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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 October 2005 (27.10.2005)

PCT

(10) International Publication Number
WO 2005/100176 A2

(51) International Patent Classification[7]: B65D 6/12

(21) International Application Number:
PCT/IL2005/000384

(22) International Filing Date: 10 April 2005 (10.04.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

10/826,293	19 April 2004 (19.04.2004)	US
10/965,920	18 October 2004 (18.10.2004)	US

(71) Applicant *(for all designated States except US)*: **POLYMER LOGISTICS (ISRAEL) LTD.** [IL/IL]; P.O.Box 3030, 43662 Ra'anana (IL).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **HADAR, Nir** [IL/IL]; 60996 Shefayim (IL).

(74) Agent: **FRIEDMAN, Mark**; 7 Jabotinsky St., 52520 Ramat Gan (IL).

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

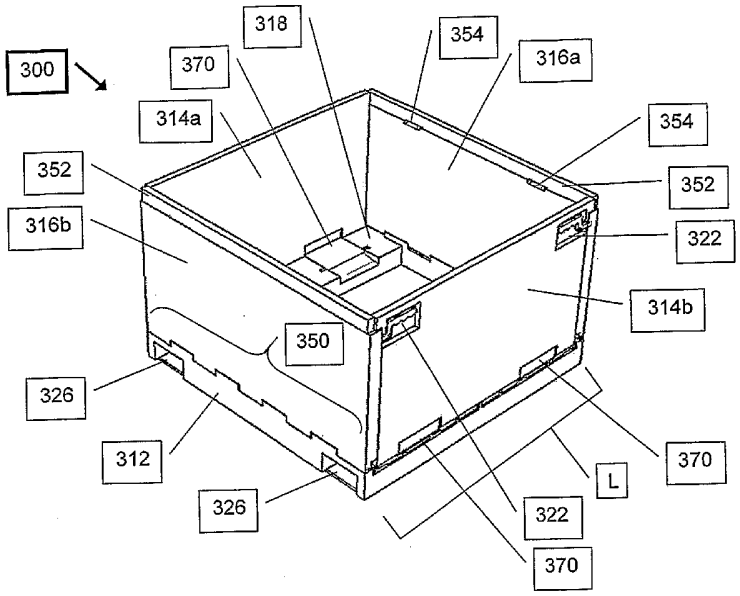
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, 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*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: KNOCK-DOWN CRATE WITH WALLS STORED IN BASE AND METHOD EMPLOYING SUCH A CRATE



(57) Abstract: A knock-down crate having a base associated with four sides. In a first embodiment, the base and the sides are hingedly interconnected. In alternative embodiments, the sides are detachably engageable with the base for deployment parallel to the length and breadth of the base. The upper surface of the base has an elongated recess extending most of the length and sized for receiving at least some of the sides. The sides can be deployed such that the base and four sides form a four-sided crate with the recess of the base contributing to the available volume of the crate. When not in use, at least some of the sides are received within the recess in the base for compact transportation.

WO 2005/100176 A2

KNOCK-DOWN CRATE WITH WALLS STORED IN BASE AND METHOD EMPLOYING SUCH A CRATE

FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to crates and, in particular, it concerns a knock-down crate in which the walls can be stored in a recess in the base, and a corresponding method for transporting produce.

It is known to provide containers of many types for transporting produce, manufactured articles, raw materials etc. from one location to another. Such containers are generally configured to be lifted by a fork-lift vehicle and are stackable. These containers, typically referred to as "bins", "box-pallets", "crates" or "totes", will be referred to generically herein as "crates".

In many cases, molded polymer containers are chosen for their light weight, robustness and long usable lifetime. To realize the maximum strength of the polymer materials, polymer crates are often molded in a single piece. As a result, however, they occupy the same volume when transported empty on a return journey as when full on an outbound journey. This extremely inefficient use of space is very costly.

Various disassembling or foldable crates have been developed in an attempt to reduce the transport volume requirements when the crates are empty. All such crates which either disassemble (i.e., come apart into separate elements) or fold (i.e., with all elements remaining interconnected) are referred to generically herein as "knock-down crates". An example of a foldable crate may be found in U.S. Patent No. 5,094,356 to Miller. Examples of crates which disassemble may be found in U.S. Patent No. 5,638,973 to Dewey et al., U.S. Patent No. 6,142,329 to Dotan, and U.S. Patent Application Publication No. 2002/0084274 to Dotan. These publications are hereby incorporated by reference as if set forth entirely herein.

While offering more efficient use of volume, knock-down crates generally suffer from a number of disadvantages. Specifically with respect to crates which disassemble into separate elements, the base and the sides once separated are generally much less convenient to handle. Furthermore, the number of individual elements which must be handled is greatly increased, and considerable extra labor may be required for packing individual bases and sides compactly for volume-efficient transportation to the next point of use.

There is therefore a need for a knock-down crate in which the walls can be stored in a recess in the base for compact and convenient handling when unloaded.

SUMMARY OF THE INVENTION

The present invention is knock-down crate and a corresponding method for transporting produce.

According to the teachings of the present invention there is provided, a knock-down crate comprising: (a) a base having a length, a breadth, and an upper surface; and (b) a first pair of sides associated with the base and configured to alternate between a first deployment parallel to the length and a storage deployment, and a second pair of sides associated with the base configured to alternate between a first deployment parallel to the breadth and a storage deployment, wherein the upper surface of the base features an elongated recess extending substantially the entirety of the length, the recess being sized for receiving at least one of the first and second pairs of sides, such that, when the first and second pairs of sides are deployed in the first deployment, the base and the sides define a four-sided crate with the recess contributing to an internal volume of the crate, and when the first and second pairs of sides are deployed in the storage deployment, at least one of the first and second pairs of sides is receivable so as to be substantially contained within the recess for compact transportation.

According to a further teaching of the present invention, association of the first and second pairs of sides with the base includes hinged interconnection of at least one of the first and second pairs of sides with the base such that the at least one of the first and second pairs of sides is rotatable between the first deployment and the storage deployment.

According to a further teaching of the present invention, both the first and second pairs of sides are hingedly interconnected to the base.

According to a further teaching of the present invention, one of the first and second pairs of sides is receivable so as to be substantially contained within the recess and the other of the first and second pairs of sides covers the recess.

According to a further teaching of the present invention, the at least one of the first and second pairs of sides having the hinged interconnection includes at least the first pair of sides, and the first pair of sides is hingedly interconnect so as to allow each side of the pair to move away from an edge of the base when deployed in the recess.

According to a further teaching of the present invention, the hinged interconnection allows a base region of the each side to descend into a depth of the recess, so as to allow each of the sides of the first pair to lie parallel to the upper surface.

According to a further teaching of the present invention, at least one of the first and second pairs of sides includes attachment features configured so as to disengagably attach adjacent sides one to another when the first and second pairs of sides are deployed in the first deployment.

According to a further teaching of the present invention, the pair of sides that covers the recess folds such that each side of the pair folds over no more than half of one of the length and the breadth.

According to a further teaching of the present invention, the other of the first and second pairs of sides includes a foldable extension portion along a top region of at least one side of the pair of sides.

According to a further teaching of the present invention, the length is substantially equal to the breadth.

According to a further teaching of the present invention, the elongated recess is a closed-ended recess terminating at two end walls.

According to a further teaching of the present invention, each side of one of the first and second pair of sides has a length no greater than a length of the closed-ended recess.

According to a further teaching of the present invention, association of the first and second pairs of sides with the base is a detachable engagement such that the first and second pairs of sides, when detached from the base, are receivable so as to be substantially contained within the recess to attain the storage deployment.

According to a further teaching of the present invention, the length is substantially equal to the breadth.

According to a further teaching of the present invention, the first pair of sides and the second pair of sides are interchangeable.

According to a further teaching of the present invention, the elongated recess is an open-ended recess extending the entirety of the length.

According to a further teaching of the present invention, at least the second pair of sides each features a downwardly projecting tab configured to

substantially close an end of the open-ended recess when the side is engaged with the base.

According to a further teaching of the present invention, the first pair of sides and the second pair of sides are interchangeable, the base including a pair of slots extending parallel to the length and configured for receiving the downwardly projecting tab of the first pair of sides.

According to a further teaching of the present invention, the elongated recess is a closed-ended recess terminating at two end walls.

According to a further teaching of the present invention, each side of the first and second pair of sides has a length no greater than a length of the closed-ended recess.

According to a further teaching of the present invention, each side of the first and second pairs of sides includes attachment features for attachment to two adjacent sides, and wherein the attachment features are further configured such that each pair of the sides are doubly-interlockable to form a unit with the pair of sides associated in close parallel relation.

According to a further teaching of the present invention, upper and lower edges of the first and second pairs of sides and upper and lower peripheral regions of the base are formed with complementary alignment projections and recesses such that, when the first and second pairs of sides are engaged with the base to form the four-sided crate, the alignment projections and recesses on the upper edges of the sides and on the lower peripheral region of the base serve to align the four-sided crate with similar crates placed above

and below the four-sided crate, and when the first and second pairs of sides are received within the recess, the alignment projections and recesses on the upper and lower peripheral regions of the base serve to align the base with similar bases placed above and below the base.

According to a further teaching of the present invention, the base and the first and second pairs of sides are all formed primarily from molded plastic material.

According to a further teaching of the present invention, the base has a pair of elongated channels extending parallel to the length for receiving tines of a forklift mechanism.

According to a further teaching of the present invention, a major part of the recess lies between the elongated channels.

There is also provided according to the teachings of the present invention, a method for using a knock-down crate to transport produce from a loading location to an unloading location, the method comprising the steps of: (a) providing a knock-down crate having: (i) a base with an upper surface including an elongated recess, and (ii) four sides deployable in a crate configuration wherein the four sides are engaged with the base and each other to form a four-sided crate, the four sides being further deployable in a knock-down configuration wherein the four sides are deployed in a storage deployment with at least two of the four sides received substantially within the elongated recess; (b) deploying the crate in the crate configuration; (c) loading the crate at the loading location with produce, at least part of the produce lying

within the elongated recess; (d) transporting the produce in the crate to the unloading location; (e) unloading the produce from the crate; and (f) deploying the crate in the knock-down configuration with at least two of the four sides located substantially within the elongated recess for transport to a next loading location.

According to a further teaching of the present invention, upper and lower edges of the sides and upper and lower peripheral regions of the base are formed with complementary alignment projections and recesses, the method further comprising: (a) stacking the crate when in the crate configuration with other similar crates such that the alignment projections and recesses on the upper edges of the sides and on the lower peripheral region of the base serve to align the crate with the other similar crates placed above and below the crate; and (b) stacking the crate when in the knock-down configuration with other similar crates such that the alignment projections and recesses on the upper and lower peripheral regions of the base serve to align the crate with the other similar crates placed above and below the crate.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

Fig. 1 is an isometric view of a first embodiment of a knock-down crate constructed and operative according to the teachings of the present invention, in which the four sides are hingedly interconnected to the base;

FIGS. 2-10 are isometric views of the embodiment of FIG.1, illustrating, in sequence, steps for folding the crate from the assembled deployment to the storage deployment;

FIGS. 11A-11E are isometric cross sections of the embodiment of FIG. 1 illustrating, in sequence, step of folding one pair of sides into the recess for deployment to the storage deployment;

FIGS. 12A and 12B are schematic isometric views of a base and a set of four sides, respectively, for use in a second embodiment of a knock-down crate constructed and operative according to the teachings of the present invention, in which the four sides are detachably engaged with the base;

FIG. 13 is a schematic isometric view of a four-sided crate constructed from the base and sides of Figures 12A and 12B;

FIG. 14 is a schematic isometric view showing the sides of Figure 12B received within a recess in the base of Figure 12A;

FIG. 15 is a schematic isometric view showing the interconnection of two of the sides of Figure 12B;

FIGS. 16A and 16B are schematic isometric views showing two of the sides of Figure 12B immediately prior to, and after, interconnection to form a two-side unit;

FIG. 17 is a schematic partially cut-away isometric view of the crate of the present invention during assembly or disassembly;

FIG. 18 is a schematic partially cut-away isometric view of the knocked-down crate of Figure 14;

FIGS. 19A and 19B are schematic isometric views of a base and a set of four sides, respectively, for use in a third embodiment of a knock-down crate constructed and operative according to the teachings of the present invention;

FIG. 20 is a schematic isometric view of a four-sided crate constructed from the base and sides of Figures 19A and 19B;

FIG. 21 is a schematic isometric view showing the sides of Figure 19B received within a recess in the base of Figure 19A;

FIG. 22 is a schematic cross-sectional view of the crate of Figure 3 or Figure 20 in use filled with produce;

FIG. 23 is a schematic cross-sectional view similar to Figure 22 showing the crate in its knocked-down configuration for return transport; and

FIGS. 24A-24C are schematic cross-sectional views showing stacking features of the crates of the present invention prior to assembly, when assembled, and when in the knocked-down state, respectively.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is a knock-down crate in which the walls can be stored in a recess in the base for compact and convenient handling when unloaded, and a corresponding method for transporting produce.

The principles and operation of knock-down crates according to the present invention may be better understood with reference to the drawings and the accompanying description.

By way of introduction, the crate of the present invention includes a base associated with four sides. The principles of the present invention will be discussed herein with regard to three basic embodiments. The first embodiment, in which the base and the sides are hingedly interconnected, will be discussed regarding Figures 1-11E. The second and third embodiments, in which the sides are detachably engageable with the base, will be discussed with regard to Figures 12A-18 and 19-23, respectively.

Referring now to the drawings, Figure 1 shows a first preferred embodiment of a knock-down crate, generally designated **300**, constructed and operative according to the teachings of the present invention. Generally speaking, crate **300** is formed from a base **312** and two pairs of sides **314*a*** and **314*b***, **316*a*** and **316*b*** all four of which are hingedly interconnected to base **312**. In this embodiment, sides **314*a*** and **314*b*** are interconnected to base **312** by a non-limiting example of a double hinge **370**, as will be discussed in detail below the regard to Figures 11A-11E.

Sides **316*a*** and **316*b*** are hingedly interconnected to base **312** by hinge **350** that, in this non-limiting example, extends for substantially the entire length of each side. It should be noted that substantially any suitable hinge arrangement is within the scope of the present invention. An upper surface **318** of base **312** features an elongated recess **320** extending substantially the entirety of a length L of base **312** and sized for receiving sides **314*a*** and **314*b*** in a storage deployment. Once sides **314*a*** and **314*b*** are stored in recess **320**, sides **316*a*** and **316*b*** are folded inwardly to cover sides **314*a*** and **314*b***, recess

320 and the exposed portions of upper surface **318** of base **312**. It should be noted that the word "inwardly" is used herein to refer to movement toward the center of the crate.

Figures 2-10 illustrate steps for deploying the two pairs of sides **314*a*** and **314*b***, **316*a*** and **316*b*** into their respective storage deployments. First, any attachment feature that secures one of the sides to an adjacent side is disengaged. The illustration here shows handles **322** configured in sides **314*a*** and **314*b***, however, substantially any disengageable attachment configuration, as discussed below with regard to a second and third preferred embodiments, may be used. Once disengaged from the adjacent sides **316*a*** and **316*b***, side **314*b*** is folded inwardly, as seen in Figure 3, until it is received into recess **320**, as seen in Figure 4. Side **314*a*** is then disengaged from the adjacent sides **316*a*** and **316*b***, and folded inwardly, as seen in Figure 5, until it is received into recess **320** and resting on side **314*b***, as seen in Figure 6. It should be noted that this sequence may be reversed and side **314*a*** may be stored away first with **314*b*** resting on top.

Next, side **316*b*** is folded inwardly, as seen in Figure 7, until it is resting on the upper surface **318** of the base **312**, as seen in Figure 8. As illustrated in Figure 8, when in the storage deployment, side **316*b*** is preferably no longer than one-half (½L) of the length L of base **312** in order to add not more than one side thickness to the thickness of the base in the overall thickness of the storage configuration of the crate. In some applications sides **316*a*** and **316*b*** may need to be longer than one-half (½L) of the length L of base **312**. For such

applications, the present invention provides a foldable extension **352** hingedly attached along the top edge of at least one of sides **316*a*** and **316*b***. The foldable extension **352** is attached by hinges **354**, and is folded into the associated side during the folding process of the side. A transverse recess **352*a*** is preferably provided in the base and/or folded sides to accommodate the foldable extensions without adding significantly to the thickness of the folded configuration.

Side **316*a*** is then folded inwardly, as seen in Figure 9, until it is resting on the upper surface **318** of the base **312**, as seen in Figure 10. When both sides **316*a*** and **316*b*** are in the storage deployment, substantially all of the upper surface **318** of the base **312**, recess **320**, and sides **314*a*** and **314*b*** are covered by sides **316*a*** and **316*b***.

In order for sides **314*a*** and **314*b*** to be deployed in recess **320** that is located between channels **326**, as discussed below, it is necessary for sides **314*a*** and **314*b*** to move away form the edge of base **312** , and preferably also to be able to descend at least partially into the depth of recess **320**. Further, it is also preferable that the base region of the side, that is the region of the side that abuts base **312**, descend into the depth of recess **320**, so as to allow each of the side to lay parallel to the upper surface **318.** Figures 11A-11E illustrate a non-limiting preferred hinged configuration for such interconnection of base **312** and sides **314*a*** and **314*b***, and steps for deploying sides **314*a*** and **314*b*** into their respective storage deployments. It should be noted that other hinge configurations may be suitable for this purpose. Such hinge configurations may

include, but are not limited to, a slideable hinge, and a hinge pin associated with a slot.

As illustrated, hinge bracket **370** provides rotation about two axes of rotation, **360** and **362**. When side **314*a*** is folded inwardly, rotation about axis **362** allows the bottom edge of side **314*a*** to move away from the edge of base **312** in order to reach recess **320**, as seen in Figure 11. Rotation about axis **360** allows side **316*a*** to lay flat when received in recess **320**, as seen in figure 11C. The "L" shape of bracket **370** allows the base region of the side to descend into the depth of recess **320**, so as to allow each of the sides **314*a*** and **314*b*** to lay parallel to the upper surface **318**. The process is repeated when side **314*b*** is brought into its storage deployment, as illustrated in Figures 11D and 11E. It will be understood that this discussion of the double hinge configuration is intended only as an example of a hinged interconnection between the base **312** and sides **314*a*** and **314*b***, and that other configurations that will provide substantially the same results are possible. It should be noted that a crate in which sides **314*a*** and **314*b*** may be detached from base **312** for insertion into recess **320** is within the scope of the present invention.

Crate **300** is preferably configured for handling by standard pallet handling equipment. To this end, as illustrated in Figure 1, base **312** preferably has a pair of elongated channels **326** extending parallel to length L for receiving tines of a forklift mechanism (forklift, pallet carrier etc.). Channels **326** typically extend along the entirety of length L, allowing insertion of tines from either end of the crate. Most preferably, at least a major portion of recess

320 is located between channels 326. Thus, considered from a different point of view, crate 300 may be considered to have a thin base 312 in the region of recess 320, with locally raised regions to provide the volume required for channels 326. It will thus be understood that the usable volume of the inside of the crate is fully maximized by making all volume other than that required for channels 326 available for loading with produce.

Figures 12A-18 show a second preferred embodiment of a knock-down crate, generally designated 10, constructed and operative according to the teachings of the present invention. Generally speaking, crate 10 is formed from a base 12 and a set 14 of sides 16*a*, 16*b*, 16*c* and 16*d*. An upper surface 18 of base 12 features an elongated recess 20 extending substantially the entirety of a length L of the base and sized for receiving set of sides 14.

The sides are configured to be detachably engageable with base 12 with a first pair 16*a* and 16*c* parallel to the length L of base 12 and a second pair 16*b* and 16*d* parallel to a breadth or width W of base 12 such that, when sides 16*a*, 16*b*, 16*c* and 16*d* are engaged with base 12, the base and the sides define a four-sided crate 10 as shown in Figure 13 with recess 20 contributing to an internal volume of the crate. When the crate is unloaded and the sides are detached from the base, the set 14 of sides 16*a*, 16*b*, 16*c* and 16*d* are received so as to be substantially contained within recess 20 to form the knocked-down configuration of Figure 14 for compact transportation.

It will be immediately appreciated that the crate of the present invention offers profound advantages over conventional knock-down crates. Specifically,

in the assembled configuration of Figure 13, recess **20** contributes significantly to the usable internal volume of the crate, thereby maximizing transport volume. In the knocked-down state of Figure 14, all parts of the crate are configured in a single compact block which is easily handled and can be efficiently stacked with other similar crates to ensure minimum volume for return transportation or storage of the crate when not in use. These and other advantages of the present invention will be better understood from the following detailed description.

Turning now to the features of crate **10** in more detail, it is a preferred feature of certain implementations of the present invention that the crate is a square crate, i.e., that length L is substantially equal to breadth W. In most preferred cases, all four sides are then made interchangeable such that the user can assemble the crate with each side located arbitrarily along any edge of the base.

In order to form a usable crate, it is clearly necessary to achieve load-bearing engagement between adjacent sides of the assembled crate and between each side and the base. Thus, each of sides **16*a***, **16*b***, **16*c*** and **16*d*** includes attachment features **22**, **24** for attachment to two adjacent sides. Figure 15 illustrates two interconnected sides **16*c*** and **16*d***, with their available attachment features clearly visible. The attachment features are shown here schematically as complementary rectangular-section interlocking tabs with through-bores for receiving a bolt element to lock the sides together and to the base. Most preferably, attachment features **22**, **24** are further configured such

that pairs of the sides are doubly-interlockable to form a unit **14*a*** with the pair of sides associated in close parallel relation. Figures 16A and 16B show such a unit **14*a*** prior to and after interconnection. Figure 17 shows a cut-away view of crate **10** partially assembled with one unit **14*a*** stored in recess **20**. Two such units together make up an easily handled set **14** of sides for insertion into recess **20** as shown in Figure 18.

It should be appreciated that the attachment features shown here are represented schematically. Various engagement configurations for removably engaging sides with a base and with each other to form a knock-down crate are known in the art. The specific choice of engagement configuration, other than certain features discussed explicitly herein, does not constitute part of the present invention per se and for conciseness will not be described here in detail. By way of non-limiting examples, the various engagement and locking configurations described in the aforementioned U.S. Patent No. 6,142,329 to Dotan, and/or U.S. Patent Application Publication No. 2002/0084274 to Dotan are considered suitable for implementation of the present invention.

Optionally, a locking arrangement (not shown) may be provided to retain set of sides **14** within recess **20** to ensure that the set of sides do not become dislodged during handling. Most preferably, at least one locking element used for interlocking the sides when assembled also functions to selectively lock the set of sides within recess **20** when in the knock-down configuration. Such an implementation is well within the capabilities of one ordinarily skilled in the art.

In most preferred implementations, base **12** and sides **16*a***, **16*b***, **16*c*** and **16*d*** are all formed primarily from molded plastic material. It should be noted, however, that implementations of the crate structure described using materials other than molded plastics also fall within the broad scope of the present invention. The various components of the crates of the present invention are illustrated here schematically and simplistically for clarity of presentation. The geometrical patterns shown here on the sides of the crates are non-functional and are included merely to facilitate visual differentiation between the inward-facing and outward-facing surfaces. It will be understood by one ordinarily skilled in the art that the various components will typically be implemented with various structures of reinforcing ribs and/or other functional or decorative features which do not per se constitute part of the present invention. Furthermore, depending upon the type of produce to be transported and the desired drainage characteristics of the crate, the base and walls may be made either solid or with drainage and ventilation openings, as is known in the art.

Crate **10** is preferably configured for handling by standard pallet handling equipment. To this end, base **12** preferably has a pair of elongated channels **26** extending parallel to length L for receiving tines of a forklift mechanism (forklift, pallet carrier etc.). Channels **26** typically extend along the entirety of length L, allowing insertion of tines from either end of the crate. Most preferably, at least a major portion of recess **20** is located between channels **26**. Thus, considered from a different point of view, crate **10** may be considered to have a thin base **12** in the region of recess **20**, with locally raised

regions to provide the volume required for channels **26**. It will thus be understood that the usable volume of the inside of the crate is fully maximized by making all volume other than that required for channels **26** available for loading with produce. Furthermore, since the sides are stored between the regions of base **12** containing channels **26**, nothing overlies the regions of the base **12** containing channels **26** in the collapsed state, making the height of the crate in its collapsed state significantly less than that of "fold-down" crates of similar dimensions.

According to the second preferred embodiment of the present invention shown here, elongated recess **20** is a closed-ended recess terminating at two end walls **28**. As a result, the length of recess **20** is slightly less than the external length L of base **12**. To ensure that sides **16*a***, **16*b***, **16*c*** and **16*d*** fit within recess **20**, each side preferably includes one corner portion of the assembled crate, with part of the adjacent side or at least engagement features for the adjacent side extending laterally from the corner portion. As a result, the length of each side is less than the external length dimension of the assembled crate by the thickness of one corner portion, preferably at least equal to a thickness of the crate side. Thus, if end walls **28** have a thickness no more than about half the thickness of sides **16*a***, **16*b***, **16*c*** and **16*d***, the sides can be accommodated within recess **20**.

Turning now to Figures 19A-21, there is shown a third preferred embodiment of a crate, generally designated **100**, constructed and operative according to the teachings of the present invention. Crate **100** is structurally

and functionally similar to crate **10** described above. For clarity and conciseness, features of crate **100** analogous to those of crate **10** are labeled with reference numerals greater by 100 than the numeral used for the analogous feature of crate **10**.

Crate **100** differs from crate **10** primarily in that recess **120** is here an open-ended recess extending the entirety of length L. In order to ensure closure of the sides of the assembled crate, at least one pair of sides **116*b*** and **116*d*** each features a downwardly projecting tab **130** configured to substantially close an end of recess **120** when the side is engaged with base **112** as shown in Figure 20. Most preferably, base **112** features an engagement indentation **132** (Figure 8A) across each end of recess **120** with which downwardly projecting tabs **130** engage when assembled to provide mechanical support to the tabs.

As mentioned earlier, it is considered advantageous that the crates of the present invention employ four interchangeable sides, thereby allowing a user to assemble the crate with each side engaged along an arbitrarily chosen edge of the base. Parenthetically, it should be noted that the term "interchangeable" as used herein refers to sides having functionally equivalent features to the extent that inadvertent swapping of two sides does not significantly impact the function of the assembled crate. Interchangeability does not necessarily imply that the sides are identical or indistinguishable.

In this embodiment, interchangeability of the sides may be achieved by providing a pair of slots **134** extending parallel to length L and configured for receiving downwardly projecting tabs **130** of the sides deployed parallel to

length L. The engagement of tabs **130** within slots **134** also adds structural strength to the assembled crate. In order to allow sides **116*a*** and **116*c*** to be located at the outer edge of base **112**, tabs **130** are most preferably slightly thinner than the main upper portion of the sides and slightly set back from the plane of the outer surface of the side.

Clearly, in an alternative implementation (not shown), tabs **130** may have a thickness equal to that of the main upper portion of the sides, the tabs being received in a corresponding external recess formed in the external surfaces of the base parallel to the length L.

In all other respects, the structure and function of crate **100** will be understood by analogy to that of crate **10** described herein.

Referring now again generically to both embodiments of a crate according to the teachings of the present invention, the sides and base are preferably configured to allow stacking of the crate with other similar crates in both the assembled crate configuration and the knock-down compact configuration. To this end, the upper and lower edges of sides **16*a***, **16*b***, **16*c*** and **16*d***, and upper and lower peripheral regions of base **112** are preferably formed with complementary alignment projections **200** and recesses **202** (Figure 24A). Alignment projections **200** and recesses **202** are positioned and configured such that, when the sides are engaged with the base to form the four-sided crate (Figure 24B), alignment projections **200** and recesses **202** on the upper edges of the sides and on the lower peripheral region of the base serve to align the four-sided crate with similar crates (not shown) placed above

and below the crate, and when the sides are received within recess **20** (Figure 24C), alignment projections **200** and recesses **202** on the upper and lower peripheral regions of the base serve to align the base with similar bases (not shown) placed above and below the base.

At this point, the use of crates **10** and **100** will be clearly understood. Specifically, the crate is deployed in its deployed "crate configuration" and loaded with produce at a loading location. It will be noted that, as shown in Figure 22, at least part of the produce **204** lies within the elongated recess **20**, thereby contributing to the total volume of produce which can be transported within the crate. Then, after transporting the produce in the crate to an unloading location, the produce is unloaded from the crate and the crate is disassembled and the walls stored in the recess to produce the "knock-down configuration" as shown in Figure 23. The crate is then compact and conveniently handled, with the four sides located substantially within elongated recess **20**, for transport to a next loading location. Most preferably, in a crate having alignment features as described with reference to Figures 24A-24C, the crate is stacked with other similar crates when in the crate configuration such that the alignment projections and recesses on the upper edges of the sides and on the lower peripheral region of the base serve to align the crate with the other similar crates placed above and below the crate, and is stacked when in the knock-down configuration with other similar crates such that the alignment projections and recesses on the upper and lower peripheral regions of the base

serve to align the crate with the other similar crates placed above and below the crate.

It will be appreciated that the above descriptions are intended only to serve as examples, and that many other embodiments are possible within the scope of the present invention as defined in the appended claims.

WHAT IS CLAIMED IS:

1. A knock-down crate comprising:

(a) a base having a length, a breadth, and an upper surface; and

(b) a first pair of sides associated with said base and configured to alternate between a first deployment parallel to said length and a storage deployment, and a second pair of sides associated with said base configured to alternate between a first deployment parallel to said breadth and a storage deployment,

wherein said upper surface of said base features an elongated recess extending substantially the entirety of said length, said recess being sized for receiving at least one of said first and second pairs of sides, such that, when said first and second pairs of sides are deployed in said first deployment, said base and said sides define a four-sided crate with said recess contributing to an internal volume of said crate, and when said first and second pairs of sides are deployed in said storage deployment, at least one of said first and second pairs of sides is receivable so as to be substantially contained within said recess for compact transportation.

2. The knock-down crate of claim 1, wherein association of said first and second pairs of sides with said base includes hinged interconnection of at least one of said first and second pairs of sides with said base such that said at least one of said first and second pairs of sides is rotatable between said first deployment and said storage deployment.

3. The knock-down crate of claim 2, wherein both said first and second pairs of sides are hingedly interconnected to said base.

4. The knock-down crate of claim 2, wherein one of said first and second pairs of sides is receivable so as to be substantially contained within said recess and the other of said first and second pairs of sides covers said recess.

5. The knock-down crate of claim 2, wherein said at least one of said first and second pairs of sides having said hinged interconnection includes at least said first pair of sides, and said first pair of sides is hingedly interconnect so as to allow each side of said pair to move away from an edge of said base when deployed in said recess.

6. The knock-down crate of claim 5, wherein said hinged interconnection allows a base region of said each side to descend into a depth of said recess, so as to allow each of said sides of said first pair to lie parallel to said upper surface.

7. The knock-down crate of claim 2, wherein at least one of said first and second pairs of sides includes attachment features configured so as to disengagably attach adjacent sides one to another when said first and second pairs of sides are deployed in said first deployment.

8. The knock-down crate of claim 4, wherein said pair of sides that covers said recess folds such that each side of said pair folds over no more than half of one of said length and said breadth.

9. The knock-down crate of claim 8, wherein said other of said first and second pairs of sides includes a foldable extension portion along a top region of at least one side of said pair of sides.

10. The knock-down crate of claim 2, wherein said length is substantially equal to said breadth.

11. The knock-down crate of claim 1, wherein said elongated recess is a closed-ended recess terminating at two end walls.

12. The knock-down crate of claim 11, wherein each side of one of said first and second pair of sides has a length no greater than a length of said closed-ended recess.

13. The knock-down crate of claim 1, wherein association of said first and second pairs of sides with said base is a detachable engagement such that said first and second pairs of sides, when detached from said base, are receivable so as to be substantially contained within said recess to attain said storage deployment.

14. The knock-down crate of claim 13, wherein said length is substantially equal to said breadth.

15. The knock-down crate of claim 14, wherein said first pair of sides and said second pair of sides are interchangeable.

16. The knock-down crate of claim 13, wherein said elongated recess is an open-ended recess extending the entirety of said length.

17. The knock-down crate of claim 16, wherein at least said second pair of sides each features a downwardly projecting tab configured to substantially close an end of said open-ended recess when said side is engaged with said base.

18. The knock-down crate of claim 17, wherein said first pair of sides and said second pair of sides are interchangeable, said base including a pair of slots extending parallel to said length and configured for receiving said downwardly projecting tab of said first pair of sides.

19. The knock-down crate of claim 13, wherein said elongated recess is a closed-ended recess terminating at two end walls.

20. The knock-down crate of claim 19, wherein each side of said first and second pair of sides has a length no greater than a length of said closed-ended recess.

21. The knock-down crate of claim 13, wherein each side of said first and second pairs of sides includes attachment features for attachment to two adjacent sides, and wherein said attachment features are further configured such that each pair of said sides are doubly-interlockable to form a unit with said pair of sides associated in close parallel relation.

22. The knock-down crate of claim 13, wherein upper and lower edges of said first and second pairs of sides and upper and lower peripheral regions of said base are formed with complementary alignment projections and recesses such that, when said first and second pairs of sides are engaged with said base to form said four-sided crate, said alignment projections and recesses on said upper edges of said sides and on said lower peripheral region of said base serve to align said four-sided crate with similar crates placed above and below said four-sided crate, and when said first and second pairs of sides are received within said recess, said alignment projections and recesses on said upper and lower peripheral regions of said base serve to align said base with similar bases placed above and below said base.

23. The knock-down crate of claim 22, wherein said base and said first and second pairs of sides are all formed primarily from molded plastic material.

24. The knock-down crate of claim 1, wherein said base has a pair of elongated channels extending parallel to said length for receiving tines of a forklift mechanism.

25. The knock-down crate of claim 24, wherein a major part of said recess lies between said elongated channels.

26. A method for using a knock-down crate to transport produce from a loading location to an unloading location, the method comprising the steps of:

(a) providing a knock-down crate having:

(i) a base with an upper surface including an elongated recess, and

(ii) four sides deployable in a crate configuration wherein said four sides are engaged with said base and each other to form a four-sided crate, said four sides being further deployable in a knock-down configuration wherein said four sides are deployed in a storage deployment with at least two of said four sides received substantially within said elongated recess;

(b) deploying said crate in said crate configuration;

(c) loading said crate at the loading location with produce, at least part of the produce lying within said elongated recess;

(d) transporting the produce in said crate to the unloading location;

(e) unloading the produce from said crate; and

(f) deploying said crate in said knock-down configuration with at least two of the four sides located substantially within said elongated recess for transport to a next loading location.

27. The method of claim 26, wherein upper and lower edges of said sides and upper and lower peripheral regions of said base are formed with complementary alignment projections and recesses, the method further comprising:

(a) stacking said crate when in said crate configuration with other similar crates such that said alignment projections and recesses on said upper edges of said sides and on said lower peripheral region of said base serve to align said crate with the other similar crates placed above and below said crate; and

(b) stacking said crate when in said knock-down configuration with other similar crates such that said alignment projections and recesses on said upper and lower peripheral regions of said base serve to align said crate with the other similar crates placed above and below said crate.

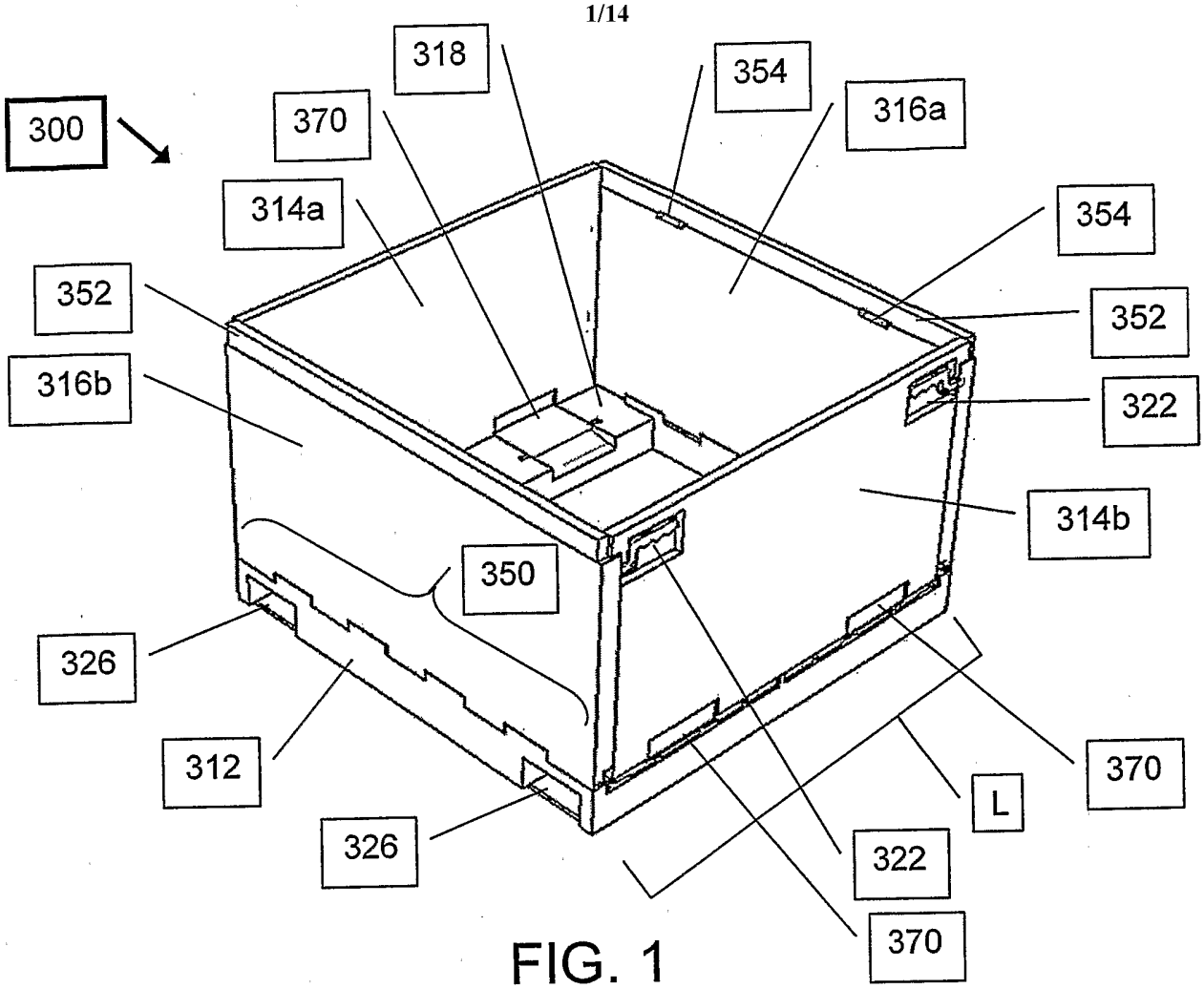

300
318
370
354
316a
314a
354
352
352
316b
322
314b
350
326
312
326
322
370
L
370

FIG. 1

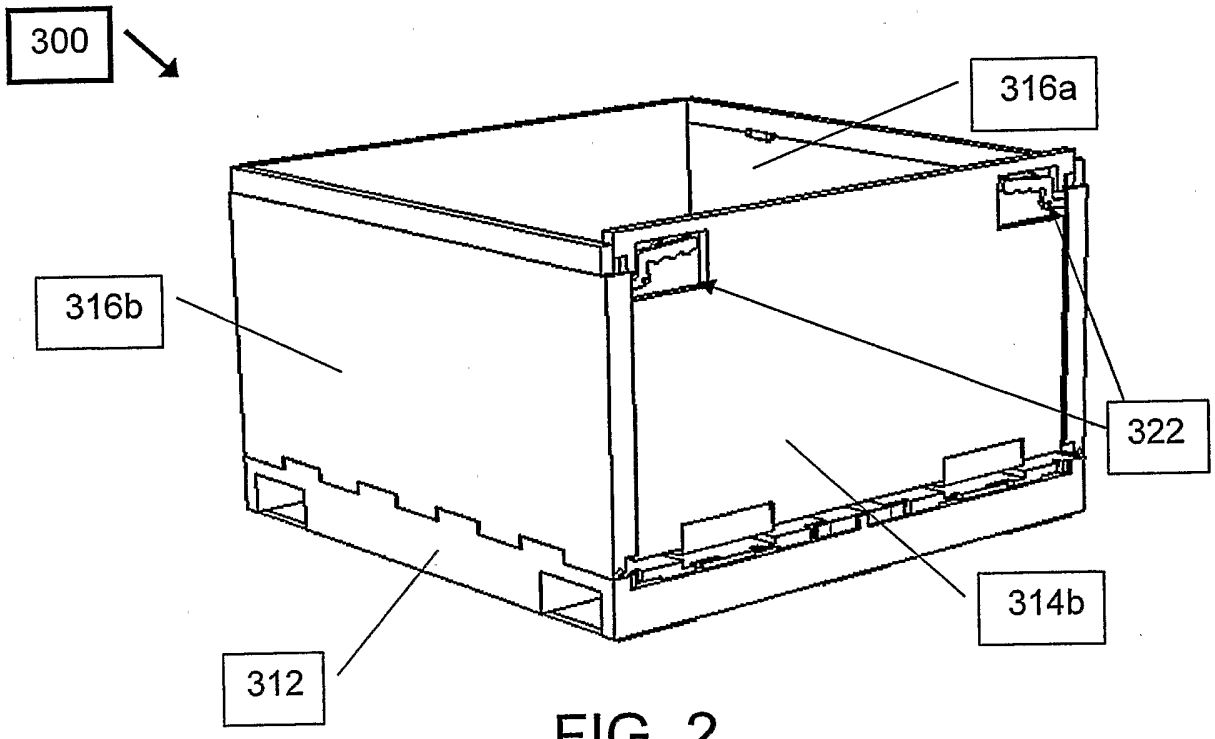

300
316a
316b
322
314b
312

FIG. 2

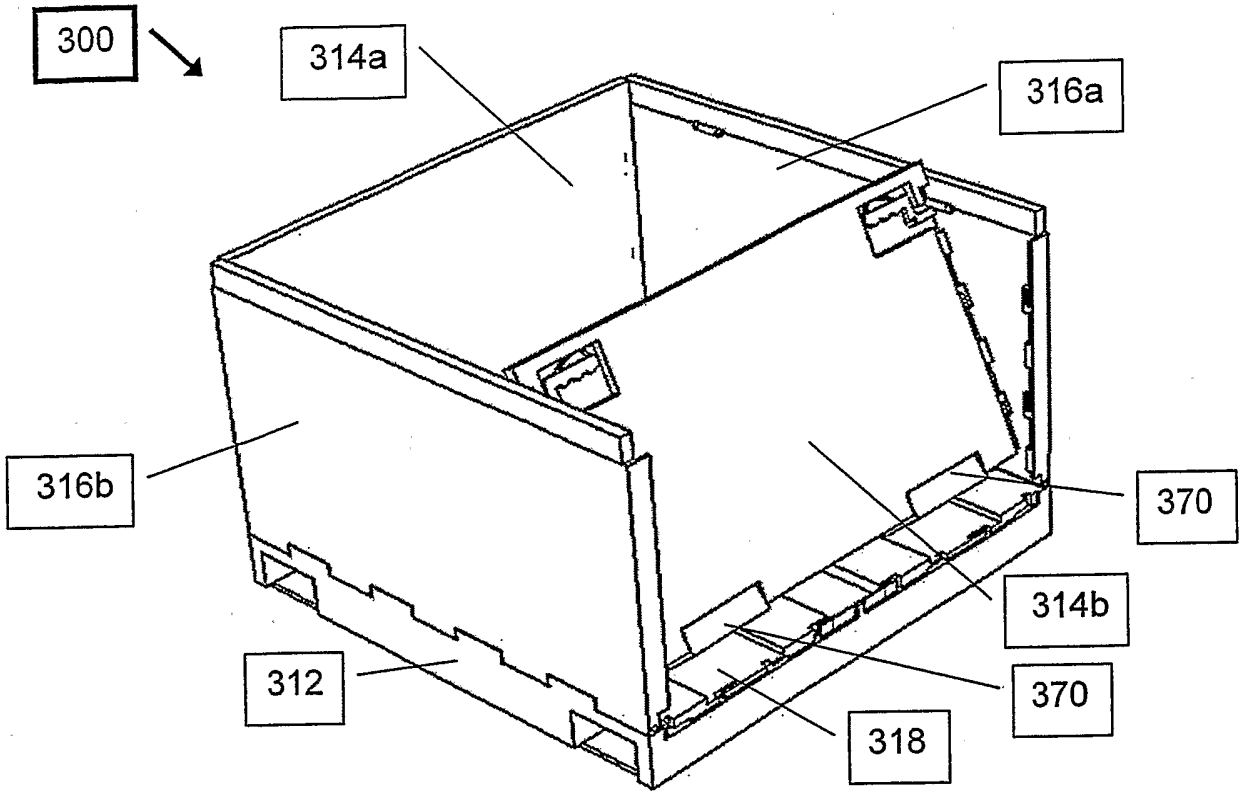

300
314a
316a
316b
370
314b
312
370
318

FIG. 3

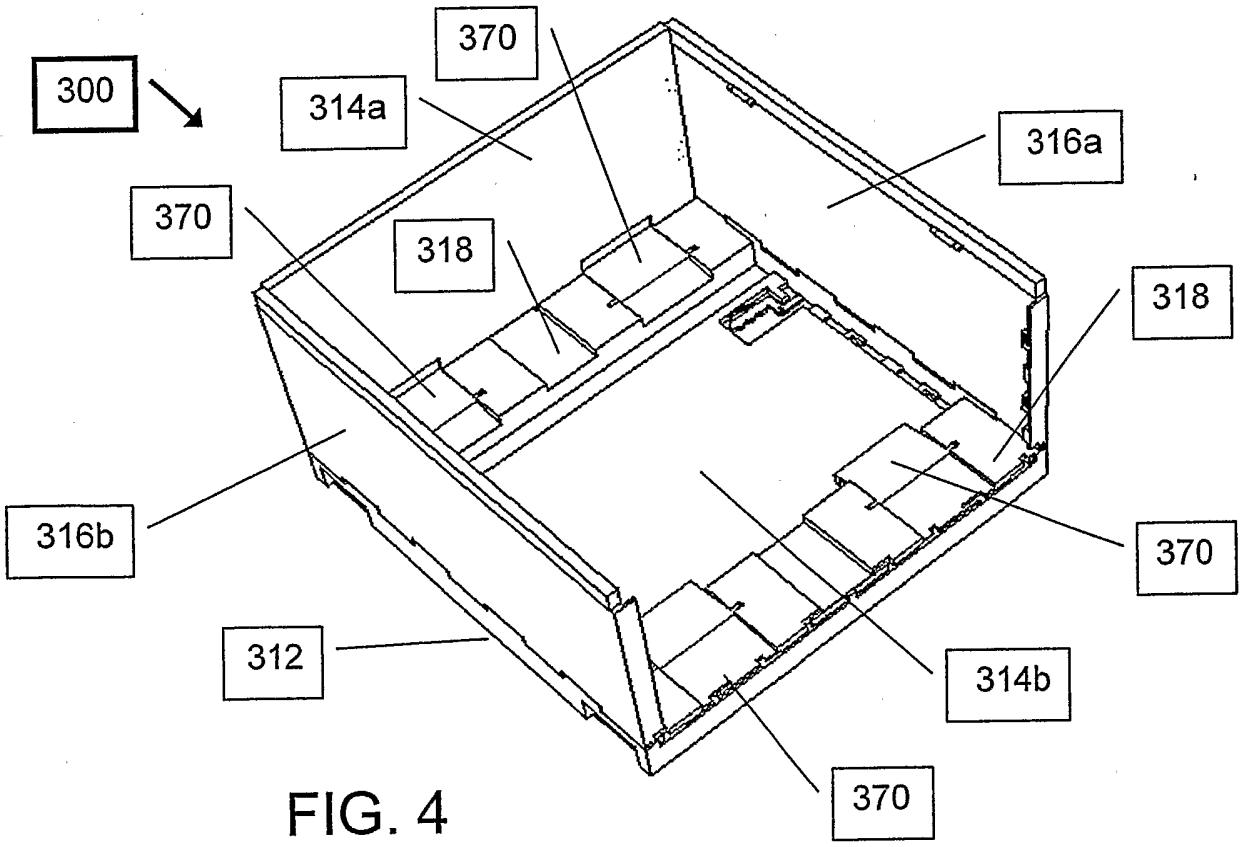

370
300
314a
316a
370
318
318
316b
370
312
314b
370

FIG. 4

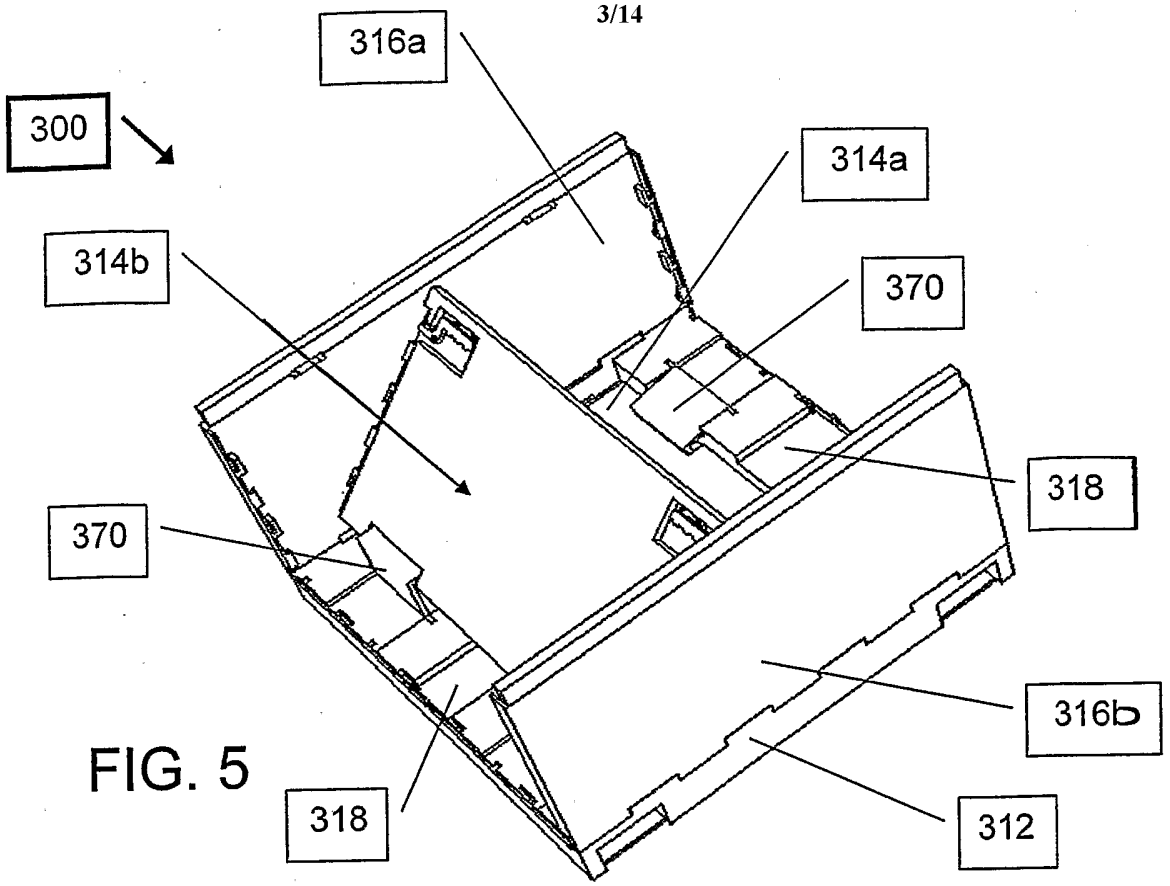

316a
300
314a
314b
370
318
370
316b
318
312

FIG. 5

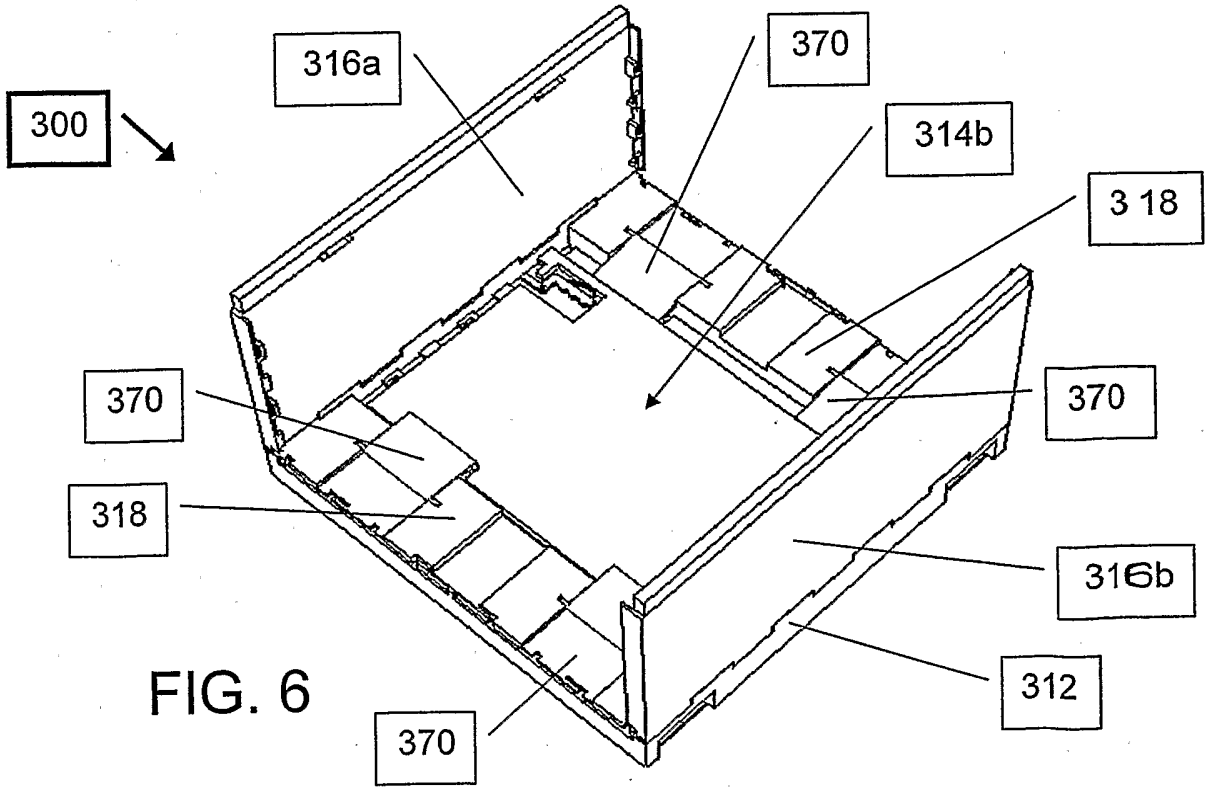

316a
370
300
314b
3 18
370
370
318
316b
312
370

FIG. 6

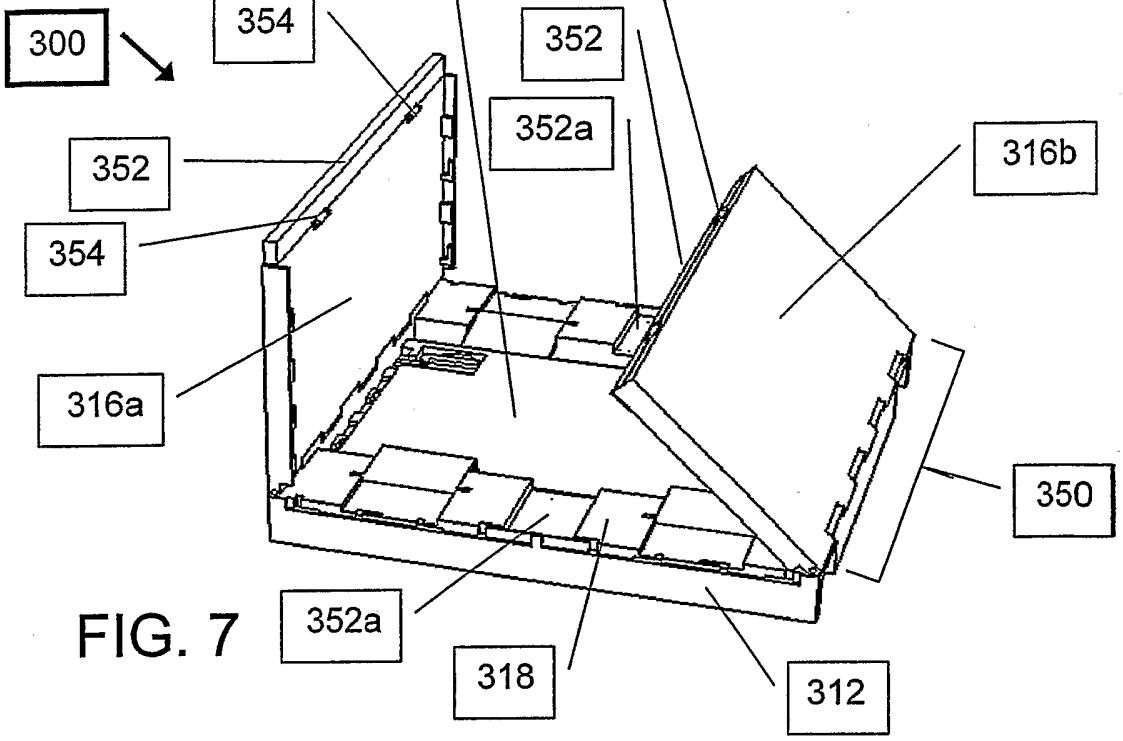

300
354
314b
354
352
352a
316b
352
354
316a
350
352a
318
312

FIG. 7

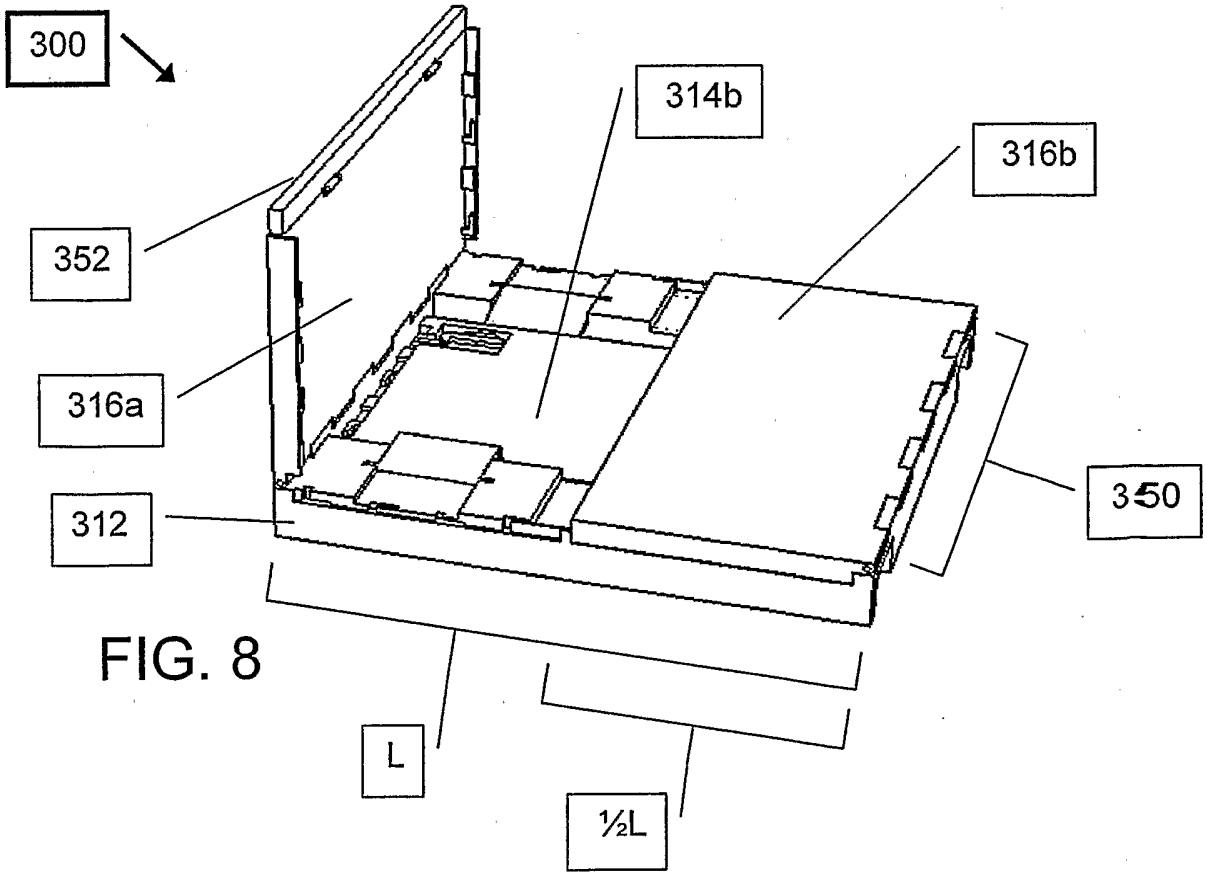

300
314b
316b
352
316a
350
312
L
½L

FIG. 8

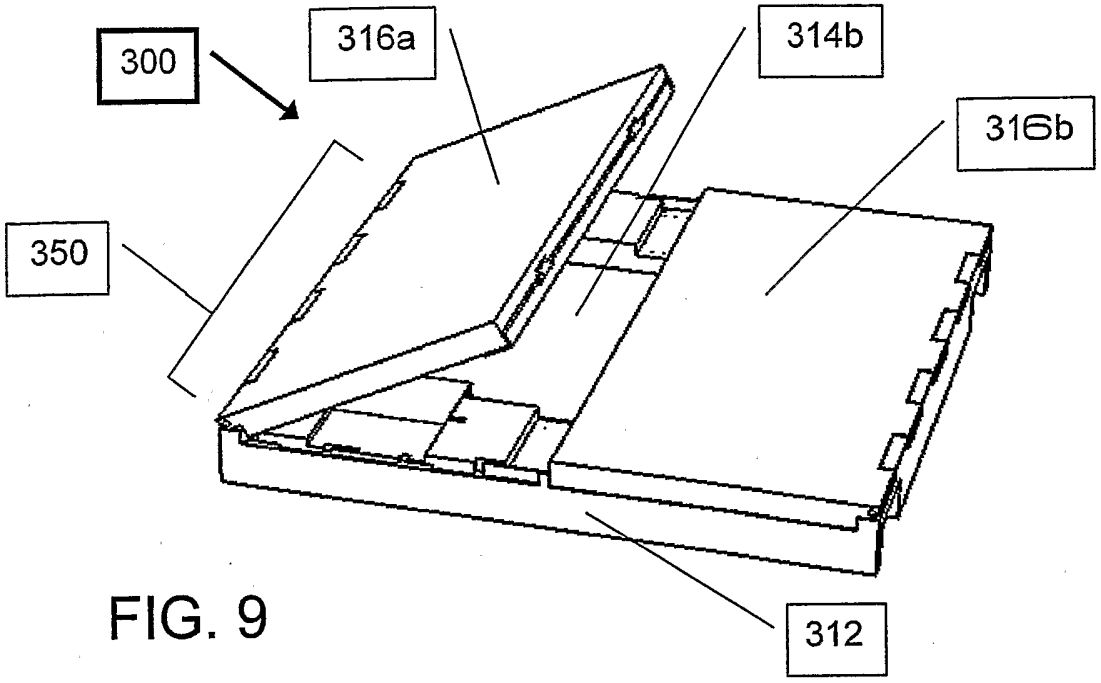


FIG. 9

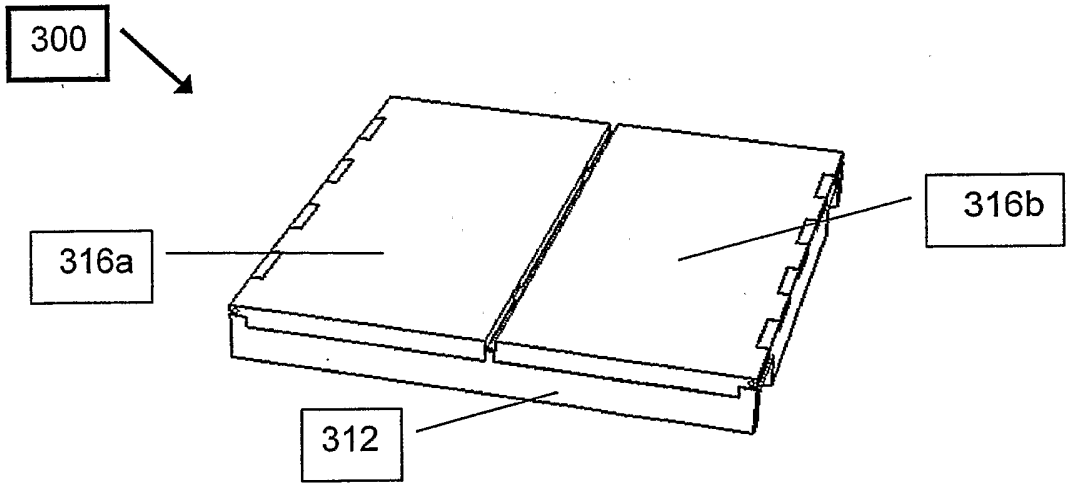


FIG. 10

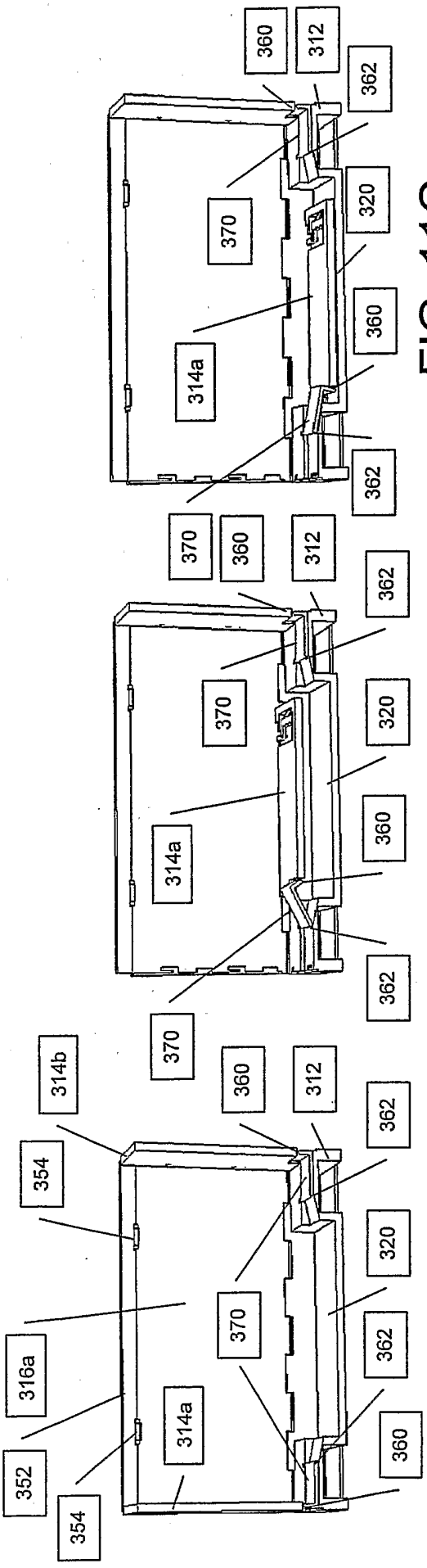


FIG. 11A

FIG. 11B

FIG. 11C

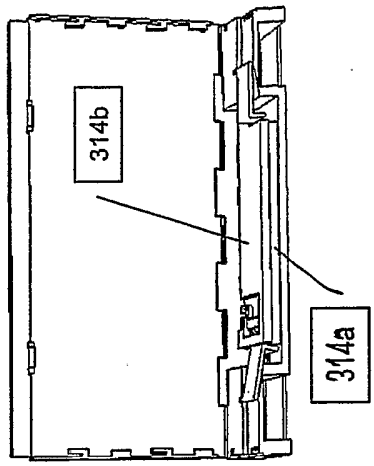


FIG. 11E

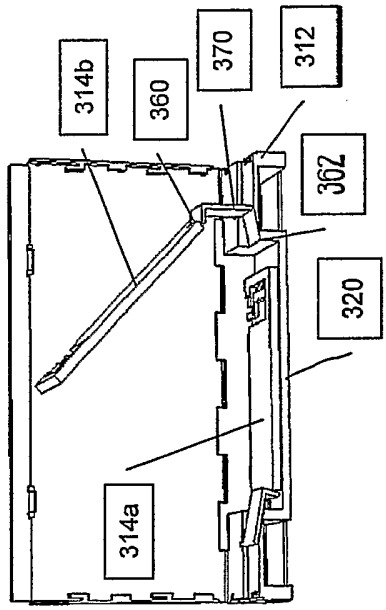


FIG. 11D

FIG. 12A

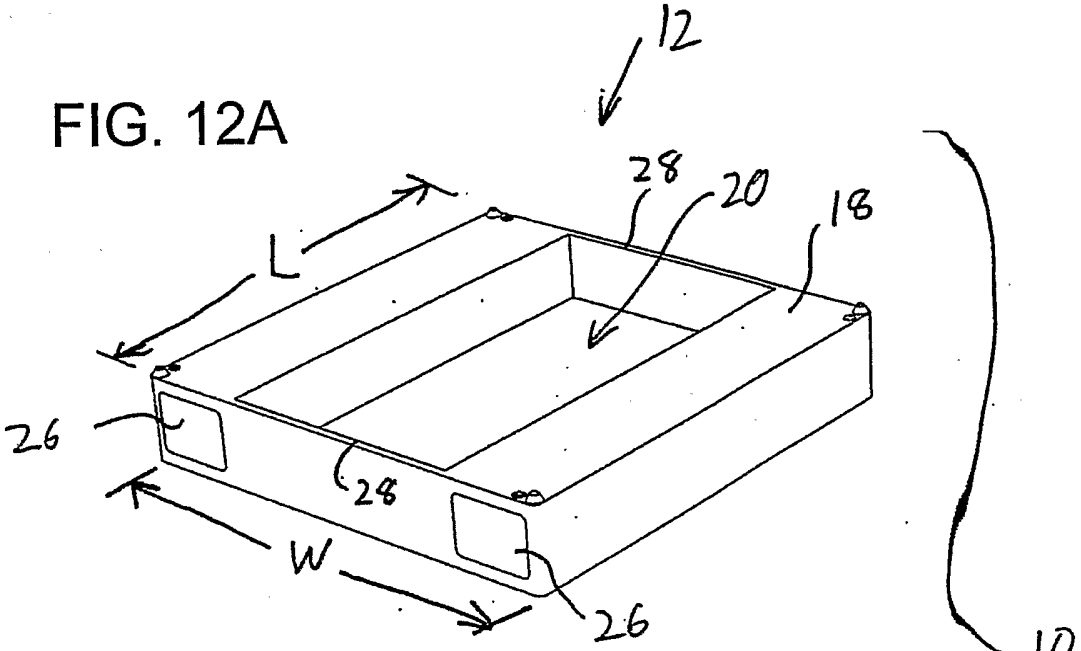


FIG. 12B

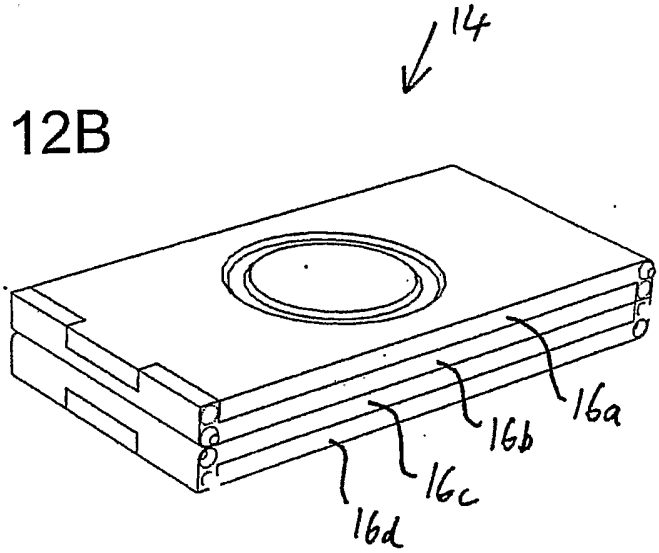


FIG. 13

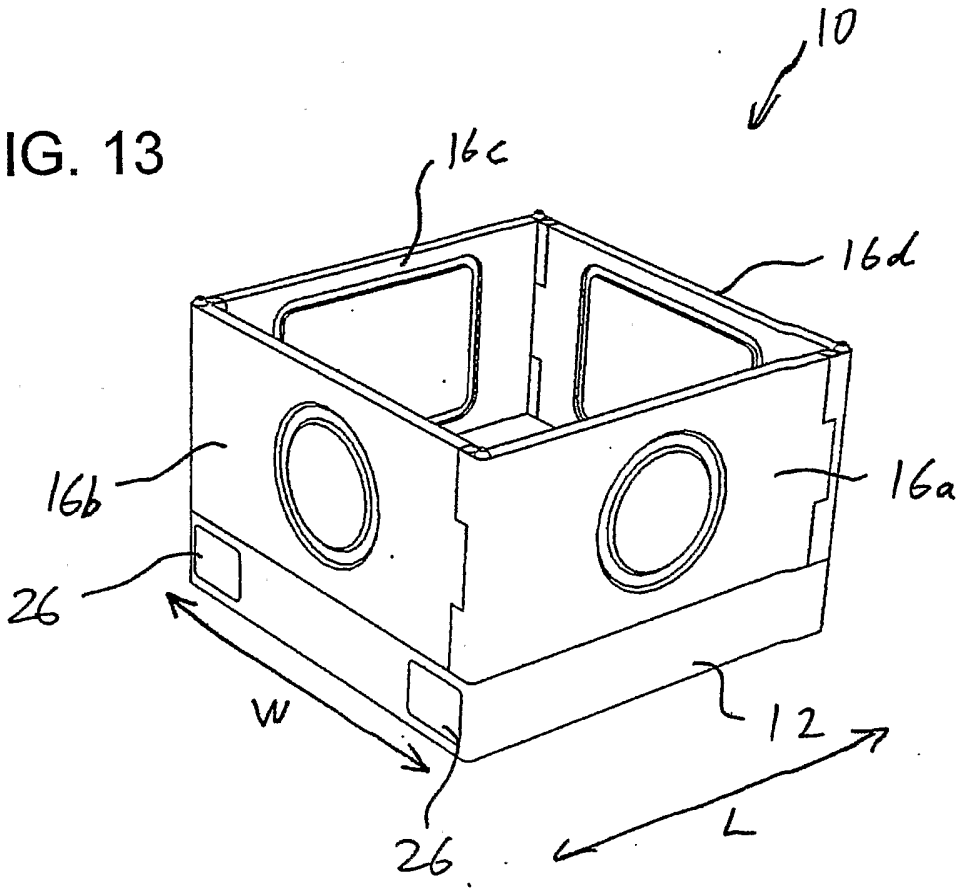


FIG. 14

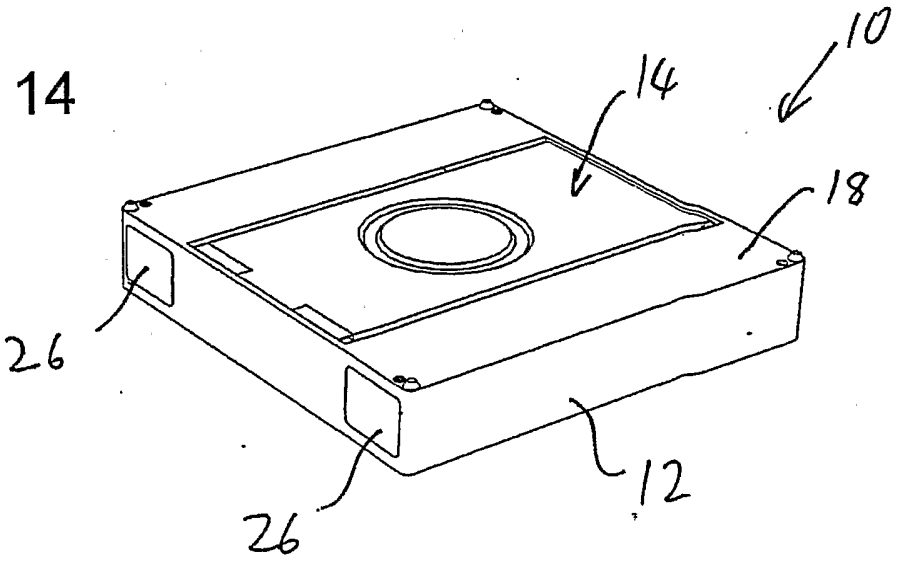


FIG. 15

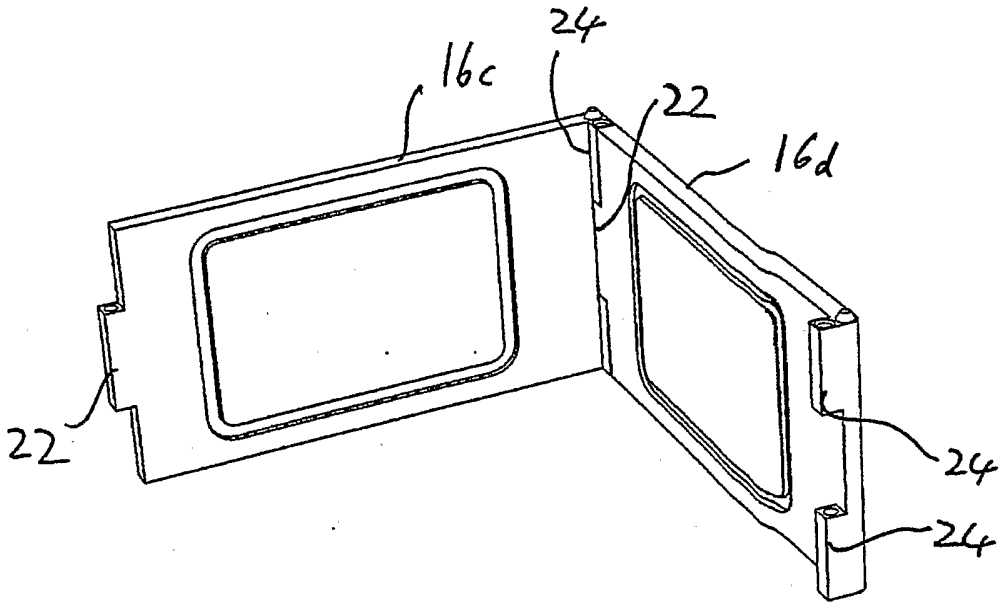


FIG. 16A

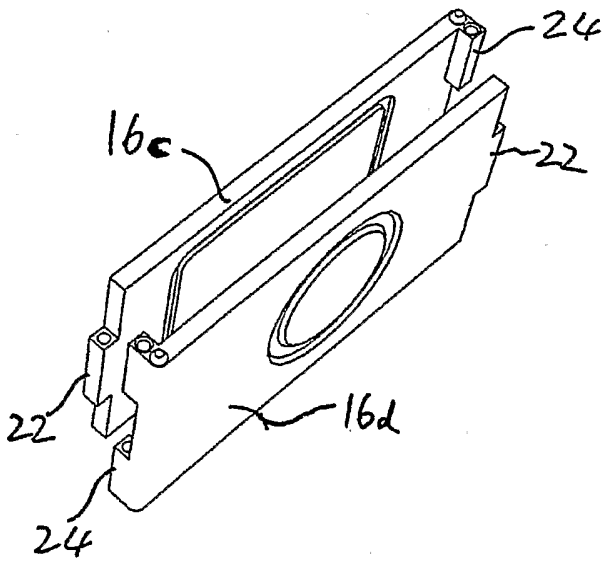


FIG. 16B

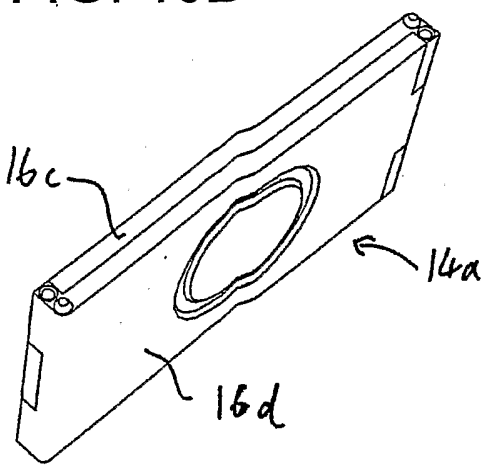


FIG. 17

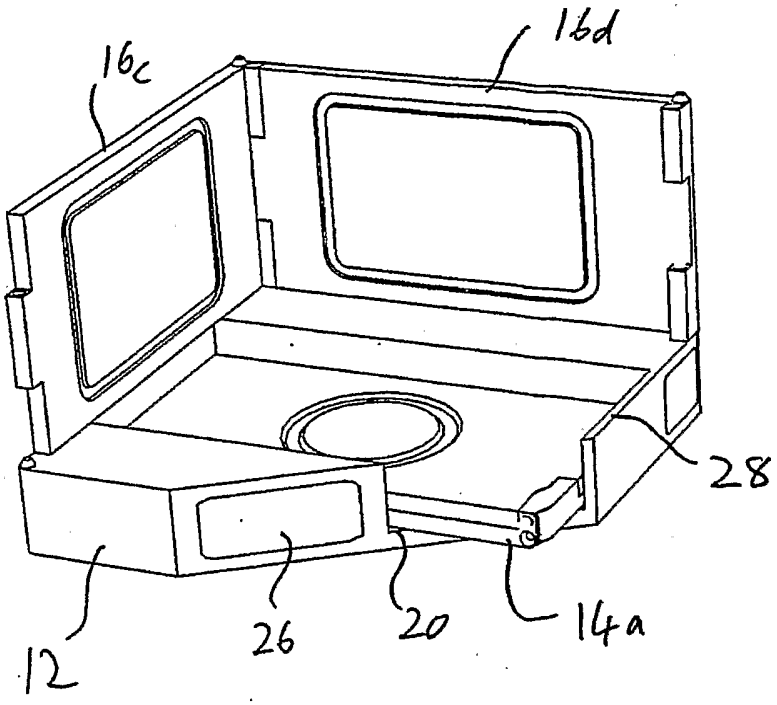


FIG. 18

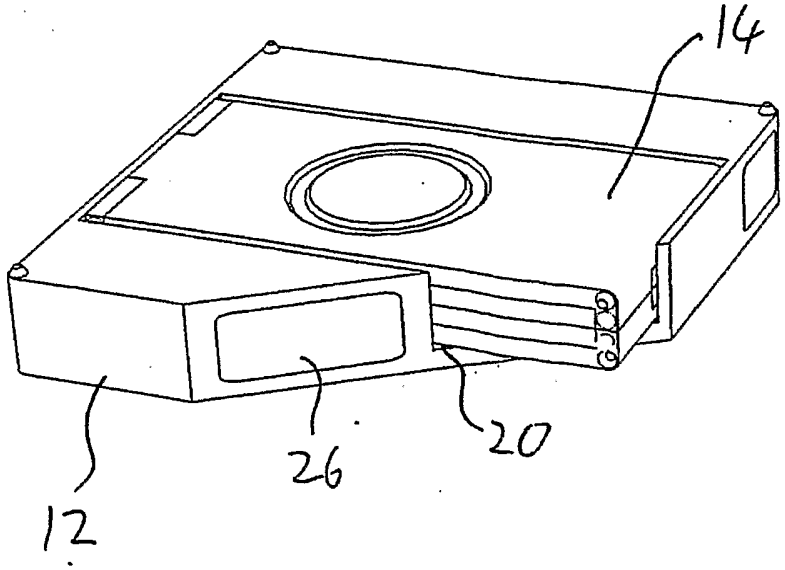


FIG. 19A

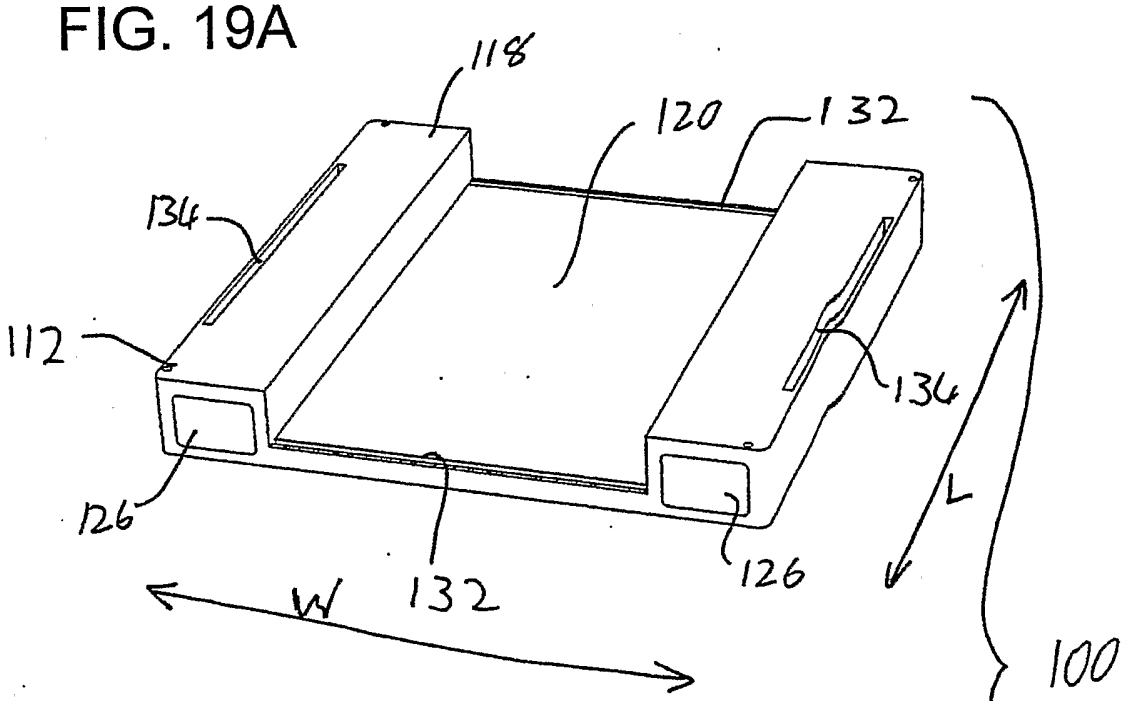


FIG. 19B

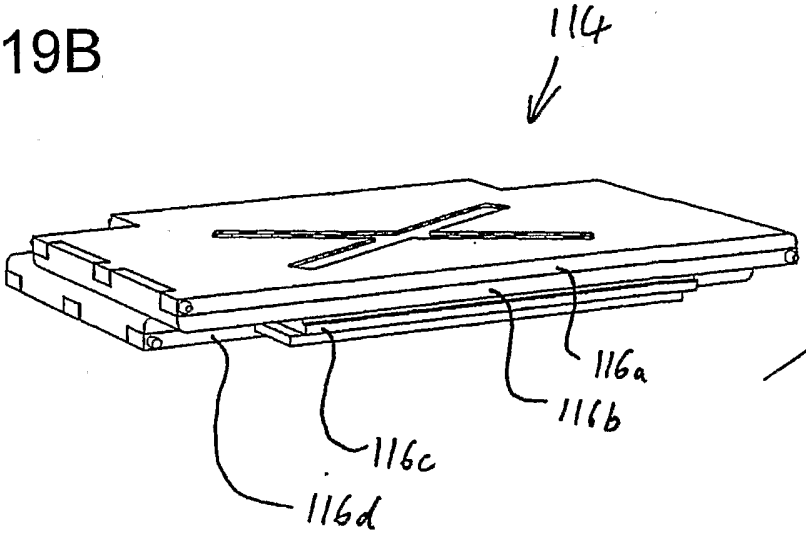


FIG. 20

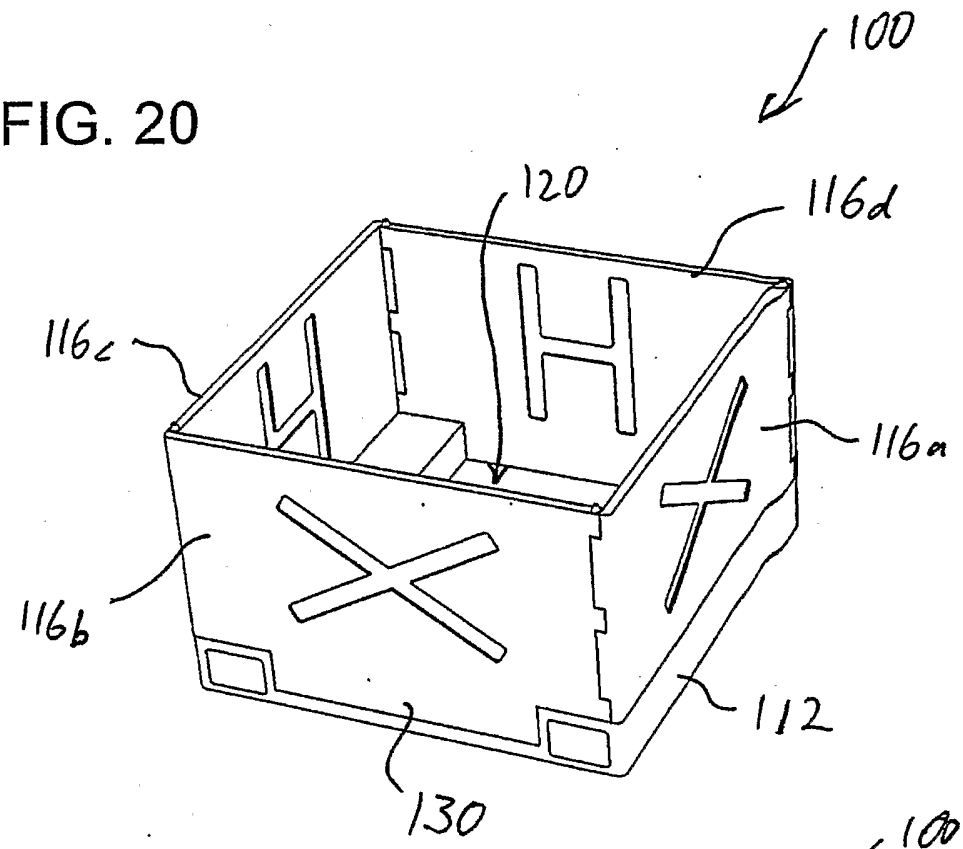


FIG. 21

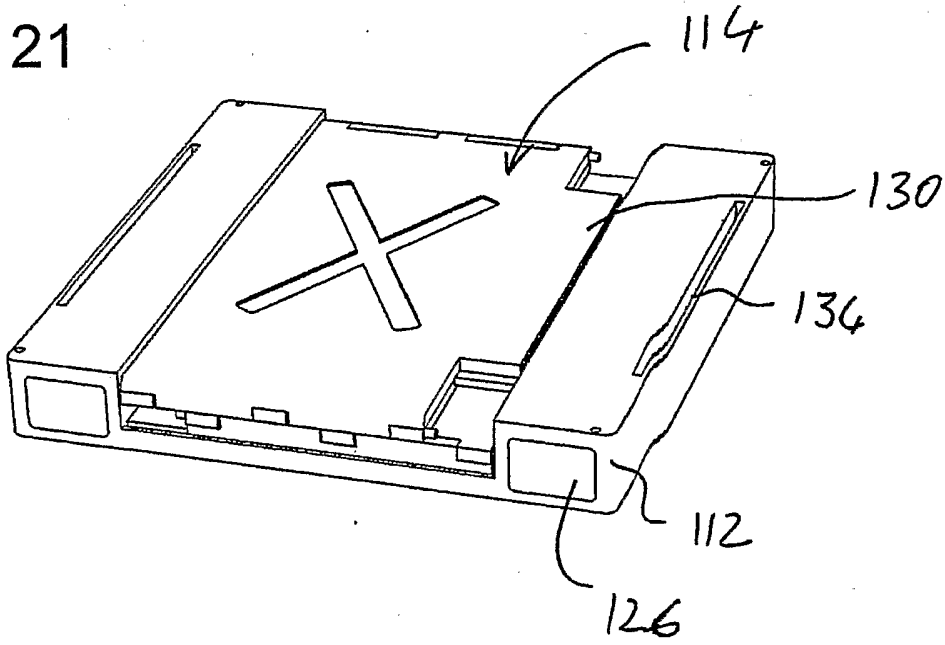


FIG. 22

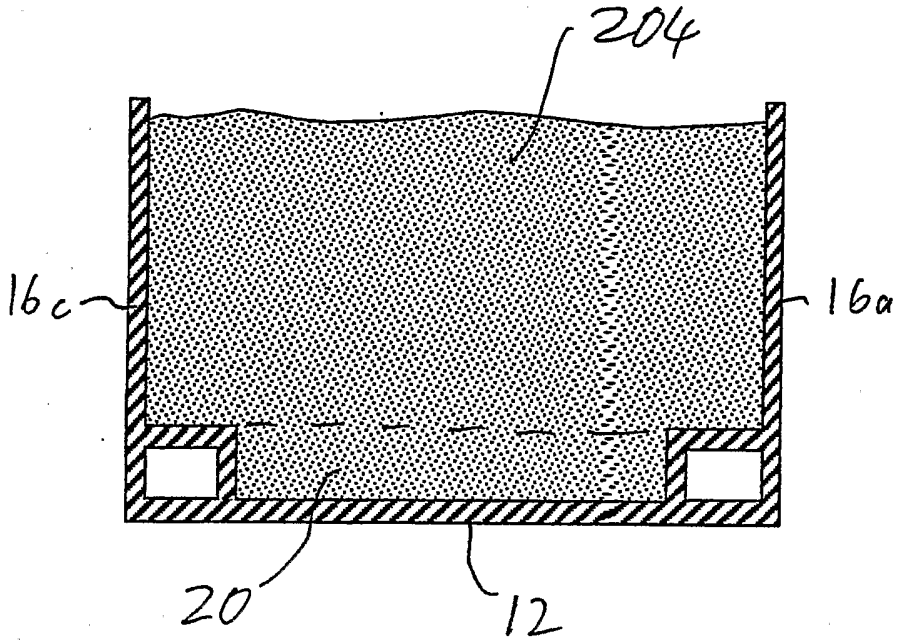


FIG. 23

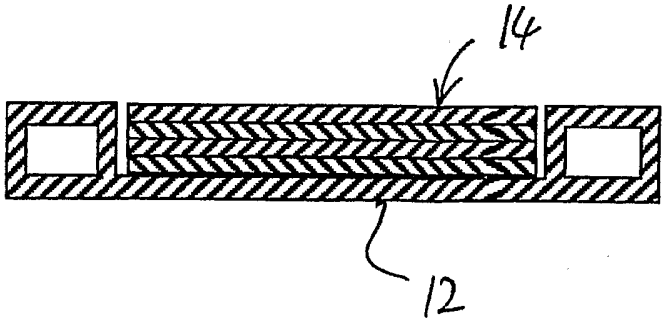


FIG. 24A

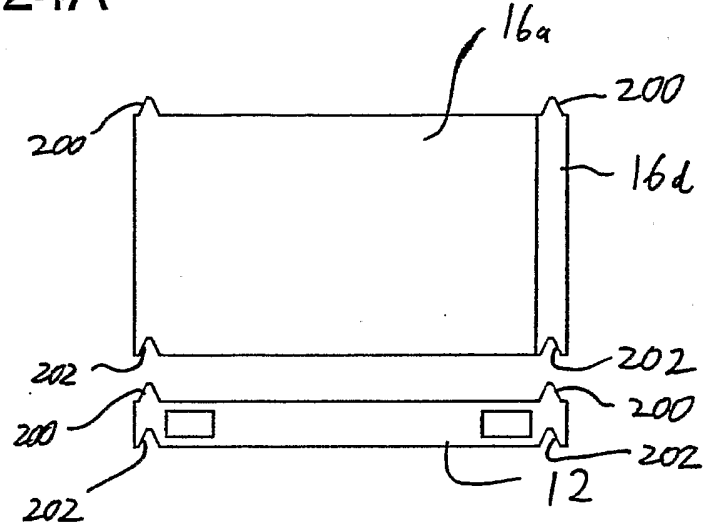


FIG. 24B

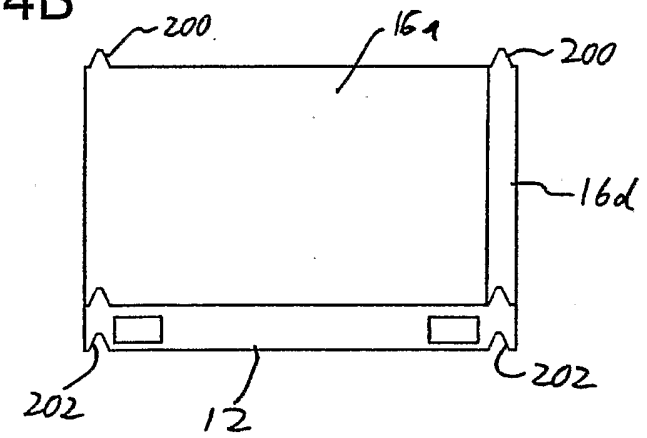


FIG. 24C

