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(54) **Passive thermally regulated knockdown shipping container**

(57) A stackable, passive thermally regulated, knockdown shipping container. The container includes (i) a pair of separate and independent interchangeable end panels, each carrying a detachable panel of fragile thermal insulation, and (ii) a plurality of separate and independent sidewall components each having at least two hingedly interconnected structural panels which carry a detachable panel of fragile thermal insulation. The end panels are each configured and arranged with (a) an external set of projections operable for stably supporting the container on a planar surface, and (b) an external set of depressions. The depressions are configured and arranged such that each projection on the panel, if inverted, would nest within a corresponding depression on the panel upon rotation of the inverted set of projections a defined angular distance about a longitudinal axis of the container relative to the set of depressions.

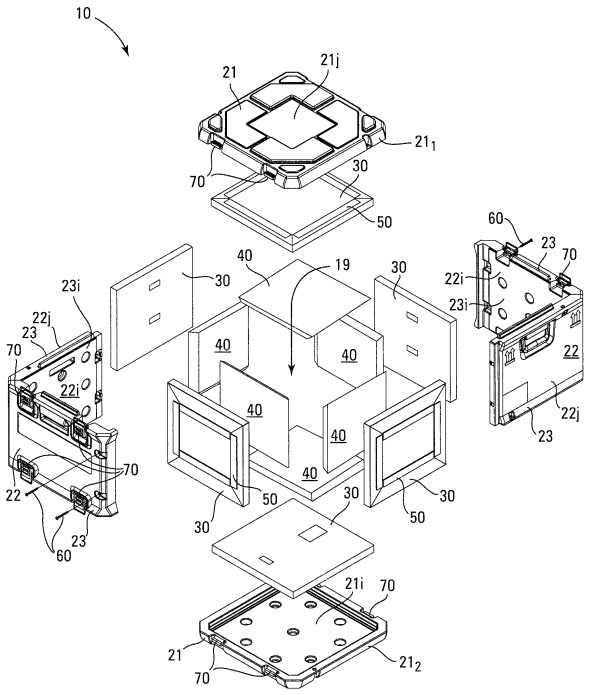

Fig. 1

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Description

BACKGROUND

[0001] Thermally labile goods are frequently transported or shipped in passive thermally regulated shipping containers (i.e., a thermally insulated container containing a thermally conditioned phase change material such as ice). While generally effective for maintaining an object to be shipped at a nominally heated or cooled temperature, the storage and return transport of empty containers remains an ongoing issue.

[0002] Efforts to construct foldable or knockdown passive thermally regulated shipping containers in an effort to minimize the space occupied by empty containers have meet with limited success as such containers tend to provide limited thermal regulation, are labor intensive and/or require trained technicians to assemble and disassemble.

[0003] Accordingly, a substantial need continues to exist for knockdown passive thermally regulated shipping container that provides superior thermal regulation and is quick and easy to assemble and disassemble without error.

SUMMARY OF THE INVENTION

[0004] A first aspect of the invention is a sidewall component suitable for use in construction of a passive thermally regulated knockdown shipping container. The sidewall component includes at least two hingedly interconnected structural panels, each carrying a detachable panel of fragile thermal insulation.

[0005] A second aspect of the invention is a passive thermally regulated knockdown shipping container. The container includes (i) a pair of separate and independent interchangeable end panels, each carrying a detachable panel of fragile thermal insulation, (ii) a plurality of separate and independent sidewall components in accordance with the first aspect of the invention, (iii) a plurality of primary connection mechanisms, each operable for affecting border to border interconnection of a pair of sidewall components pivoted into a use configuration to form an encircling sidewall assembly, and (iv) a plurality of secondary connection mechanisms, each operable for attaching one of the end panels to the sidewall assembly over an open end of the assembly to form an enclosure defining a thermally regulated payload retention chamber.

[0006] A third aspect of the invention is a stackable panel. The panel is configured and arranged with (i) a set of projections extending longitudinally from a first major surface of the panel operable for stably supporting the panel on a planar surface, and (ii) a set of longitudinally inset depressions in the first major surface. The depressions are configured and arranged on the panel such that each projection on the panel, if inverted, would nest within a corresponding depression in the panel upon rotation of the inverted set of projections a defined angular distance about a longitudinal axis of the panel relative to the set of depressions.

[0007] A fourth aspect of the invention is a stackable container. The container has one or more sidewalls longitudinally separating identically configured and arranged top and bottom panels. The top and bottom panels are each configured and arranged with (i) an external set of projections operable for stably supporting the container on a planar surface, and (ii) an external set of depressions. The depressions are configured and arranged such that each projection on the panel, if inverted, would nest within a corresponding depression on the panel upon rotation of the inverted set of projections a defined angular distance about a longitudinal axis of the container relative to the set of depressions.

[0008] The following aspects are preferred embodiments of the invention.

1. A sidewall component suitable for use in construction of a passive thermally regulated knockdown shipping container, comprising at least two hingedly interconnected structural panels each carrying a detachable panel of fragile thermal insulation.

2. The sidewall component of aspect 1 wherein the panels of thermal insulation are precisely aligned on the structural panels such that the panels of thermal insulation do not contact one another when the structural panels are disposed in a planar storage configuration, and abut one another along a length of a border area thereof when the structural panels are disposed in a three-dimensional use configuration by pivoting the structural panels about the interconnecting hinge until further pivotal movement is inhibited by the structure of the component.

3. The sidewall component of aspect 1 wherein the structural panels are comprised of a plastic material and are interconnected by a live hinge.

4. The sidewall component of aspect 1 wherein the component has two structural panels.

5. The sidewall component of aspect 1 wherein the panels of fragile thermal insulation are vacuum insulated panels.

6. The sidewall component of aspect 1 wherein the panels of fragile thermal insulation are attached to the structural panels with hook and loop tape.

7. The sidewall component of aspect 1 wherein the panels of fragile thermal insulation are adhesively attached to the structural panels.

8. A passive thermally regulated knockdown shipping container, comprising:

(a) a pair of separate and independent interchangeable end panels, each carrying a detachable panel of fragile thermal insulation,
(b) a plurality of separate and independent sidewall components in accordance with aspect 2,
(c) a plurality of primary connection mechanisms, each operable for affecting border to border interconnection of a pair of sidewall components pivoted into the use configuration to form an encircling sidewall assembly, and
(d) a plurality of secondary connection mechanisms, each operable for attaching one of the end panels to the sidewall assembly over an open end of the assembly to form an enclosure defining a thermally regulated payload retention chamber.

9. The thermally regulated shipping container of aspect 8 further including panels of phase change material lining the payload retention chamber.

10. The thermally regulated shipping container of aspect 8 wherein the structural panels are comprised of a plastic material and are interconnected by a live hinge.

11. The thermally regulated shipping container of aspect 8 wherein each sidewall component has two structural panels.

12. The thermally regulated shipping container of aspect 8 wherein the panels of fragile thermal insulation are vacuum insulated panels.

13. The thermally regulated shipping container of aspect 8 wherein the panels of fragile thermal insulation are attached to the structural panels with hook and loop tape.

14. The thermally regulated shipping container of aspect 8 wherein the panels of fragile thermal insulation are adhesively attached to the structural panels.

15. An article of commerce, comprising a stackable panel having longitudinally spaced first and second major surfaces, the panel configured and arranged with a set of projections extending longitudinally from the first major surface of the panel operable for stably supporting the panel on a planar surface and a set of longitudinally inset depressions in the first major surface configured and arranged such that each projection on the panel would nest within a corresponding depression in the panel upon rotation of an inverted set of projections a defined angular distance about a longitudinal axis of the panel relative to the set of depressions.

16. A stackable container defining a longitudinal axis and a payload retention chamber, and comprising one or more sidewalls longitudinally separating identically configured and arranged top and bottom panels, each panel configured and arranged with an external set of projections operable for stably supporting the container on a planar surface and an external set of depressions configured and arranged such that each projection on the panel would nest within a corresponding depression on the panel upon rotation of an inverted set of projections a defined angular distance about the longitudinal axis of the container relative to the set of depressions.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Figure 1 is an exploded isometric view of one embodiment of the invention.
[0010] Figure 2 is an isometric view of the container depicted in FIG. 1 fully assembled.
[0011] Figure 2A is a top view of the assembled container depicted in FIG. 1.
[0012] Figure 2B is a side view of the assembled container depicted in FIG. 2A.
[0013] Figure 3 is an isometric view of one of the sidewall components depicted in FIG. 1 disposed in a planar storage position.
[0014] Figure 4 is a cross-sectional side view of the sidewall component depicted in FIG. 3 taken along line 4-4.

[0015] Figure $4A_1$ is a grossly enlarged portion of the cross-sectional side view of the sidewall component depicted in FIG. 4 for purposes of allowing depiction of one means for detachably attaching the thermal insulation panel to the structural sidewall panel.

[0016] Figure $4A_2$ is a grossly enlarged portion of the cross-sectional side view of the sidewall component depicted in FIG. 4 for purposes of allowing depiction of another means for detachably attaching the thermal insulation panel to the structural sidewall panel.

[0017] Figures 5A-D depict various arrangements of variously shaped projections and depressions on structural end panels of various cross-sectional shapes that permit stable nestable stacking of containers employing identical structural end panels as both the top and bottom of the containers.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Definitions

[0018] As utilized herein, including the claims, the term "***detachable***" means capable of being detached without application of violent force and without damage to or destruction of either the item being detached or the substrate from which the item is being detached.

Nomenclature

[0019]

10	Passive Thermally Regulated Shipping Container
19	Payload Retention Chamber
20	Outer Structural Shell
21	Structural End Panel
21_1	Upper Structural End Panel
21_2	Lower Structural End Panel
21i	Interior Major Surface of Structural End Panel
21j	Exterior Major Surface of Structural End Panel
21p	Projections Extending from the Exterior Major Surface of Structural End Panel
21d	Depressions in the Exterior Major Surface of Structural End Panel
22	Structural Sidewall Component
22i	Interior Major Surface of Structural Sidewall Component
22j	Exterior Major Surface of Structural Sidewall Component
23	Sidewall Panel on Structural Sidewall Component
23i	Interior Major Surface of Structural Sidewall Panel
24	Live Hinge Interconnecting First and Second Structural Sidewall Panels on Structural Sidewall Component
30	Thermal Insulation Panel
30b	Border Area of Thermal Insulation Panel
40	Phase Change Material Panels (PCM Panel)
50	Means for Detachably Attaching Thermal Insulation Panel to a Structural Panel
50_1	Hook and Loop Tape
50_2	Pressure Sensitive Adhesive
60	Connection Mechanism for Attaching Structural Sidewall Components
70	Connection Mechanism for Attaching Structural End Panel to Erected Structural Sidewall Assembly
x10	Longitudinal Axis of Shipping Container
x21	Longitudinal Axis of Structural End Panel

Construction

[0020] Referring generally to FIG. 1, the present invention is directed to various components of a modular kit operable for assembly into a passive thermally regulated stackable shipping container **10**, and a shipping container **10** assembled therefrom.

[0021] When assembled, the shipping container **10** includes an outer structural shell **20**, a layer of thermal insulation **30**, and optionally a layer of phase change material (not shown) retained within PCM panels **40**, defining a passive thermally regulated payload retention chamber **19**.

[0022] The outer structural shell **20** may be solid or hollow and may be made from any material possessing sufficient

structural integrity, including specifically but not exclusively, cellulosic materials such as paperboard and cardboard, engineered wood products such as laminated and unlaminated fiberboard and plywood, wood, plastics such as polyethylene, polypropylene, polyethylene terephthalate, nylon polycarbonates and phenolic resins, wood-plastic composites, metals such as aluminum, copper, brass and steel, glass, ceramics, combinations thereof, and the like.

[0023] The outer structural shell **20** is divided into separate and independent structural end panels 21 and at least one structural sidewall component **22**. These units are capable of being repeatedly attached to and detached from one another.

[0024] Assembly of a shipping container **10** requires two structural end panels **21** - one to cover the top $\mathbf{21}_1$ and another to cover the bottom $\mathbf{21}_2$. The top $\mathbf{21}_1$ and bottom $\mathbf{21}_2$ structural end panels are preferably interchangeable with one another so that only a single style end panel **21** need be manufactured and stocked. Use of interchangeable top $\mathbf{21}_1$ and bottom $\mathbf{21}_2$ structural end panels also simplifies assembly of the shipping container **10** as there is no need to obtain and identify separate top $\mathbf{21}_1$ and bottom $\mathbf{21}_2$ structural end panels. A technician assembling a shipping container **10** need only obtain two structural end panels **21**.

[0025] The exterior major surface **21j** of the structural end panels **21** may be contoured with a set of rotationally spaced longitudinal projections **21p** and rotationally displaced "matching" set of longitudinal depressions **21d** whereby (i) the projections **21p** terminate along a single horizontal plane such that the structural end panel **21** can rest stably upon the projections **21p** when placed upon a flat horizontal surface, and (ii) the projections **21p** on both structural end panels **21**, disposed with their exterior major surfaces **21j** facing one another, will nest within corresponding depressions **21d** on the other facing structural end panel **21** when one of the facing panels **21** is rotated a defined angular distance about the longitudinal axis **x21** of the panel **21**. This permits interchangeable top $\mathbf{21}_1$ and bottom $\mathbf{21}_2$ structural end panels to be used in assembling a shipping container **10** while still allowing such assembled shipping containers **10** to be stably and nestably stacked upon one another by simply rotating an overlying shipping container **10** a defined angular distance about the longitudinal axis **x10** of the shipping container **10** relative to the immediately underlying shipping container **10**.

[0026] Exemplary operable arrangements of variously shaped projections **21p** and depressions **21d** on structural end panels **21** having various cross-sectional shapes are depicted in FIGs 5A-D, wherein depressions 21d are shaded and projections 21p are unshaded. Each is described in further detail in TABLE ONE.

TABLE ONE

FIG#	PROJECTIONS		SHAPE OF PANEL	NECESSARY ANGULAR ROTATION TO ACHIEVE NESTING
	#	CROSS-SECTIONAL SHAPE		
5A	4	Square	Rectangle	180°
5B	4	Triangle	Square	90°
5C	3	Circle	Square	180°
5D	3	Hexagon	Hexagon	60°

[0027] Assembly of a shipping container **10** also requires at least three structural sidewall panels **23**.

[0028] Structural sidewall panels **23** are grouped together on structural sidewall components 22, with the structural sidewall panels **23** on each structural sidewall component **22** interconnected by a hinge **24**, such as a live hinge.

[0029] The structural sidewall components **22** can be constructed with any number of hingedly interconnected structural sidewall panels **23** on each structural sidewall component **22**. However, as the number of panels **23** on each component **22** increases, so too does the difficulty and complexity of storing and handling the structural sidewall component **22**. A nonexhaustive listing of various geometric and configurational options for the structural sidewall components **22** and shipping containers **10** constructed therefrom is provided below in table TWO.

TABLE TWO

SIDEWALL COMPONENT	SHIPPING CONTAINER	
# of Panels on Each	***# of Sidewall Components***	***Cross-Sectional Shape***
2	2	Square
2	3	Hexagon
2	4	Octagon
2	5	Decagon
3	1	Triangle

(continued)

SIDEWALL COMPONENT	SHIPPING CONTAINER	
# of Panels on Each	***# of Sidewall Components***	***Cross-Sectional Shape***
3	2	Hexagon
3	3	Nonagon
4	1	Square
4	2	Octagon
5	1	Pentagon
5	2	Decagon

[0030] When the shipping container **10** is constructed from two or more structural sidewall components **22** the structural sidewall components **22**, as with the end panels **21**, are preferably interchangeable with one another so that only a single style structural sidewall component **22** need be manufactured and stocked.

[0031] The structural sidewall panels **23** on each structural sidewall component **22** are configured and arranged such that the structural sidewall panels **23** can be pivoted relative to one another as between a planar storage configuration in which the structural sidewall panels **23** do not contact one another, and a three-dimensional use configuration in which the and structural sidewall panels **23** abut one another along a length of a border area thereof.

[0032] A panel of thermal insulation **30** is detachably attached to the interior major surface **21i** of each structural end panel **21** and the interior major surface **23i** of each structural sidewall panel **23** on each structural sidewall component **22**. The panels of thermal insulation **30** may be constructed of any material having good thermal insulating qualities, (*i.e.*, having a high thermal resistance "R"), such as Styrofoam, vacuum insulated panels, or the like.

[0033] The panels of thermal insulation **30** are aligned on the structural sidewall panels **23** so that the panels of thermal insulation **30** do not contact one another when the structural sidewall panels **23** are disposed in the planar storage configuration, but abut one another along a length of a border area **30b** thereof when the structural sidewall panels **23** are disposed in the three-dimensional use configuration.

[0034] In a similar fashion, the panels of thermal insulation **30** are aligned on the structural end panels **21** so that the panels of thermal insulation **30** on the end panels **21** abut the panels of thermal insulation **30** attached to the structural sidewall panels **23** along a length of a border area thereof when the structural end panel **21** is attached to the assembled structural sidewall panels **23**.

[0035] Preferred materials for use as the thermal insulating panels **30** tend to be fragile and/or frangible (*e.g.*, panels of Styrofoam or vacuum insulated panels). This results in all too frequent damaging of the thermal insulating panels **30** and resultant loss of insulating value. In order to facilitate replacement of damaged and/or failing thermal insulating panels **30** without requiring replacement of an entire structural end panel **21** or structural sidewall panel **23**, the thermal insulating panels **30** are detachably attached to the structural end panels **21** and structural sidewall panels **23**.

[0036] A wide variety of options are available for detachably attaching the thermal insulating panels **30** to the interior major surface **21i** of each structural end panel **21** and the interior major surface **23i** of each structural sidewall panel **23**. A preferred option is hook and loop tape $\mathbf{50}_1$ such as shown in FIG. $4A_1$. Another preferred option is double-sided pressure sensitive adhesive tape $\mathbf{50}_2$ such as shown in FIG. $4A_2$. Yet another preferred attachment means is a layer of pressure sensitive adhesive coated directly upon the structural end panel **21**, structural sidewall panel **23**, and/or thermal insulating panel **30**. Mechanical fasteners may also be used, such as elastic straps, reversible snap fit, reversible press-fit, etc. However, such mechanical fasteners should generally be avoided as they tend to prevent direct contact between the thermal insulating panels **30** when the container **10** is fully assembled, leaving a gap in the layer of thermal insulation through which significant heat loss can occur.

[0037] Referring to FIG 1, the payload retention chamber **19** can be lined with panels of phase change material (PCM panels) **40**. The PCM panels **40** can be filled with any suitable phase change material, such as water or various hydrocarbons.

[0038] Either of the structural end panels **21** on the shipping container **10** can be selectively removable from the sidewall assembly for allowing insertion and removal of goods from the payload retention chamber **19**. PCM panels **40** deployed within the payload retention chamber 19 may similarly be removed for thermal conditioning.

[0039] A primary connection mechanism **60** releasably attaches structural sidewall components **22** to one another. A secondary connection mechanism **70** releasably attaches structural end panels **21** to the longitudinal ends of a fully assembled sidewall assembly. Both the primary **60** and secondary **70** connection mechanisms can be selected from the wide variety of known mechanical type fasteners capable of repetitive attachment and detachment of components. A nonexhaustive list of such fasteners includes bolts, buckles, catches, clamps, clasps, hasps, latches, hook and loop

tape, and the like.

Assembly and Use

[0040] For simplification purposes only, assembly, use and disassembly of a shipping container **10** in accordance with this invention shall be based upon the shipping container **10** depicted in FIGs 1, 2, 2A and 2B.

[0041] The shipping container **10** depicted in FIGs 1, 2, 2A and 2B can be rapidly assembled by (i) obtaining a pair of structural end panels **21** and a pair of structural sidewall components **22**, (ii) placing one of the structural end panels **21** onto a planar horizontal surface (not shown) with the interior major surface **21i** of the selected end panel **21** facing upward to establish a bottom structural end panel $\mathbf{21}_2$, (iii) placing both structural sidewall components **22** - pivoted into the three-dimensional use position - into orthogonal fitted engagement with the periphery of the interior major surface **21i** of the bottom structural end panel $\mathbf{21}_2$ and into orthogonal fitted engagement with one another to define a payload retention chamber **19**, (iv) securing the structural sidewall components **22** together with the primary connection mechanisms **60** to form an encircling structural sidewall assembly, (v) securing the structural sidewall assembly to the bottom structural end panel $\mathbf{21}_2$ with the lower sets of secondary connection mechanisms **70**, (vi) placing the other structural end panel **21** over the open longitudinal end of the structural sidewall assembly in orthogonal fitted engagement with the structural sidewall components **22** to establish a top structural end panel $\mathbf{21}_1$, and (vii) securing the top structural end panel $\mathbf{21}_1$ to the structural sidewall assembly with the upper sets of secondary connection mechanisms **70**.

[0042] Loading thermally labile goods (not shown) into an assembled shipping container **10** for transport includes the steps of: (a) detaching the top structural end panel $\mathbf{21}_1$ from the structural sidewall assembly by disengaging the upper sets of secondary connection mechanisms **70**, (b) removing the detached top structural end panel $\mathbf{21}_1$ from the structural sidewall assembly for providing access to the payload retention chamber **19**, (c) optionally lining the payload retention chamber **19** with thermally conditioned PCM panels **40**, (d) placing the payload of thermally labile goods (not shown) into the lined or unlined payload retention chamber **19**, (e) optionally covering the open top of the loaded payload retention chamber **19** with a thermally conditioned PCM panel **40**, (f) placing the top structural end panel $\mathbf{21}_1$ back over the open longitudinal end of the structural sidewall assembly, and (g) securing the top structural end panel $\mathbf{21}_1$ to the structural sidewall assembly with the upper sets of secondary connection mechanisms **70**.

[0043] Unloading thermally labile goods (not shown) from a shipping container **10** includes the steps of: (A) detaching the top structural end panel $\mathbf{21}_1$ from the structural sidewall assembly by disengaging the upper sets of secondary connection mechanisms **70**, (B) removing the detached top structural end panel $\mathbf{21}_1$ from the structural sidewall assembly, (C) removing any underlying PCM panel **40** for providing access to the payload retention chamber **19**, and (D) removing the payload of thermally labile goods (not shown) from the payload retention chamber **19**.

[0044] Knocking down an unloaded shipping container **10** for return transport includes the steps of (1) removing any PCM panels **40** still in the payload retention chamber **19**, (2) detaching the structural sidewall components **22** from one another by disengaging the primary connection mechanisms **60**, (3) detaching the structural sidewall components **22** from the bottom structural end panel $\mathbf{21}_2$ by disengaging the lower sets of secondary connection mechanisms **70**, and (4) removing the structural sidewall components **22** from the bottom structural end panel $\mathbf{21}_2$.

Claims

1. An article of commerce, comprising a sidewall component suitable for use in construction of a passive thermally regulated knockdown shipping container, the component comprising at least two hingedly interconnected structural panels each carrying a detachable panel of fragile thermal insulation.

2. The article of claim 1 wherein the panels of thermal insulation are precisely aligned on the structural panels such that the panels of thermal insulation do not contact one another when the structural panels are disposed in a planar storage configuration, and abut one another along a length of a border area thereof when the structural panels are disposed in a three-dimensional use configuration by pivoting the structural panels about the interconnecting hinge until further pivotal movement is inhibited by the structure of the component.

3. The article component of claim 1 wherein the component has two structural panels.

4. An article of commerce, comprising a passive thermally regulated knockdown shipping container, the container comprising at least:

(a) a pair of separate and independent interchangeable end panels, each carrying a detachable panel of fragile thermal insulation,

(b) a plurality of separate and independent sidewall components in accordance with claim 2,
(c) a plurality of primary connection mechanisms, each operable for affecting border to border interconnection of a pair of sidewall components pivoted into the use configuration to form an encircling sidewall assembly, and
(d) a plurality of secondary connection mechanisms, each operable for attaching one of the end panels to the sidewall assembly over an open end of the assembly to form an enclosure defining a thermally regulated payload retention chamber.

5. The article of claim 4 further including panels of phase change material lining the payload retention chamber.

6. The article of claim 1 or 4 wherein the structural panels are comprised of a plastic material and are interconnected by a live hinge.

7. The article of claim 4 wherein each sidewall component has two structural panels.

8. The article of claim 1 or 4 wherein the panels of fragile thermal insulation are vacuum insulated panels.

9. The article of claim 1 or 4 wherein the panels of fragile thermal insulation are attached to the structural panels with hook and loop tape.

10. The article of claim 1 or 4 wherein the panels of fragile thermal insulation are adhesively attached to the structural panels.

11. An article of commerce, comprising a stackable panel having longitudinally spaced first and second major surfaces, the panel configured and arranged with a set of projections extending longitudinally from the first major surface of the panel operable for stably supporting the panel on a planar surface and a set of longitudinally inset depressions in the first major surface configured and arranged such that each projection on the panel would nest within a corresponding depression in the panel upon rotation of an inverted set of projections a defined angular distance about a longitudinal axis of the panel relative to the set of depressions.

12. A stackable container defining a longitudinal axis and a payload retention chamber, and comprising one or more sidewalls longitudinally separating identically configured and arranged top and bottom panels according to claim 11, each panel configured and arranged with an external set of projections operable for stably supporting the container on a planar surface and an external set of depressions configured and arranged such that each projection on the panel would nest within a corresponding depression on the panel upon rotation of an inverted set of projections a defined angular distance about the longitudinal axis of the container relative to the set of depressions.

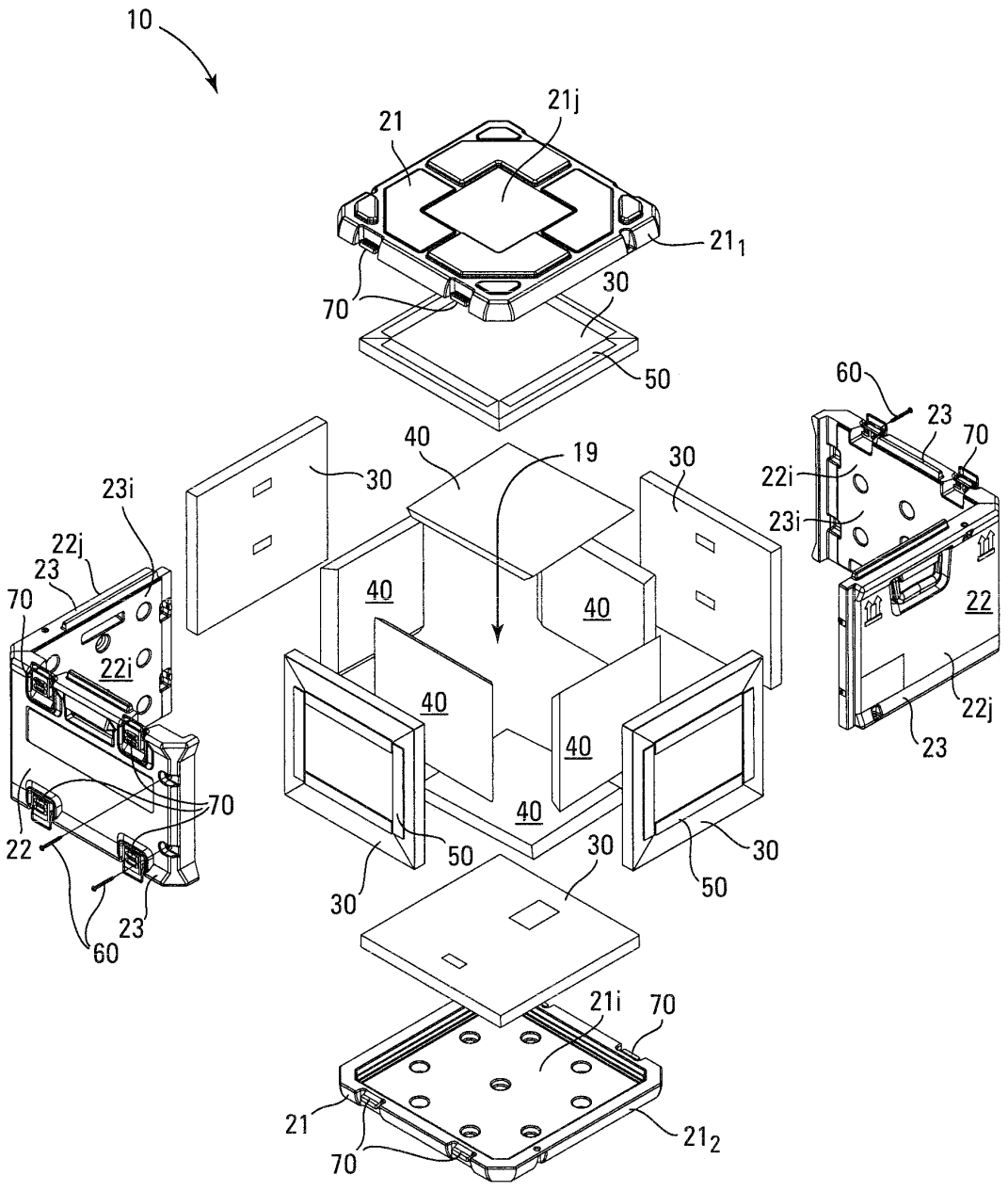
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Fig. 1

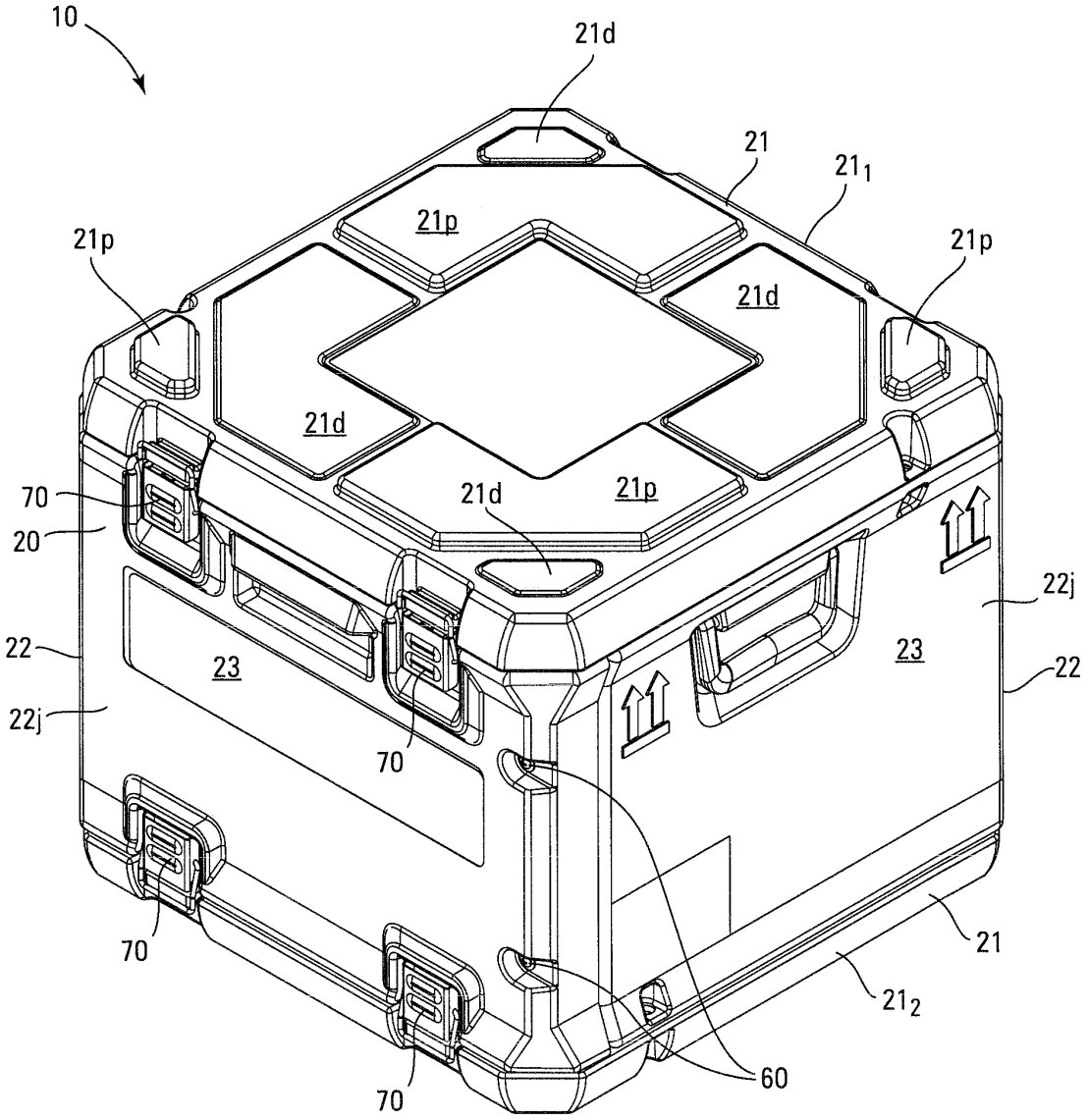
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Fig. 2

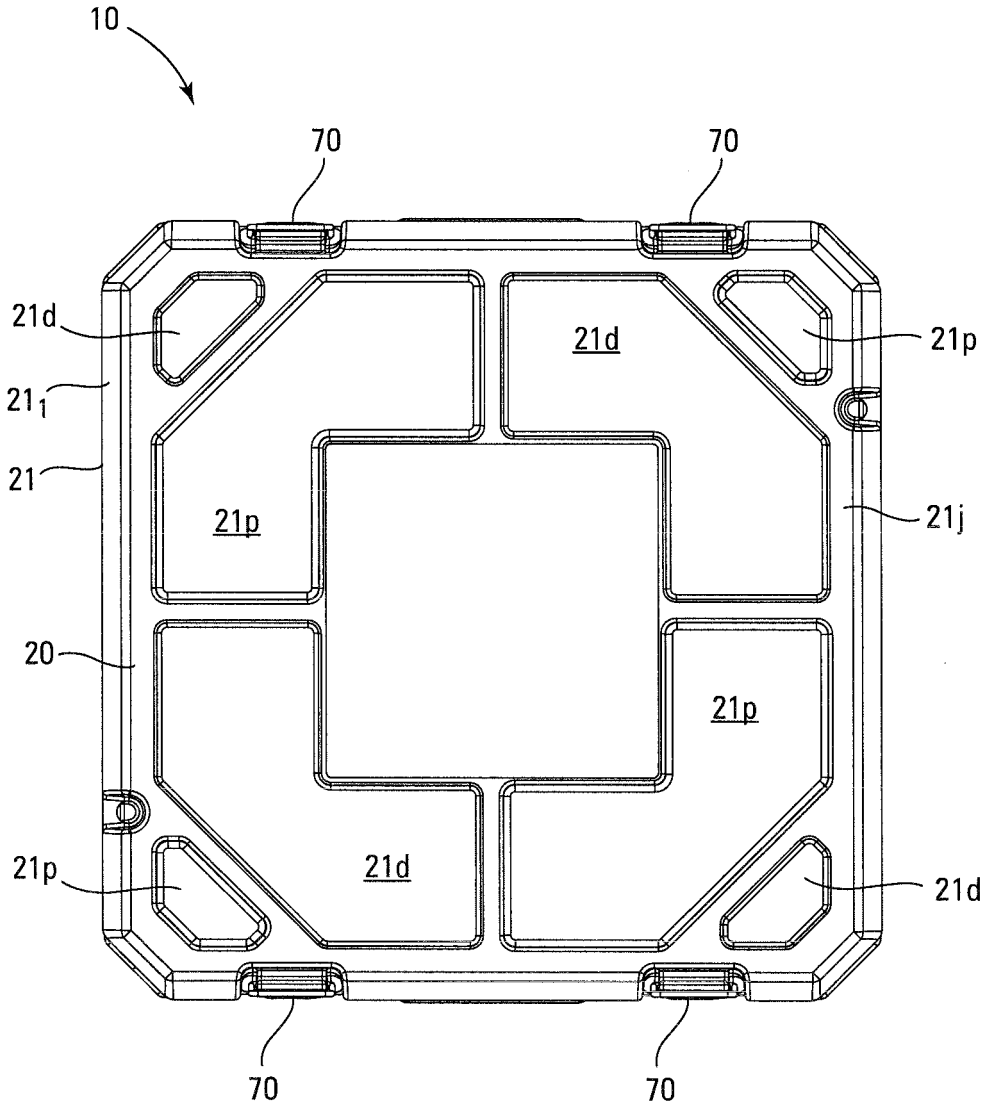

Fig. 2A

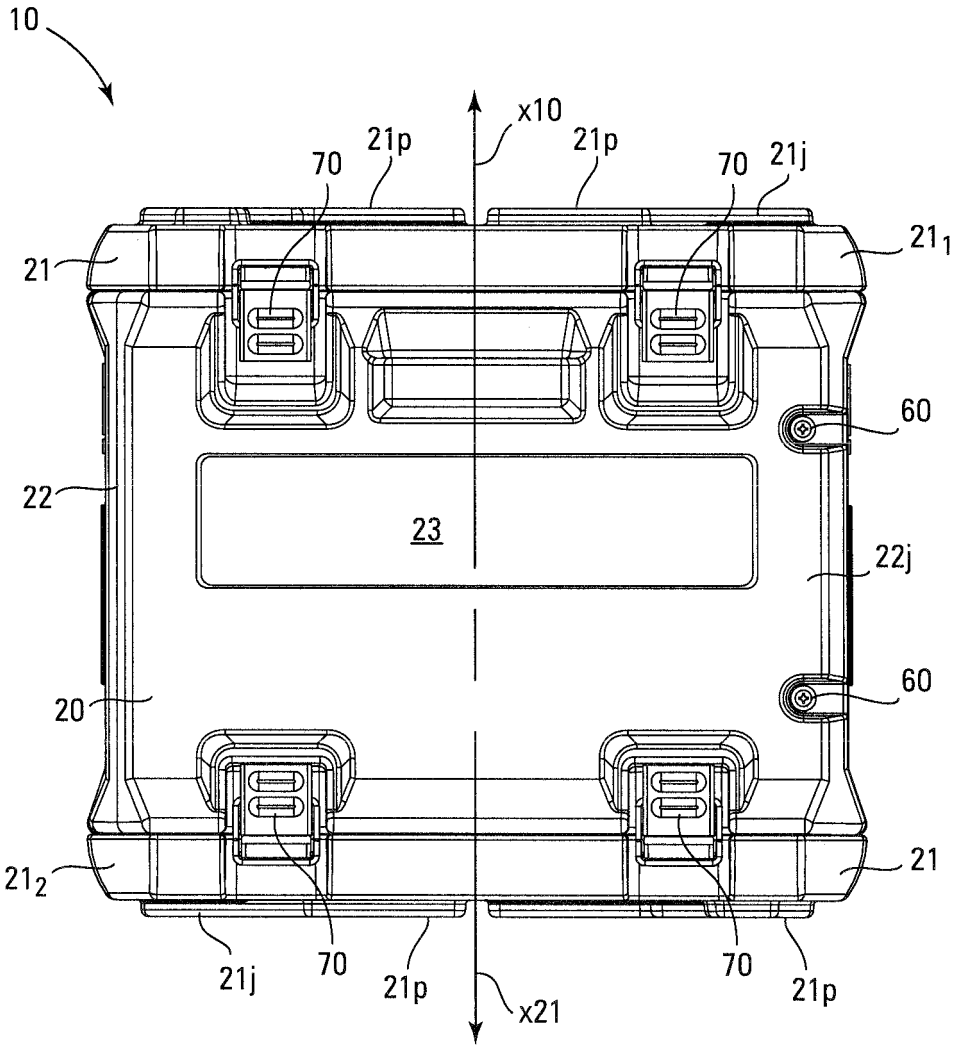
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Fig. 2B

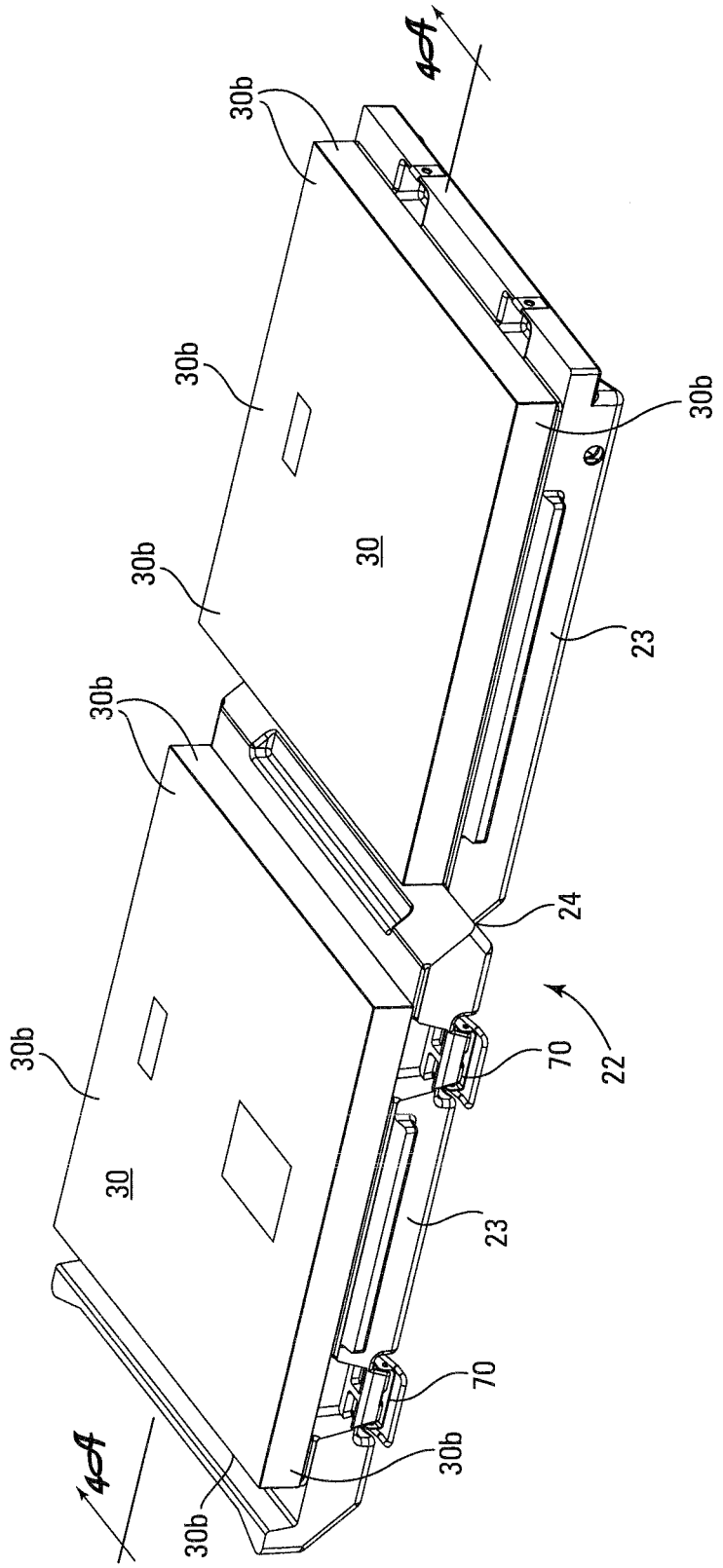

Fig. 3

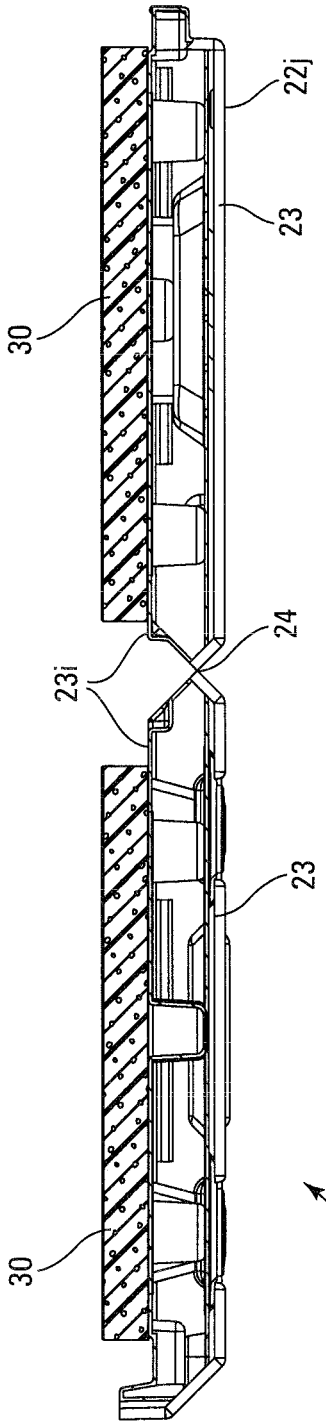

Fig. 4

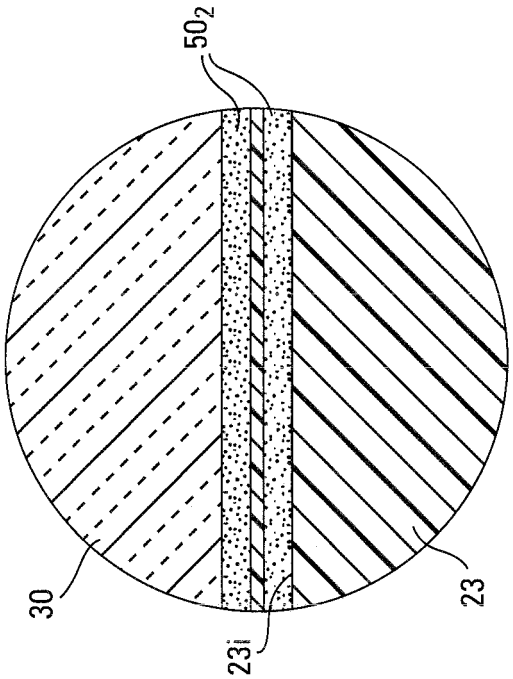

Fig. 4A2

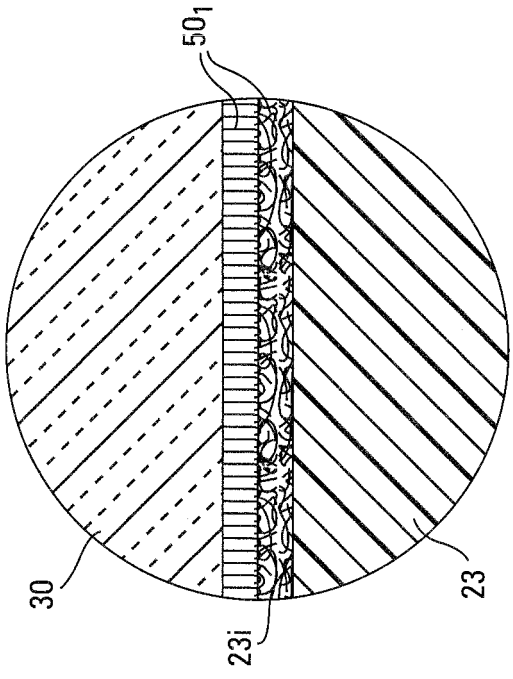

Fig. 4A1

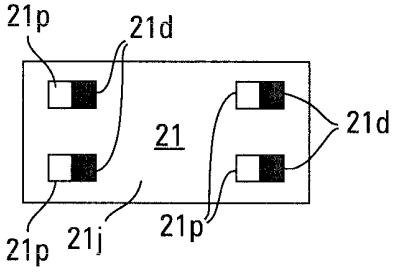

Fig. 5A

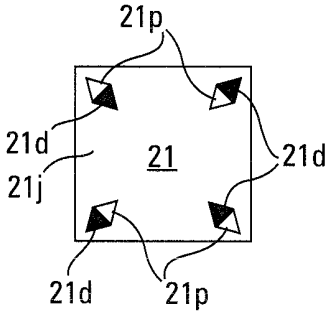

Fig. 5B

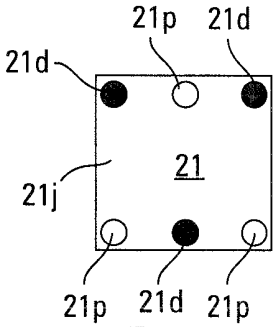

Fig. 5C

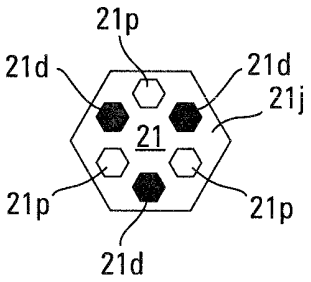

Fig. 5D