprising a frame unit having a plurality of outer sides made of sheet material each of which having a different angular disposition, wherein first and second longitudinal ends of said frame unit are interconnected by means of a female fastener embedded in said first end and of a male fastener introduced through said second end and coupled with said female fastener.
2. The article according to claim 1, wherein at least one expanded stabilizing element is frictionally engaged with inner faces of the frame unit, for increasing the structural strength of the three-dimensional article.
3. The article according to claim 1, wherein the first end of the frame unit comprises a side flap formed with at least one aperture, said side flap being folded and affixed to a base portion of a frame unit side such that the female fastener placed on a predetermined region of said base region is embedded within said side flap while being accessible to the male fastener by means of a corresponding aperture.
4. The article according to claim 3, wherein the second end of the frame unit comprises a side flap formed with at least one aperture, said side flap of the second end remaining in an opened position while its at least one aperture is aligned with the at least one aperture of the folded side flap of the first end and a male fastener introduced through an aperture of the second end is coupled with a corresponding embedded female faster, whereby to form a reinforced connection.
5. The article according to claim 4, wherein the reinforced connection protrudes from the inner side of the frame unit.

6. The article according to claim 4, wherein the frame unit comprises a plurality of exterior members, each of which being interconnected by means of a reinforced connection.
7. The article according to claim 6, wherein each exterior member comprises a base portion, a flap inwardly extending from said base portion, and at least one extension outwardly extending from said base portion and provided with a single projection protruding from an outward edge thereof, a first portion of said inward flap being adhesively affixed to said base portion and a second portion of said inward flap being foldable perpendicularly to said base portion.
8. The article according to claim 7, further comprising an insert made of the sheet material that is inwardly introduced within the interior of the frame unit until contacting each inward flap second portion of the frame unit.
9. The article according to claim 8, wherein a plurality of apertures are formed in the insert and the extension of each exterior member is inwardly folded until the projection protruding from its outward edge engages a corresponding aperture formed in the insert, thereby concealing a corresponding reinforced connection.
10. The article according to claim 7, wherein a first exterior member comprises two side flaps that are folded and adhesively affixed to the base portion, two female fasteners being embedded in each side flap and being accessible via a corresponding aperture formed therein, and a second exterior member comprises two side flaps each of which are in an opened position and bored with two apertures, a male fastener introduced through a side flap aperture of said second exterior member being coupled with a corresponding female fastener embedded within said first exterior member to form a reinforced connection.

11. The article according to claim 7, wherein each exterior member comprises a first side flap that is folded and adhesively affixed to the base portion, two female fasteners being embedded in said first side flap, and a second side flap that is opened and bored with two apertures, a male fastener introduced through a second side flap aperture of a first exterior member being coupled with a corresponding female fastener embedded within a first side flap of a second exterior member to form a reinforced connection.

12. The article according to claim 8, further comprising a reinforcement adhesively attached to the base portion of each exterior member, an outwardly folded peripheral element of the insert being positioned within the spacing between said reinforcement and a corresponding inward flap second portion while the insert is being inwardly introduced within the interior of the frame unit.

13. The article according to claim 1, which is selected from the group consisting of cabinet, table, storage box, wheeled storage box stool, doll house, chair, trunk, bench, wine holder, and file holder.

14. A kit for assembling a three-dimensional article, comprising a plurality of separate or separable members made from sheet material and set in a flat condition, including one or more first members configured with a side flap in which is embedded at least one accessible female fasteners, one or more second members configured with a side flap in an opened position formed with at least one aperture, and one or more stabilizing elements, wherein a male fastener introduced through an aperture of the opened side flap of a second member is coupleable with a corresponding and aligned embedded female faster of a first member, so that when a plurality of said first and second members are serially interconnected such that each of which has a different angular disposition a frame unit is formed, said one or more stabilizing elements frictionally engageable with inner faces of said frame unit.

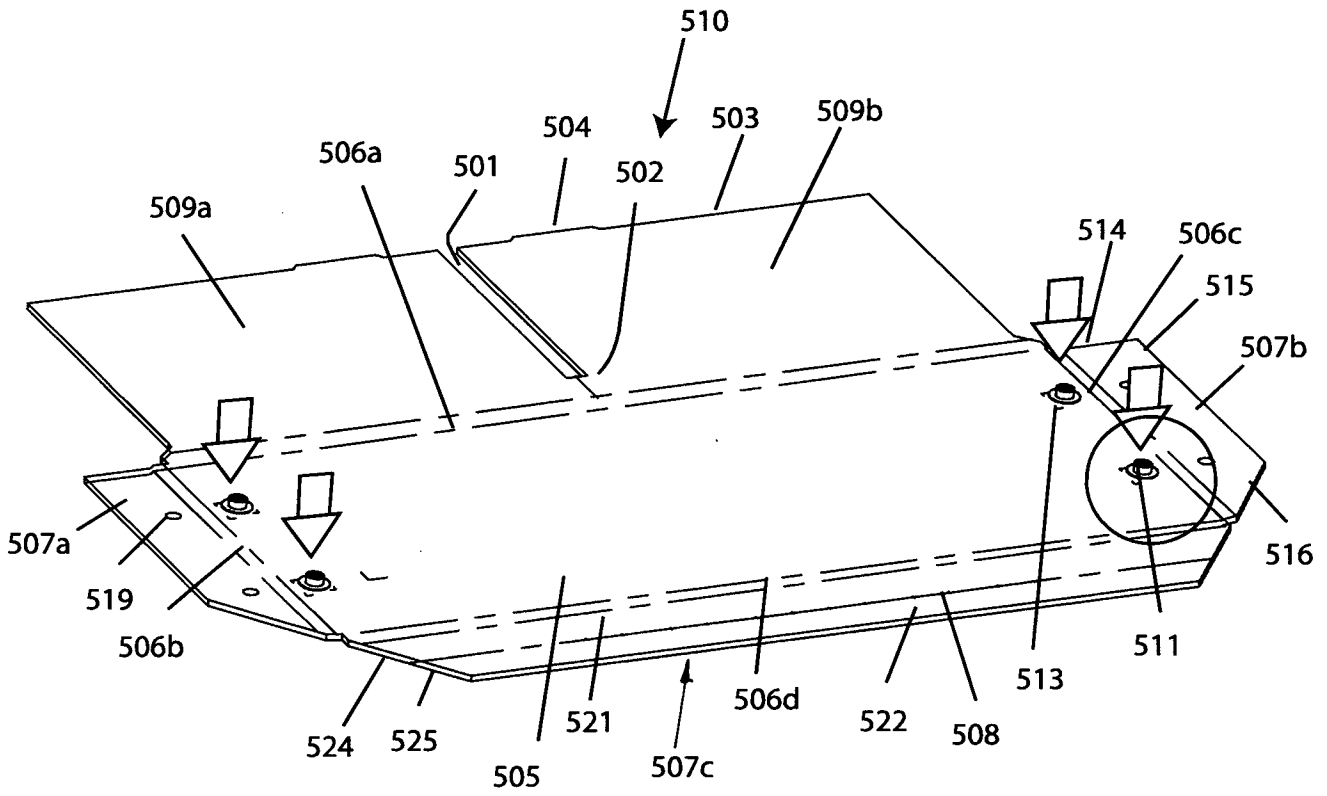


Fig. 1

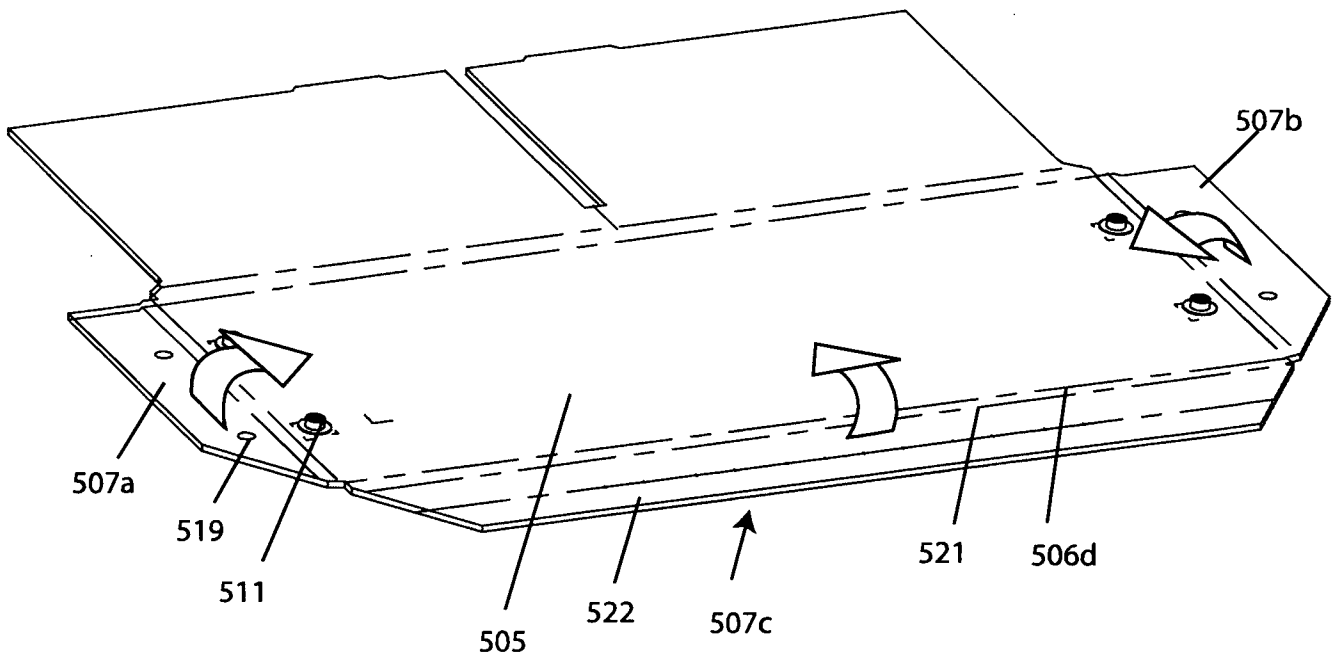


Fig. 2

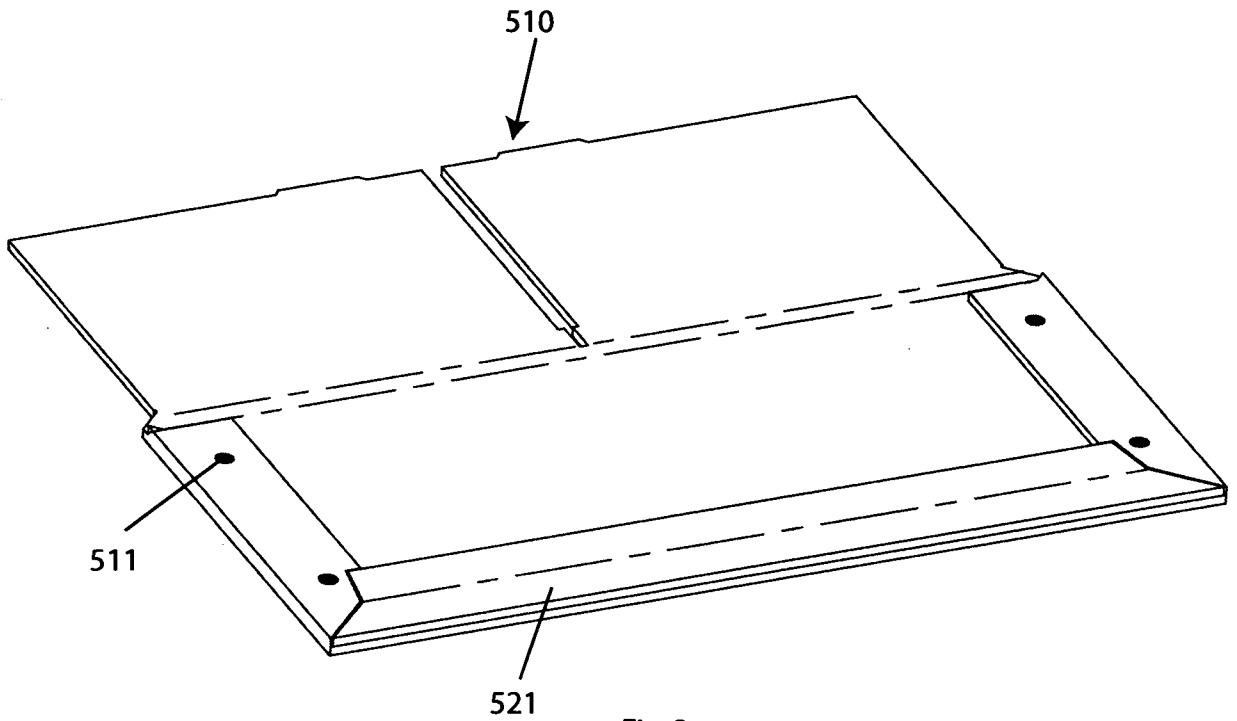


Fig. 3

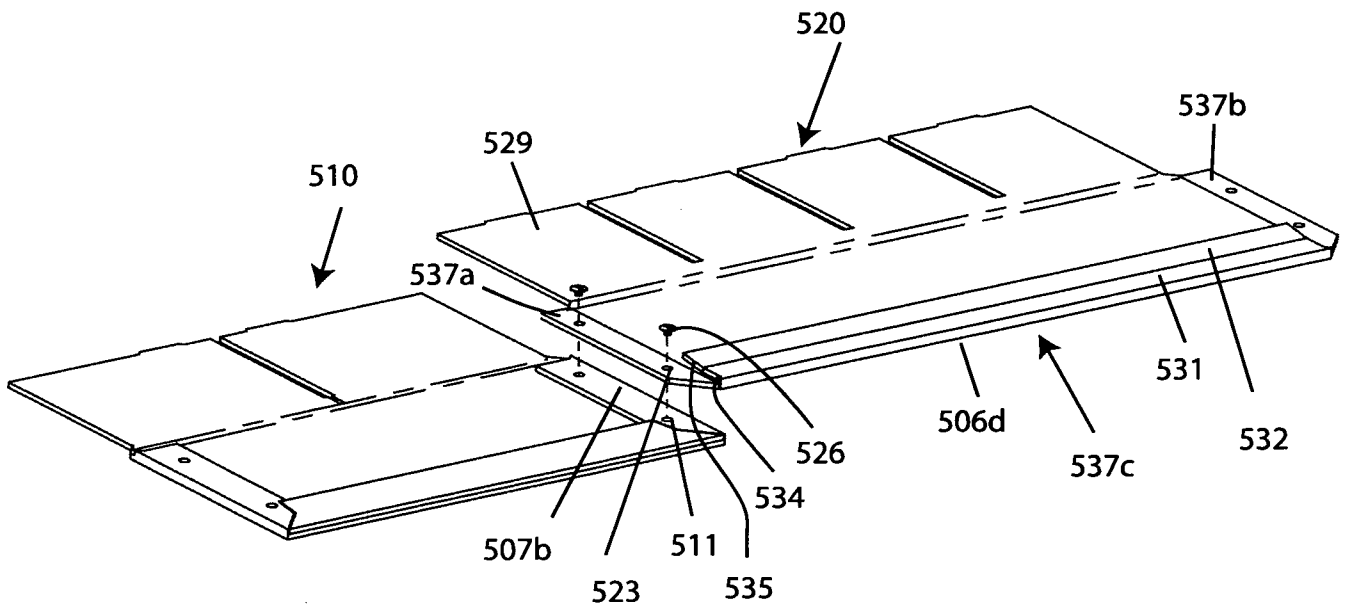


Fig. 4

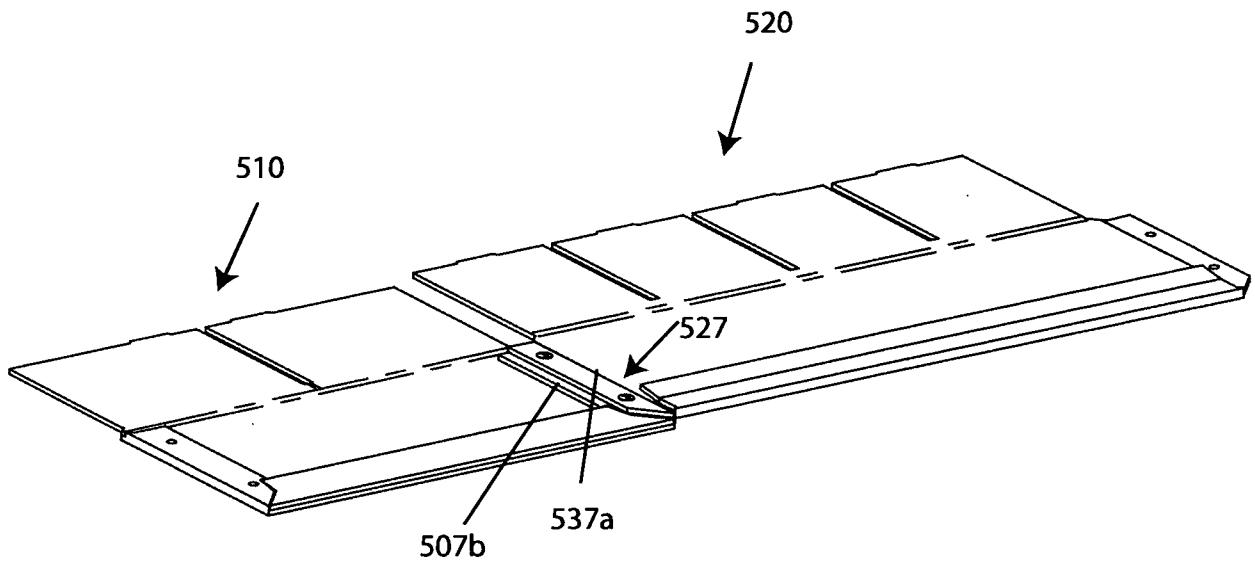


Fig. 5

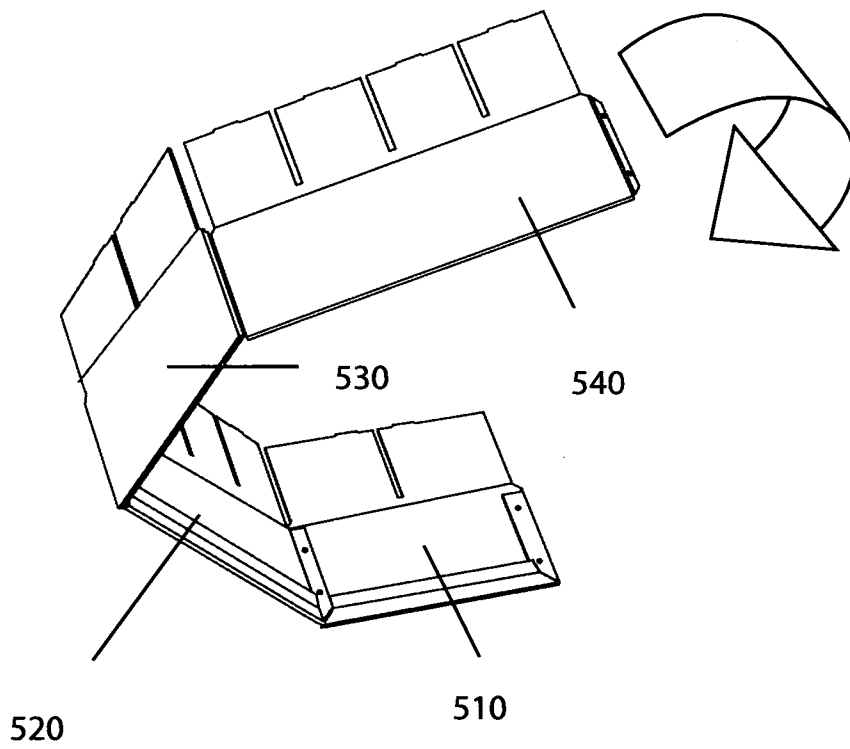


Fig. 6

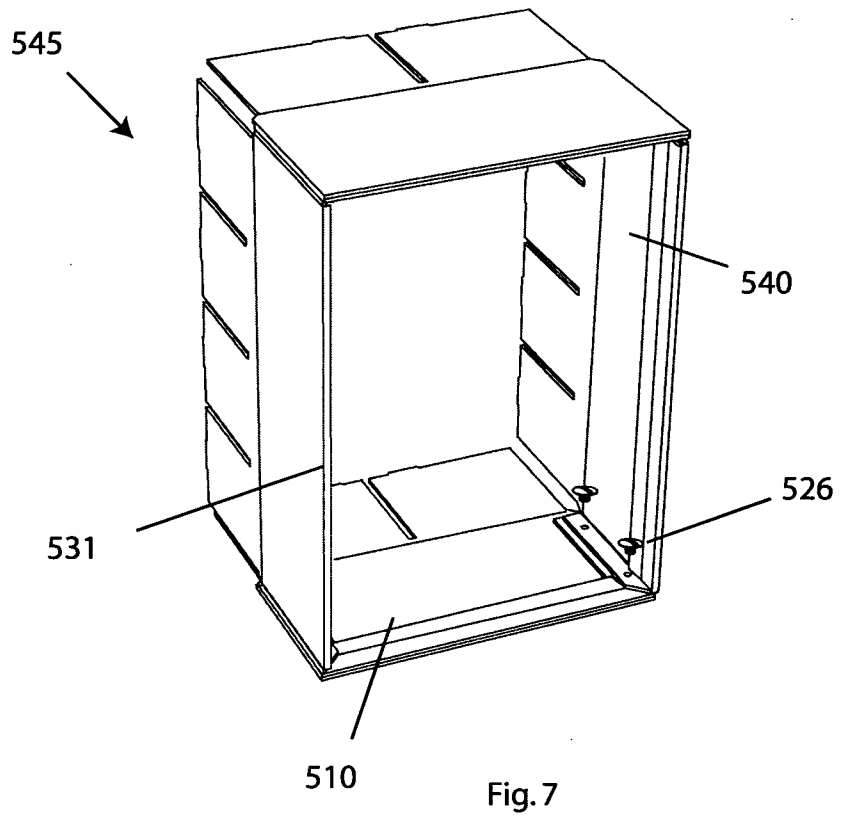


Fig. 7

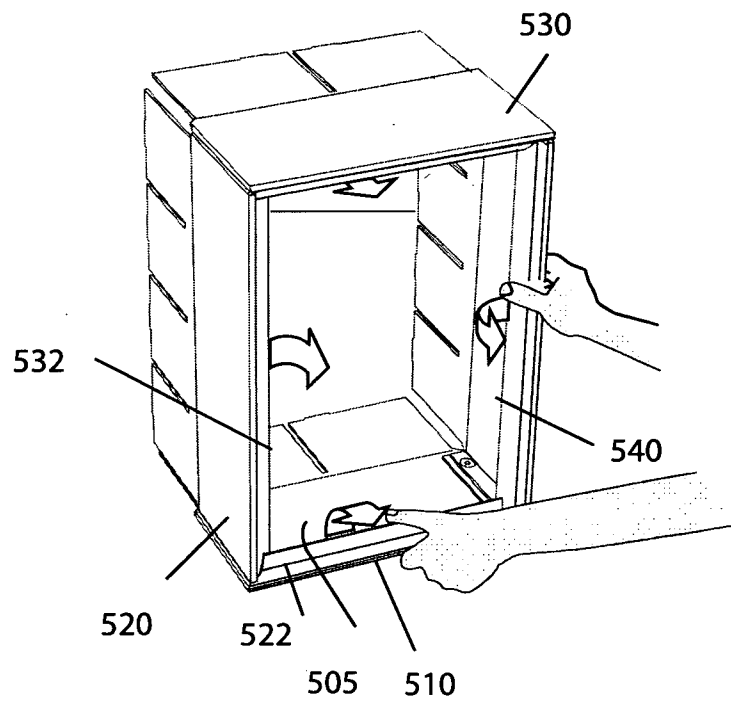
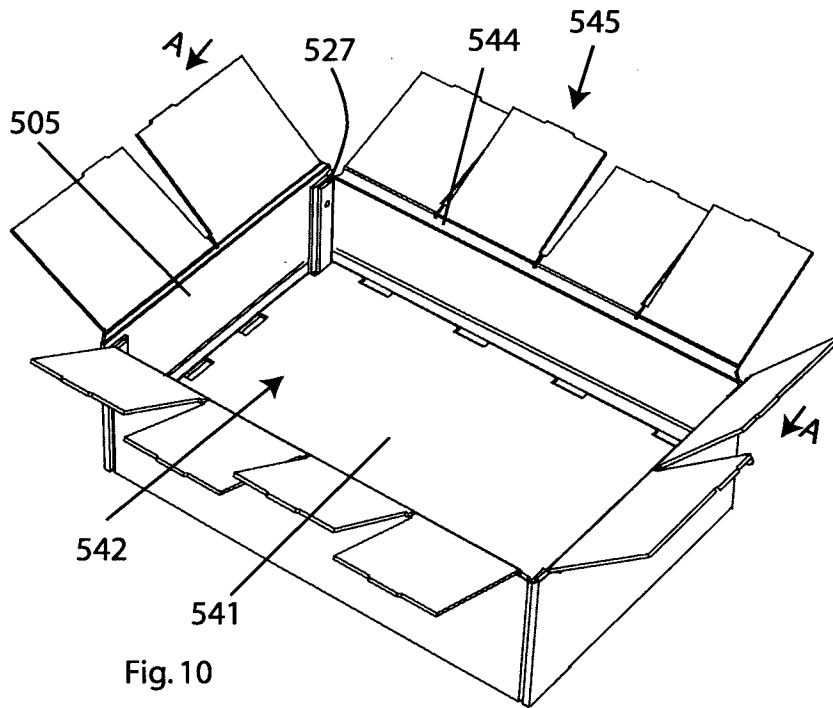
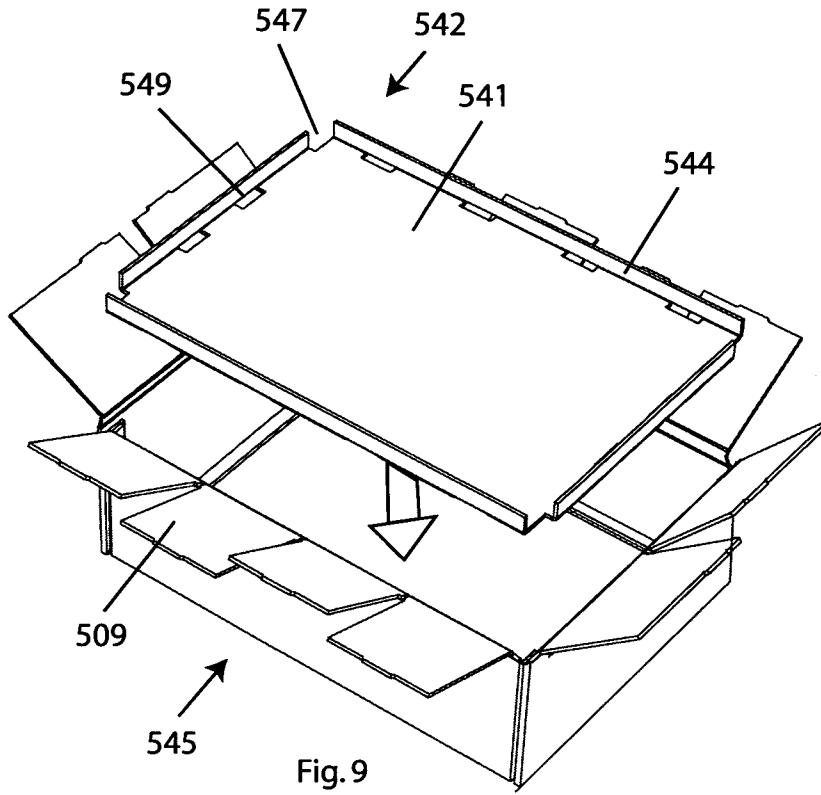
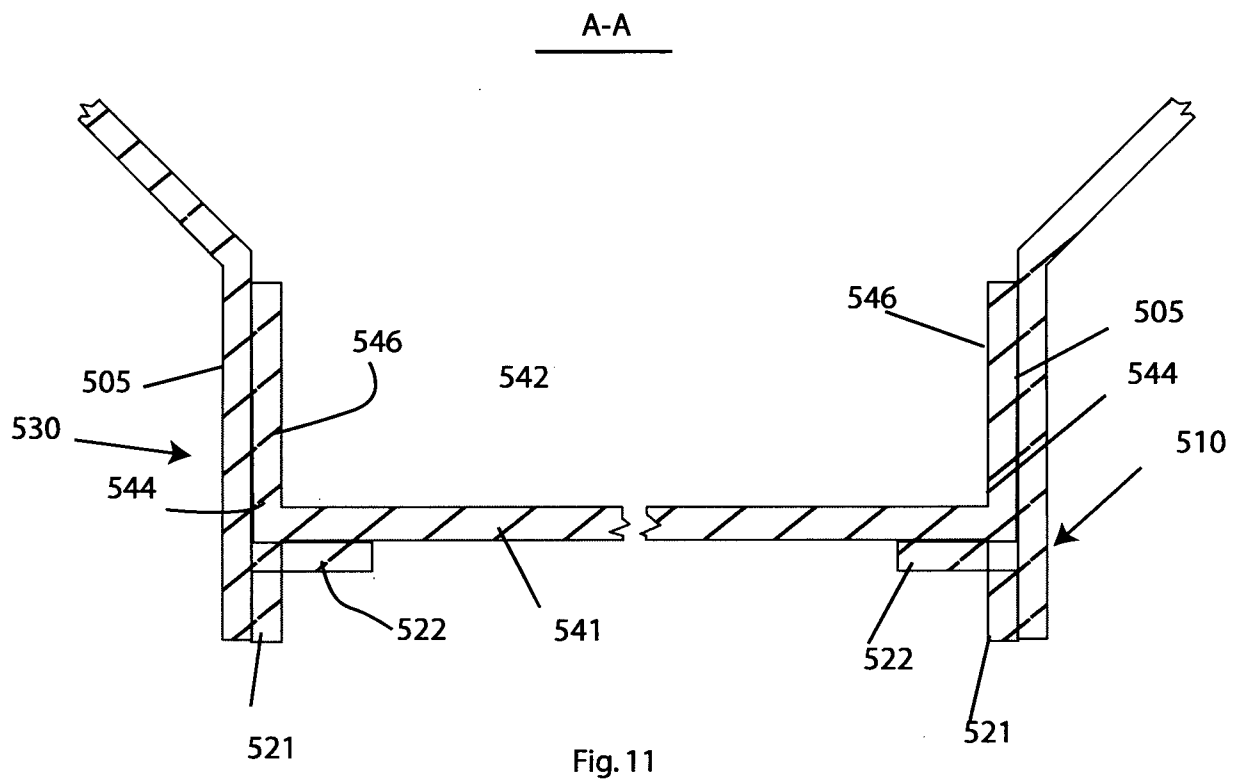


Fig. 8





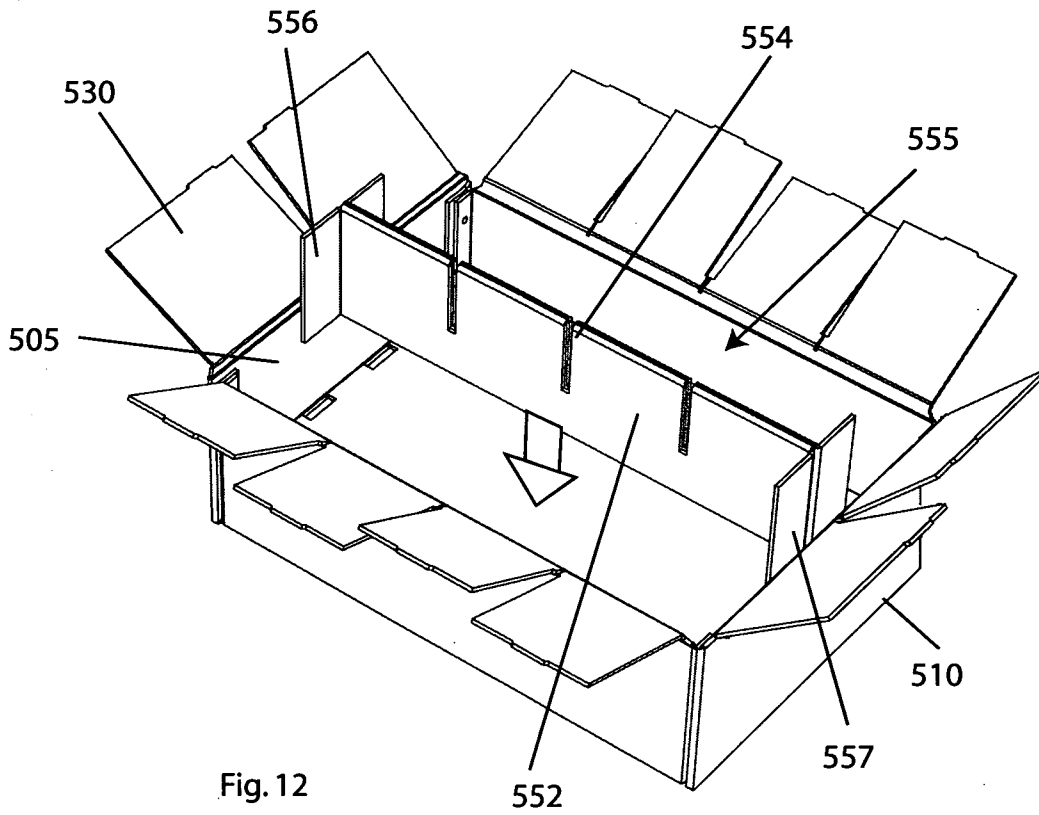


Fig. 12

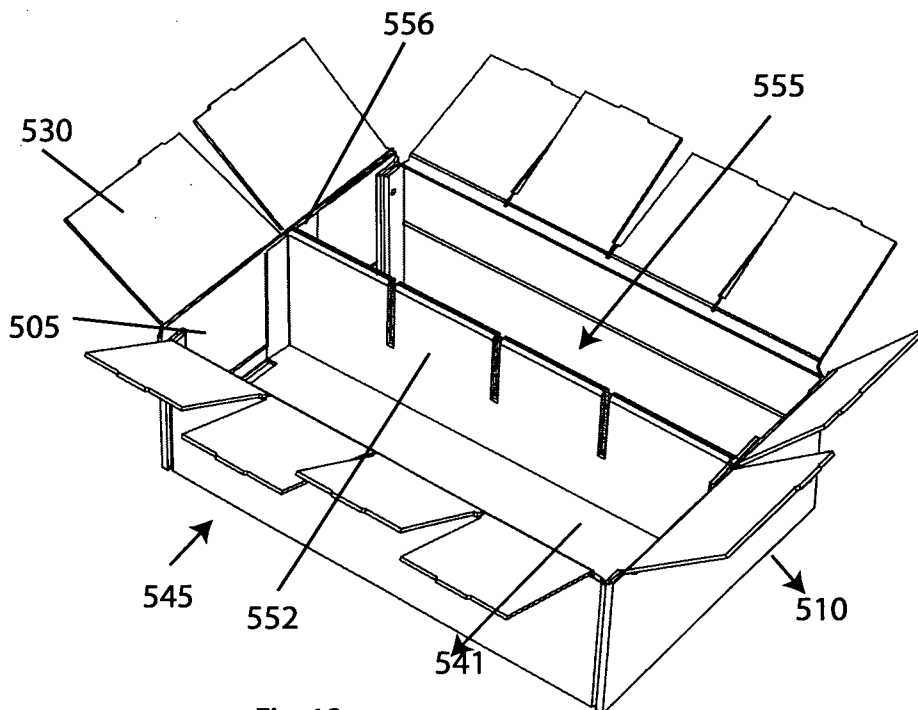
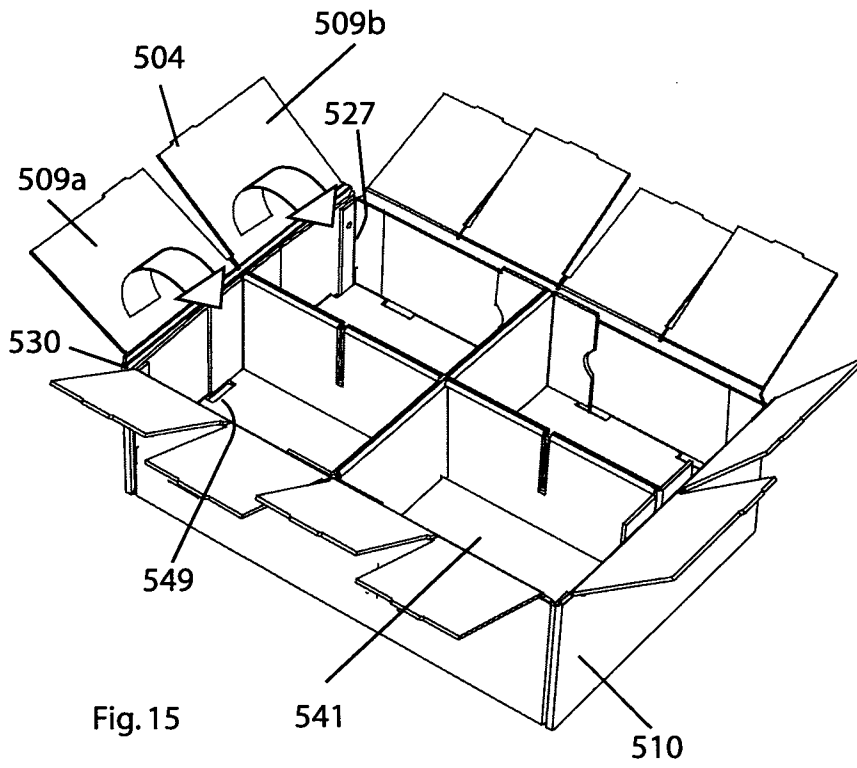
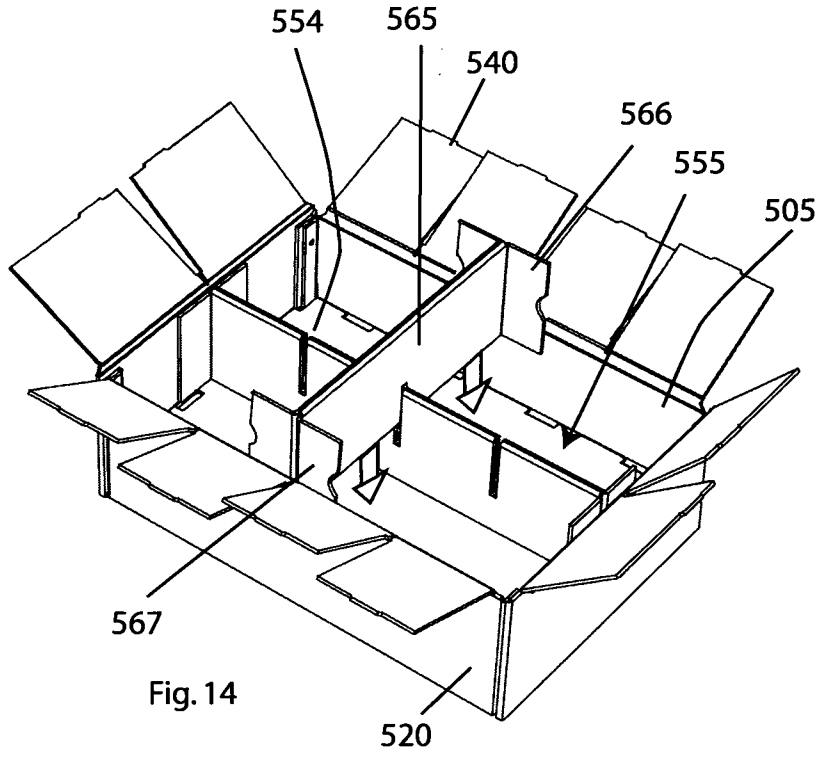


Fig. 13
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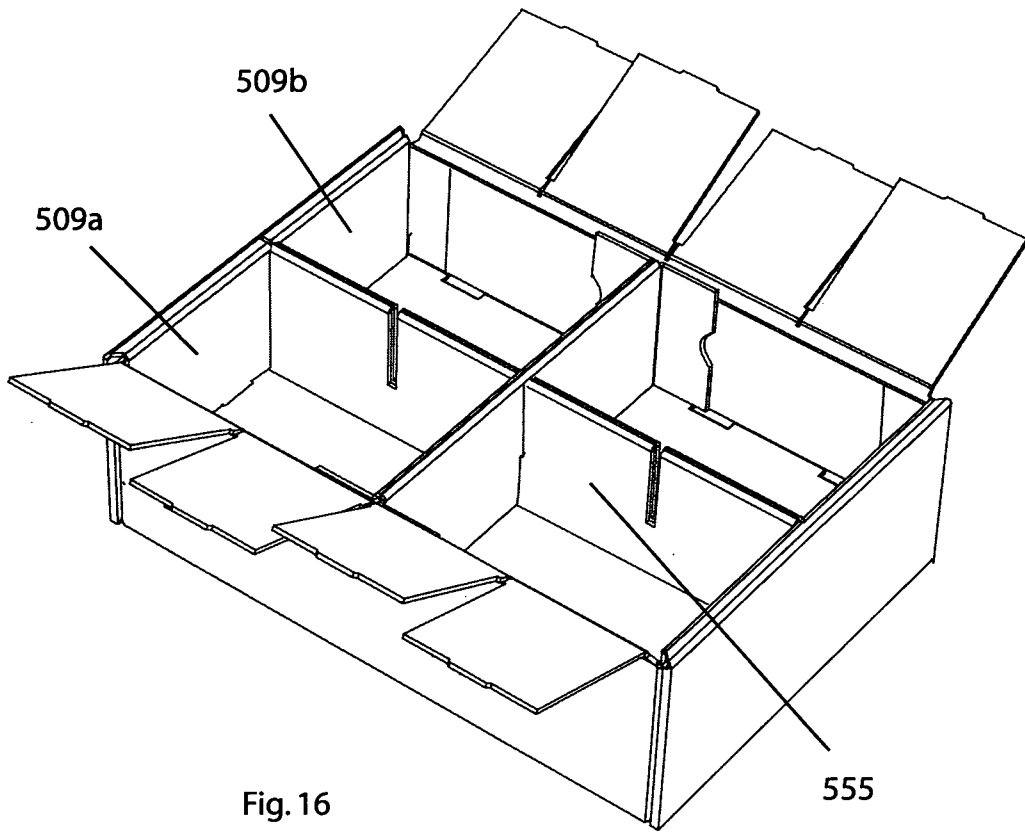


Fig. 16

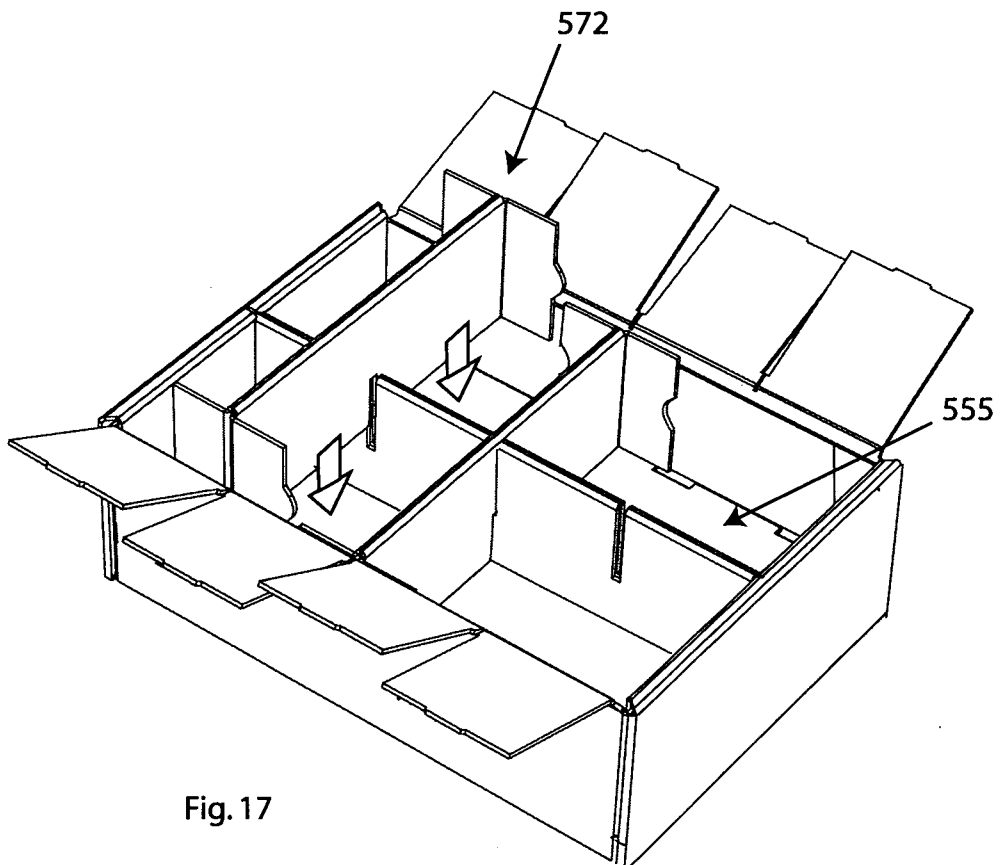


Fig. 17

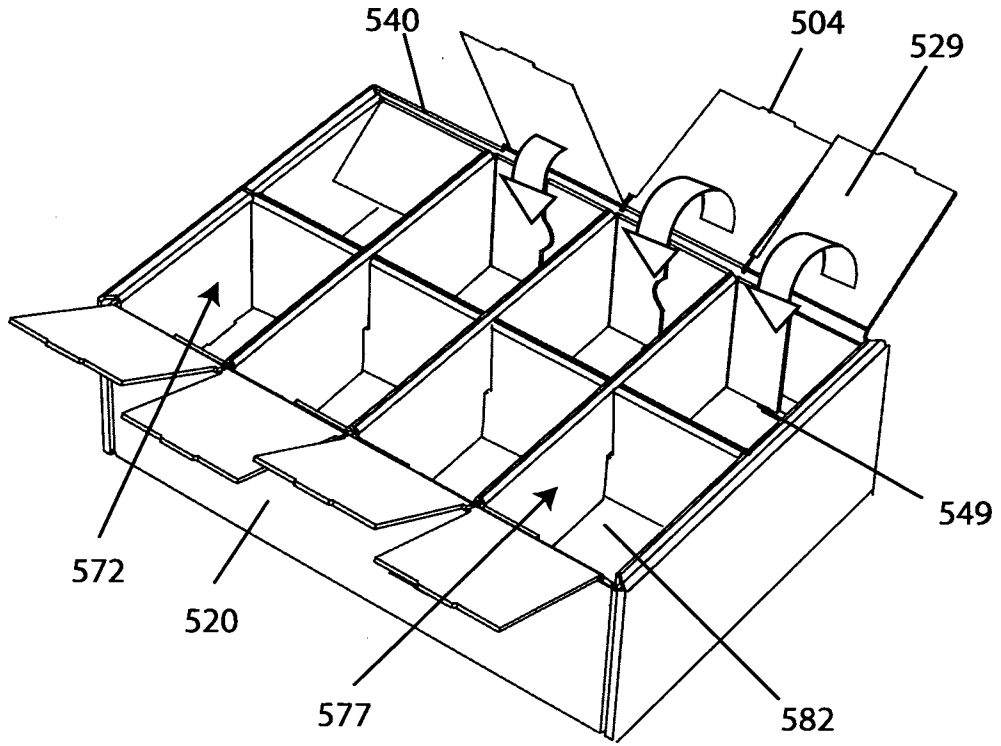


Fig. 18

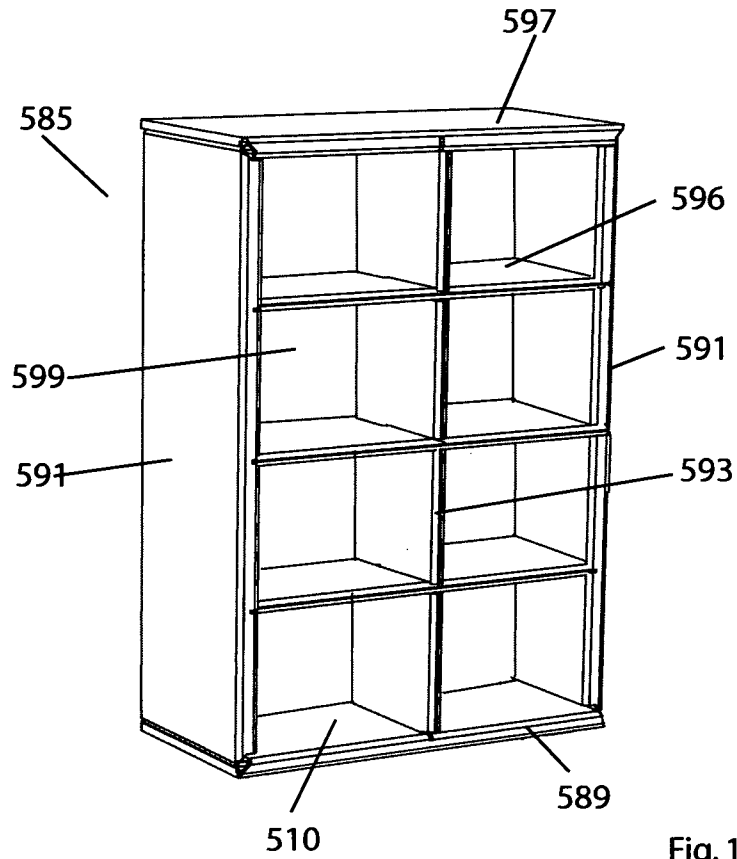


Fig. 19

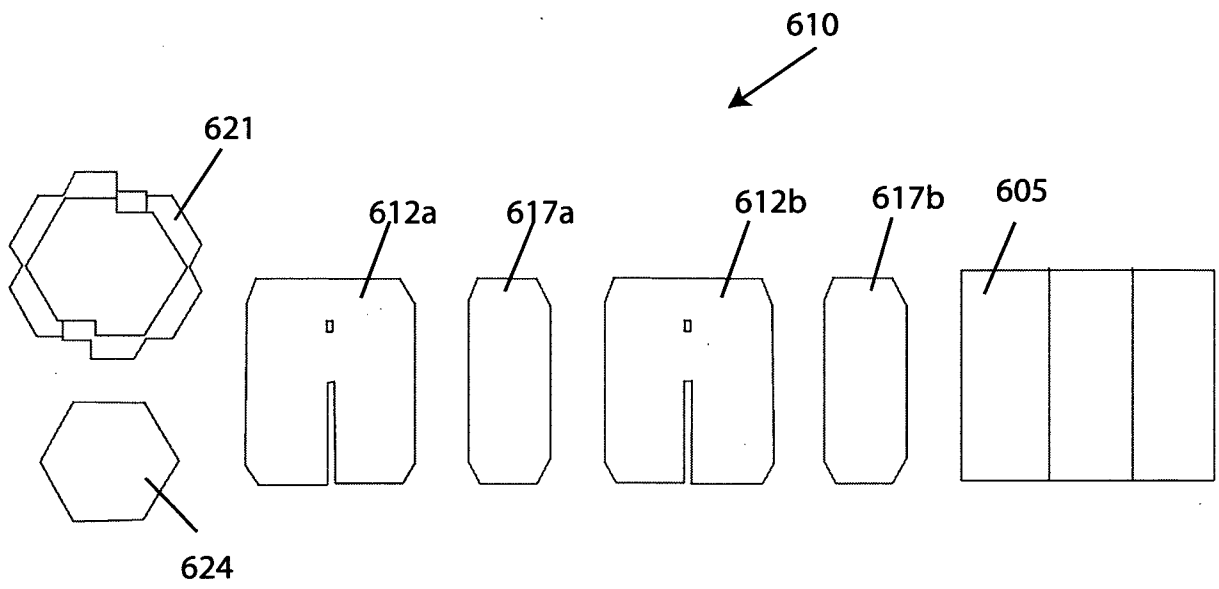


Fig. 20

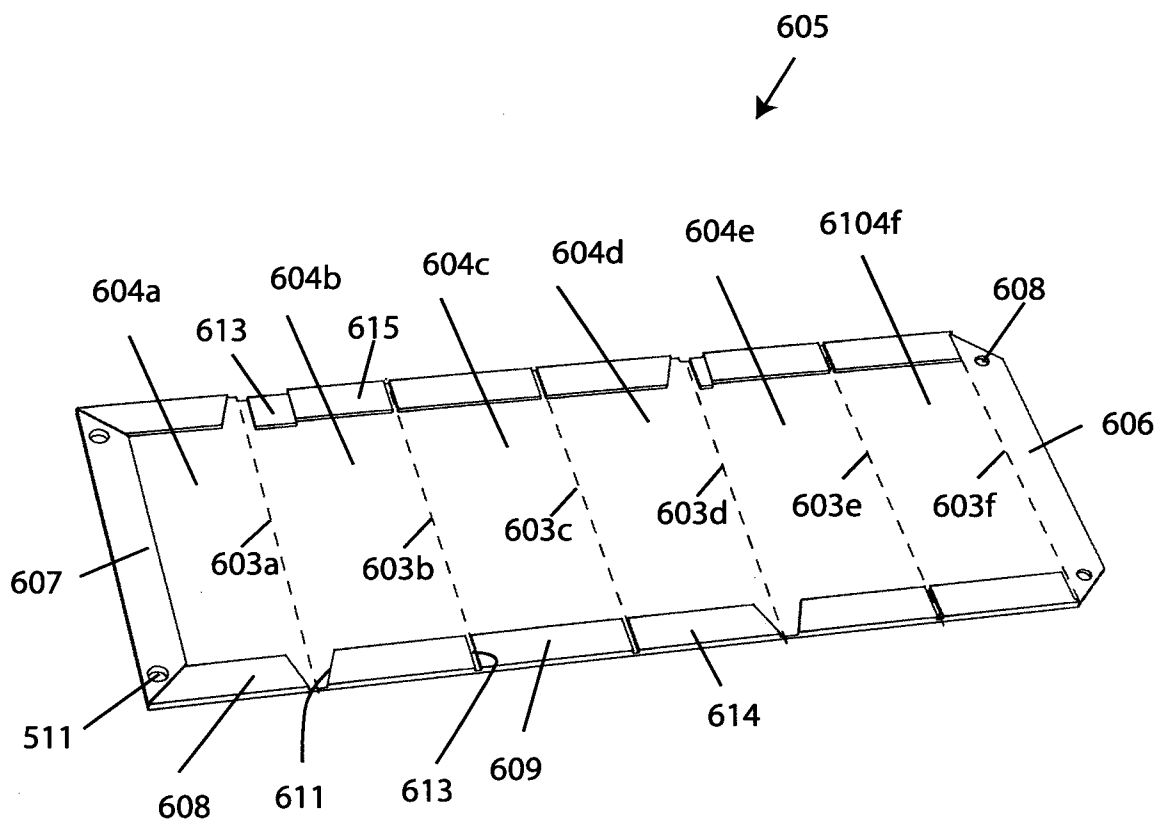


Fig. 21

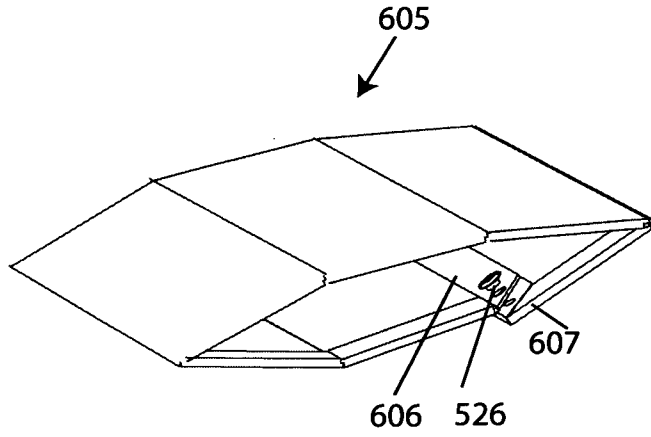


Fig. 22

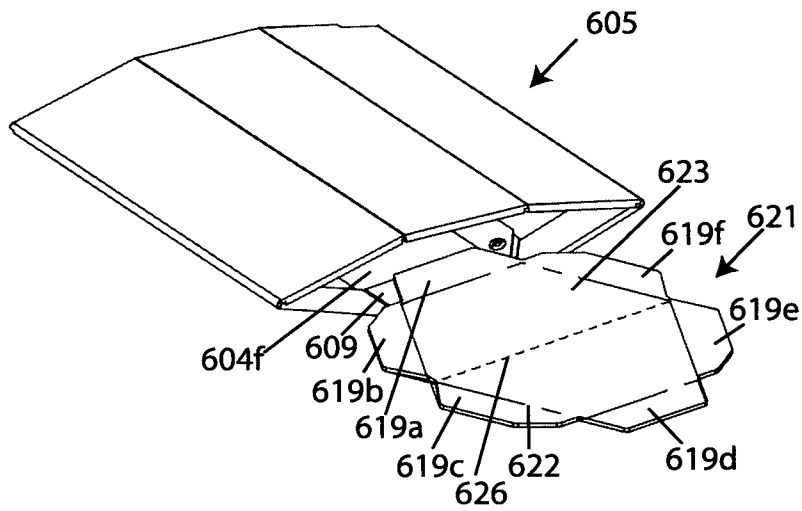


Fig. 23

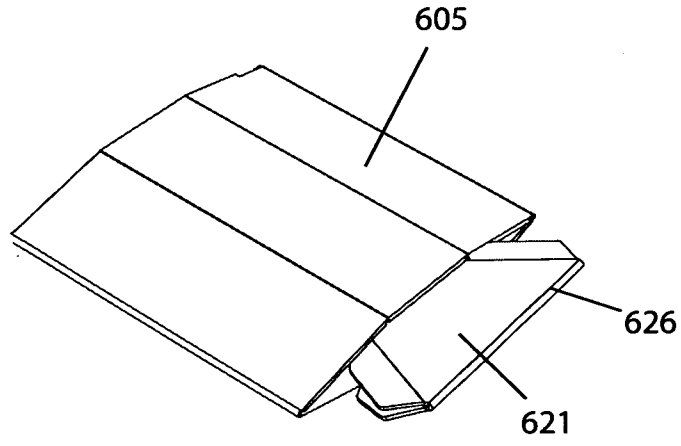


Fig. 24

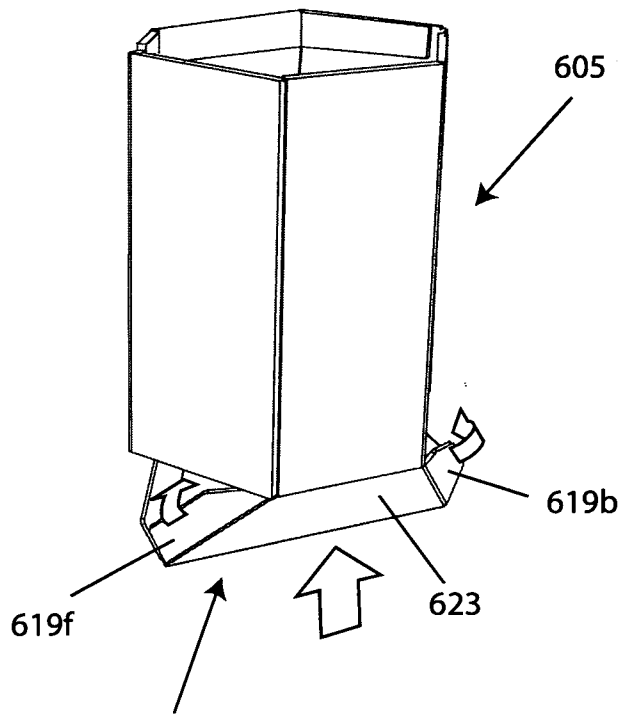


Fig. 25

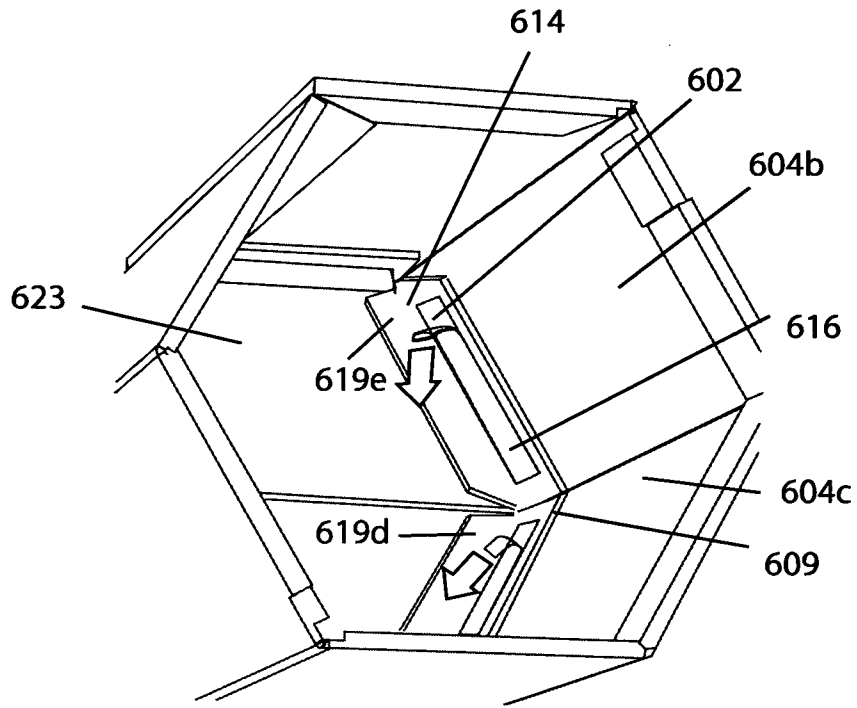


Fig. 26

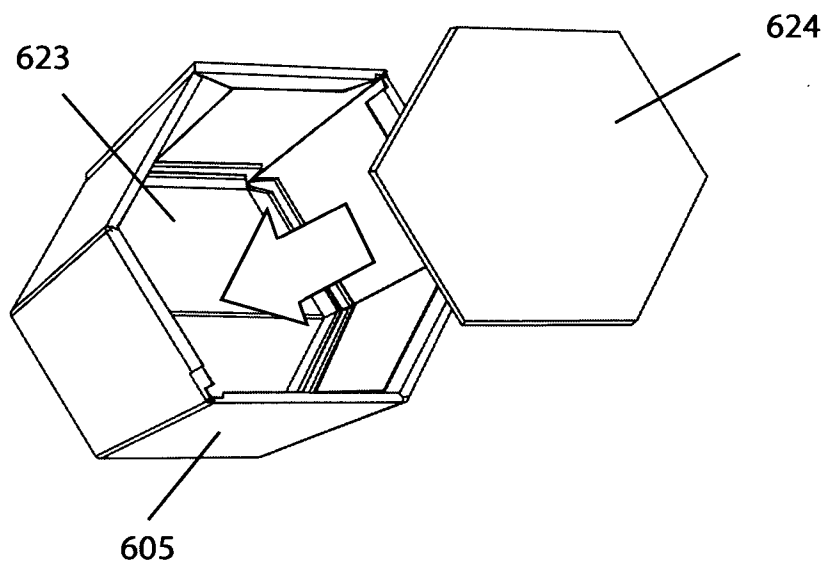


Fig. 27

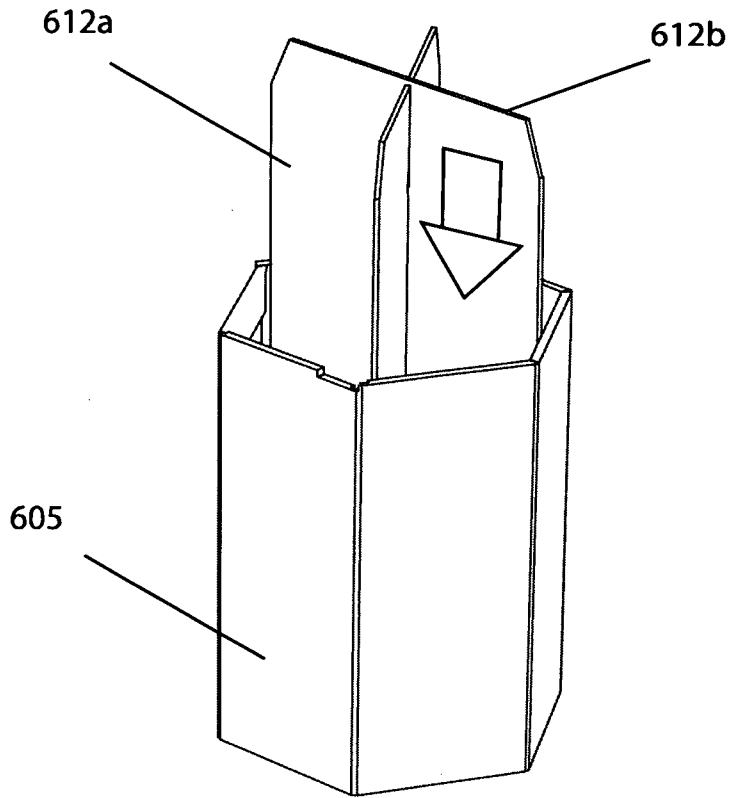


Fig. 28

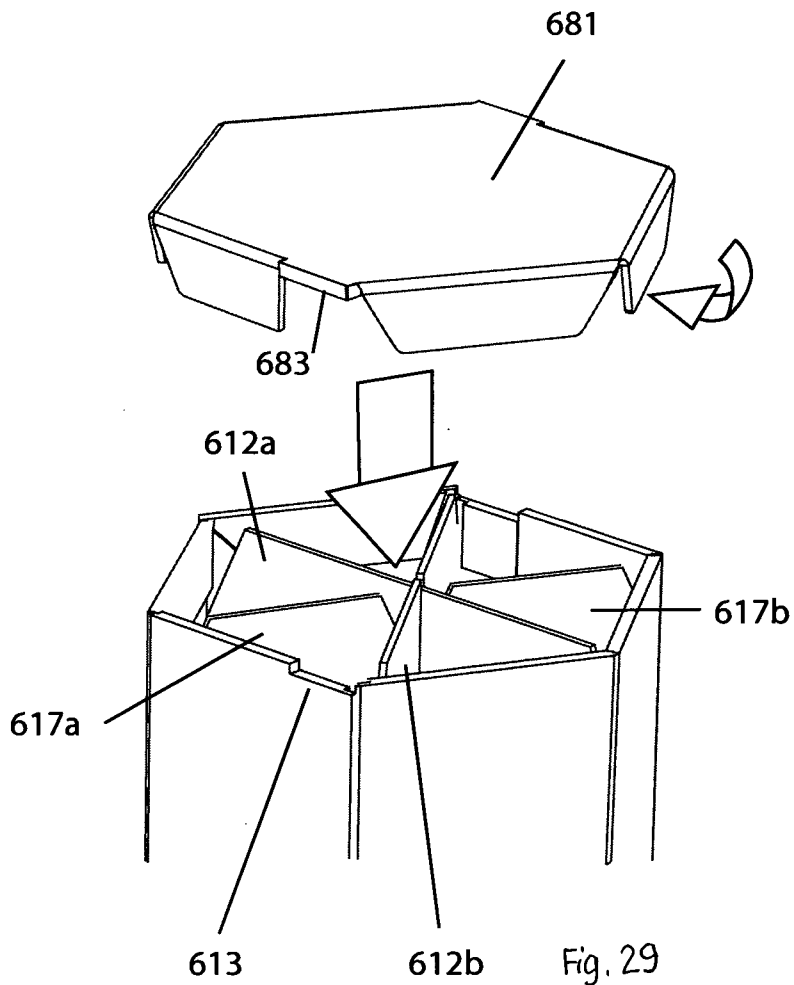
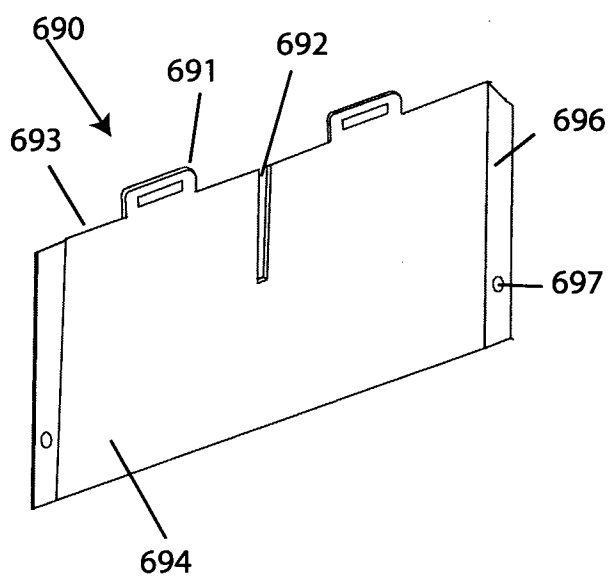
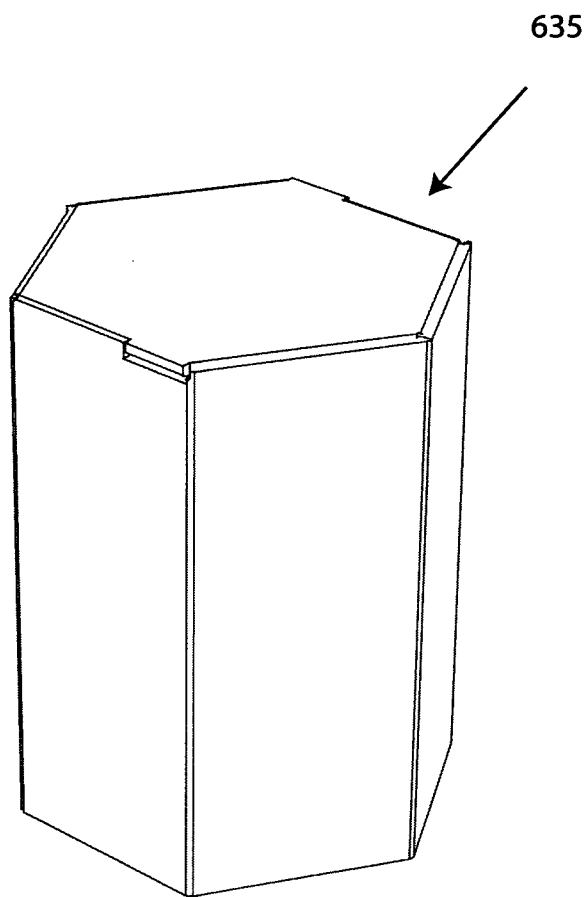


Fig. 29



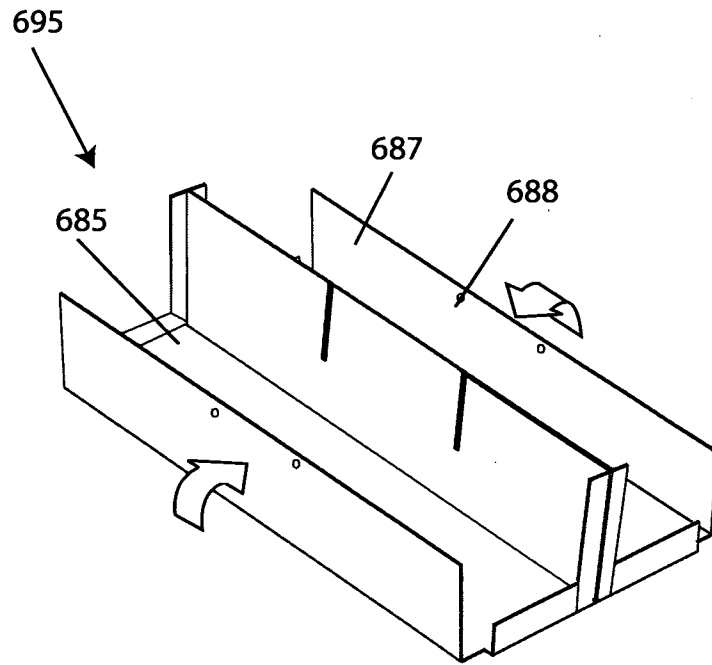


Fig. 32

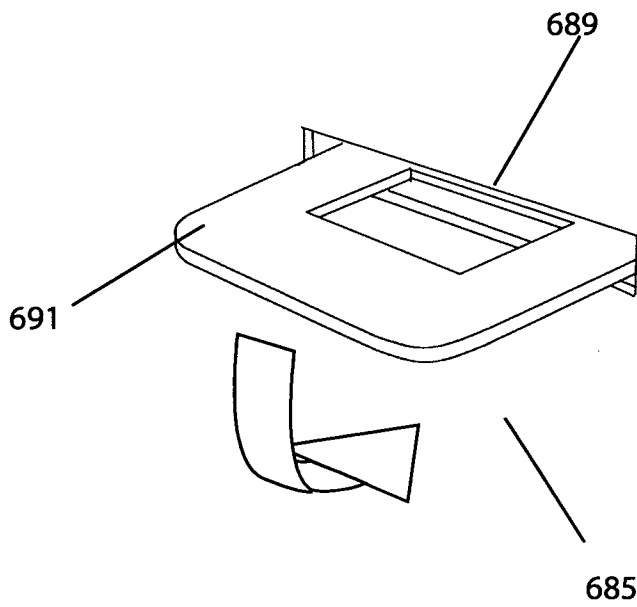


Fig. 33A

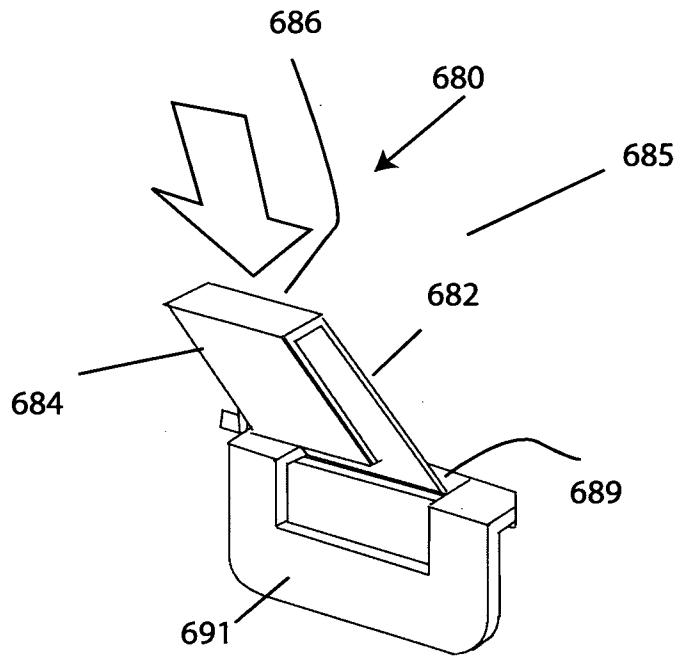


Fig. 33B

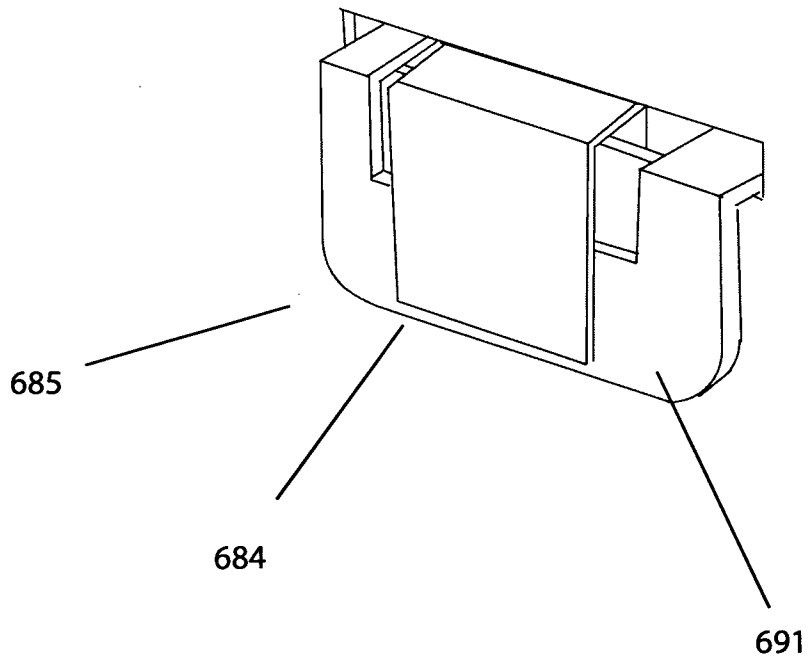


Fig. 33C

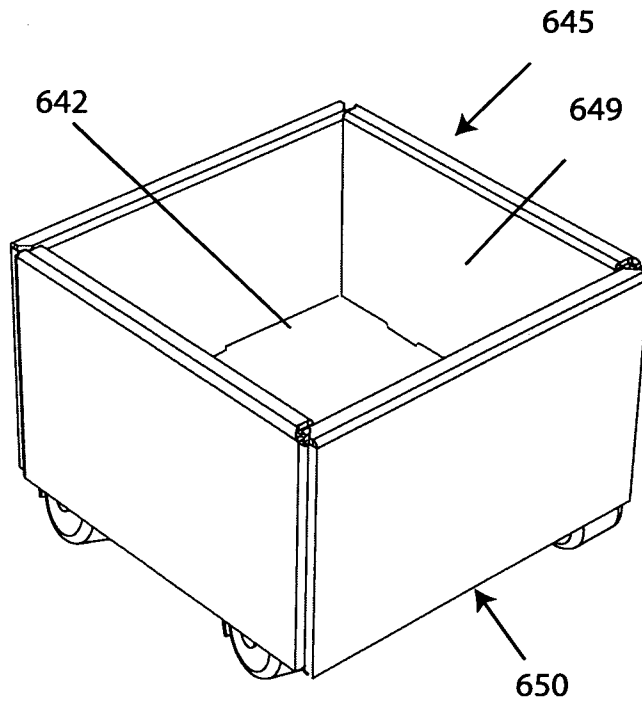


Fig. 34

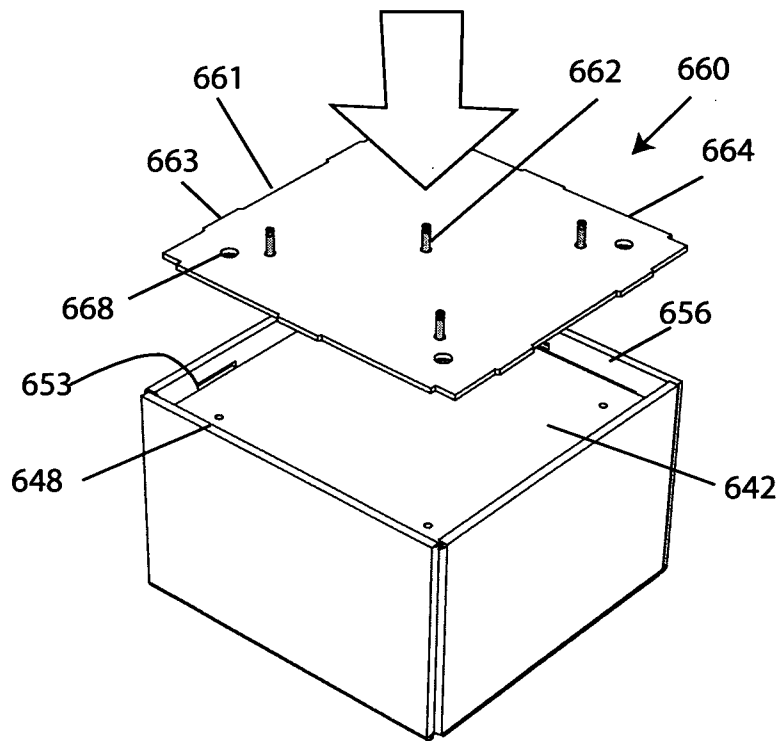


Fig. 35
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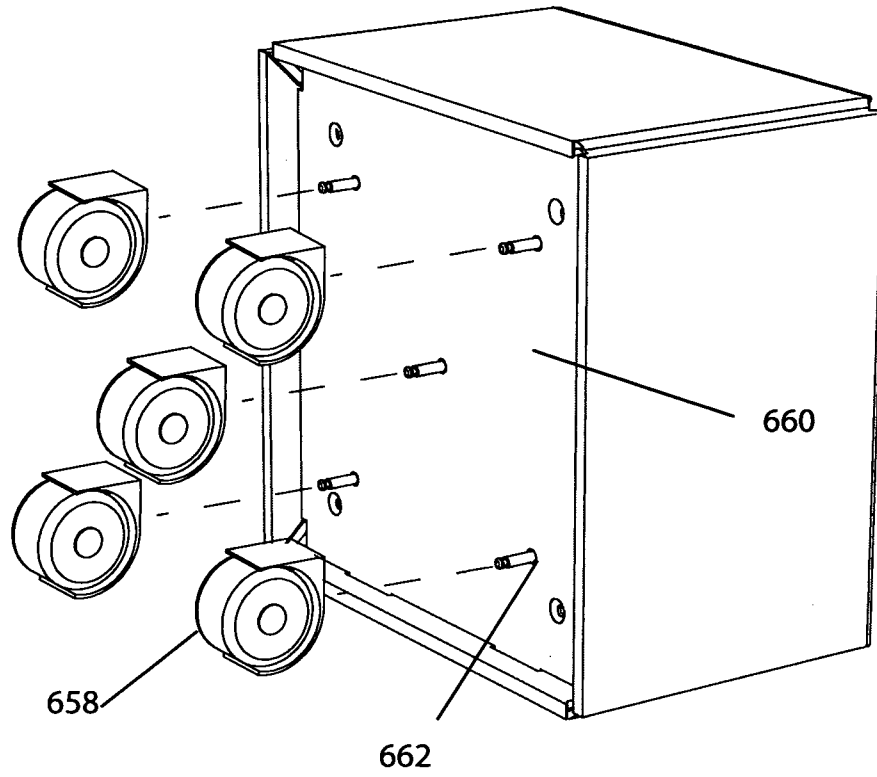


Fig. 36

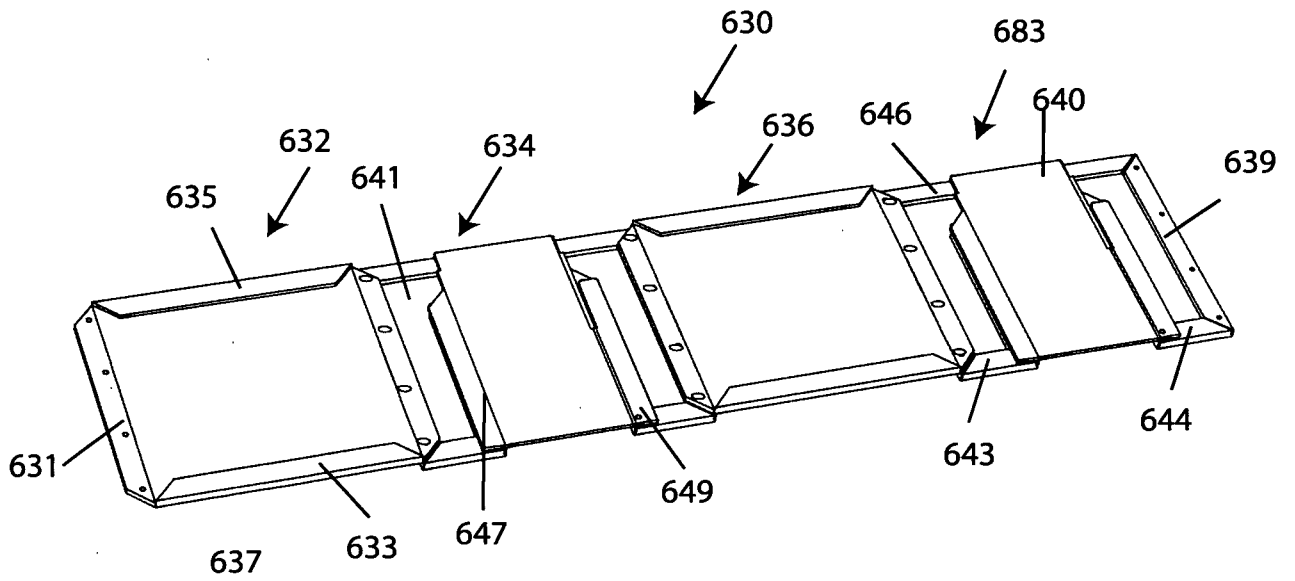


Fig. 37

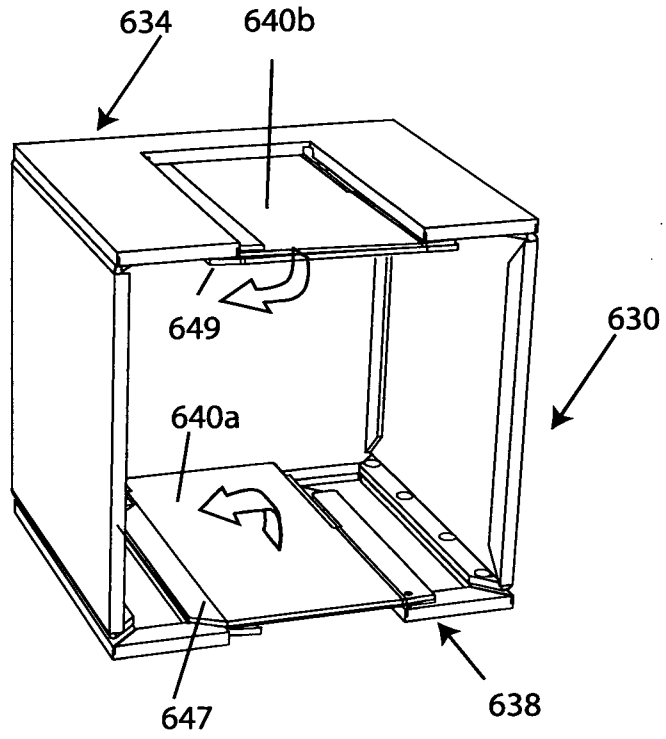


Fig. 38

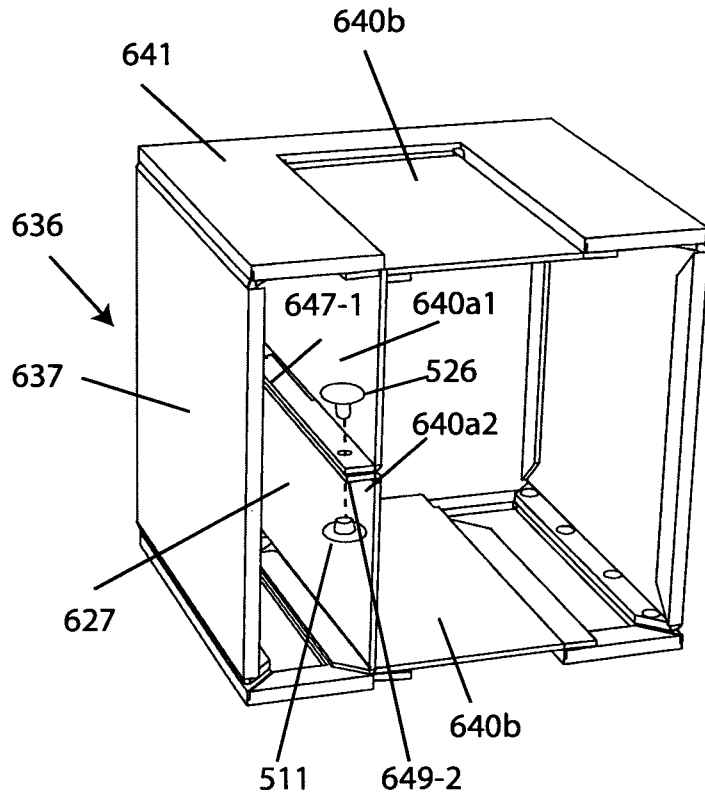


Fig. 39

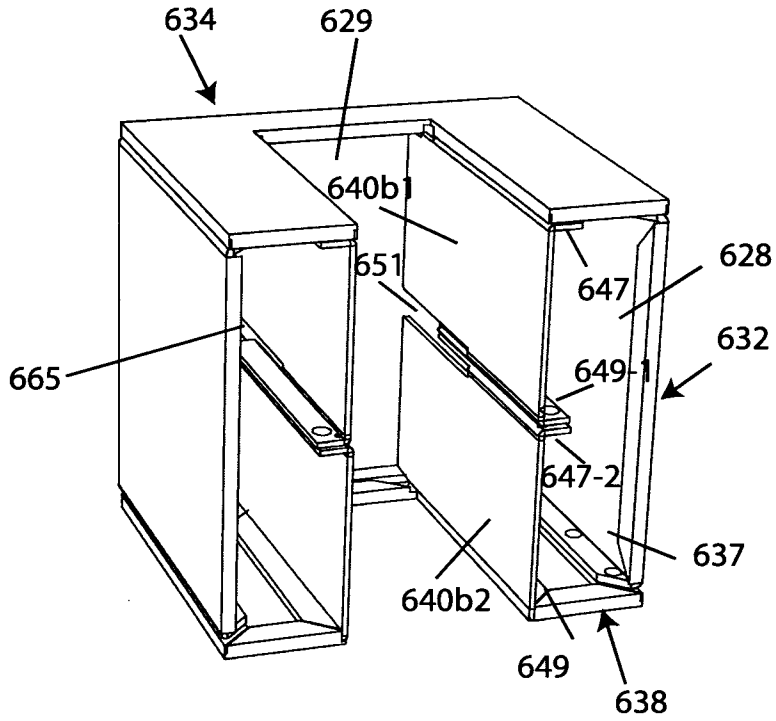


Fig.40

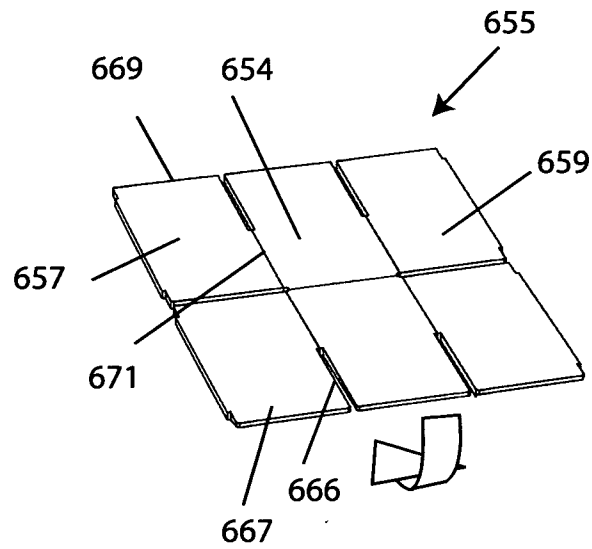


Fig.41A

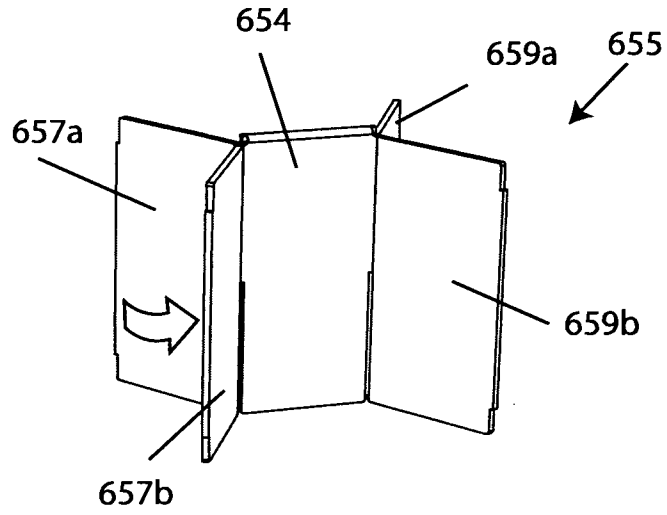


Fig. 41B

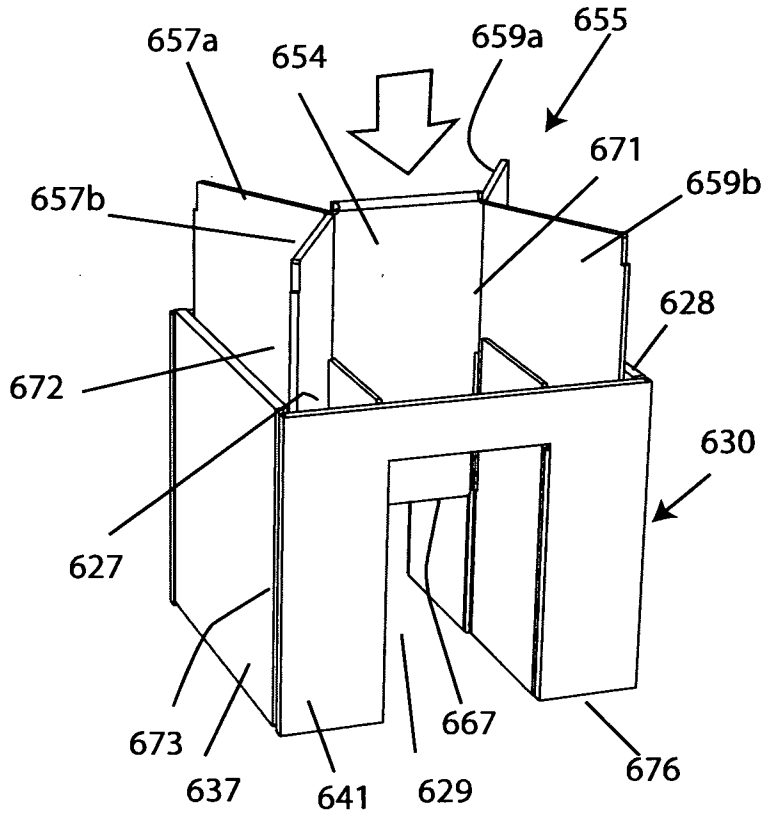


Fig. 42

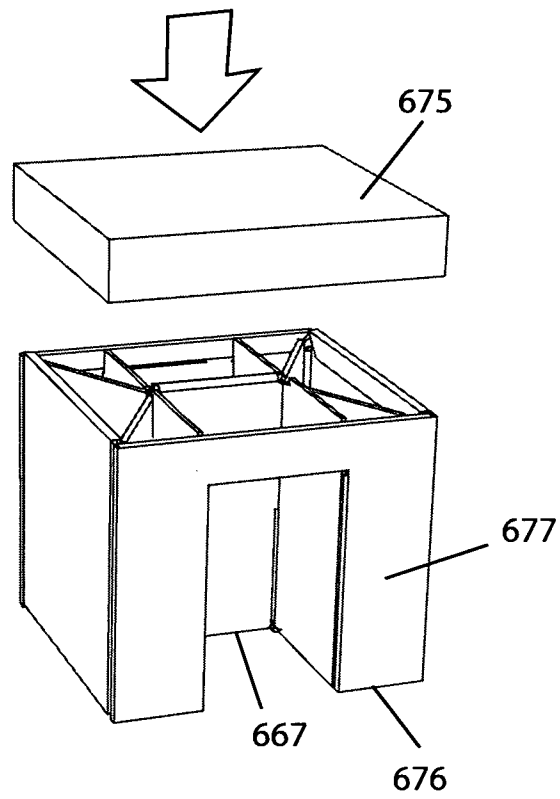


Fig. 43

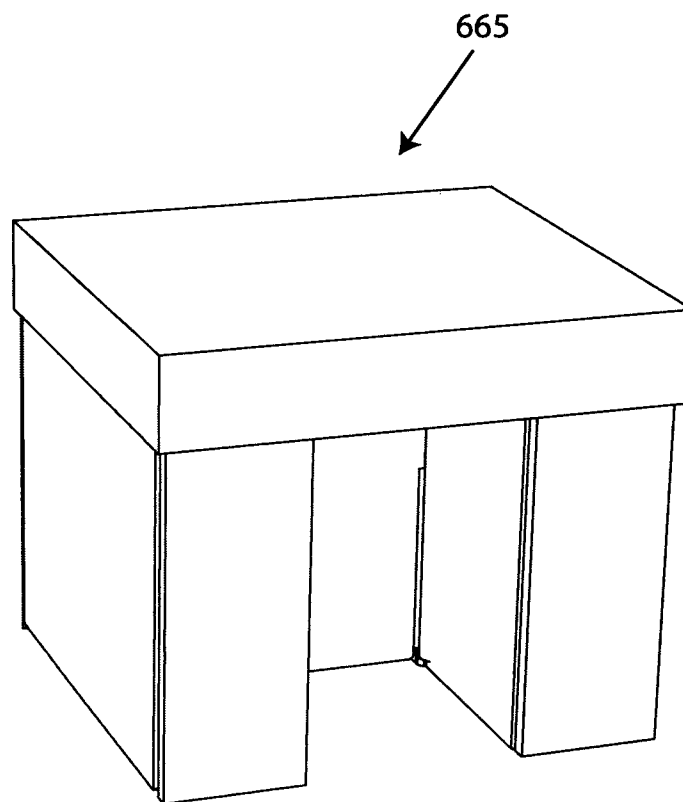


Fig. 44

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL 10/00597

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A47F 5/00 (2010.01)

USPC - 211/135

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
USPC- 211/135Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC- 211/135,149,189,195; 248/174; 229/120.02,123.29,181,189 (Term Limited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PubWest (USPT,PGPB,EPAB,JPAB), Google, Google Patents

Search Terms: sheet, cardboard, paperboard, panel, corrugated, frame, housing, case, casing, connect, join, fastener, snap, bolt, screw, nut, female, fold, flap, double, laminated, fold, hinge, embedded, captive, encased, secured, stabilizer, reinforcement, friction, force, etc.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008/0155944 A1 (Bertele) 03 July 2008 (03.07.2008): para [0002], [0004], [0011], [0034]-[0038], [0041], [0042], [0045], [0046], [0048]; fig 1, 3.	1-14
Y	US 4,509,645 A (Hotta) 09 April 1985 (09.04.1985): col 1, ln 31-34; col 3, ln 50-53; col 5, ln 55, 56; fig 3, 5, 7.	1-14.
Y	US 6,039,243 A (Lickton) 21 March 2000 (21.03.2000): col 1, ln 5-7; col 3, ln 37-40; col 6, ln 18-20, 36-39; fig 10.	3-12
Y	US 5,273,169 A (Maglione) 28 December 1993 (28.12.1993): col 1, ln 5-7, 67 to col 2, ln 1, 4-6, 24-27; fig 5.	7-12
Y	US 3,336,608 A (Lerner) 22 August 1967 (22.08.1967): col 1, ln 10-14; col 2, ln 22-26; fig 6, 8.	10, 11

 Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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