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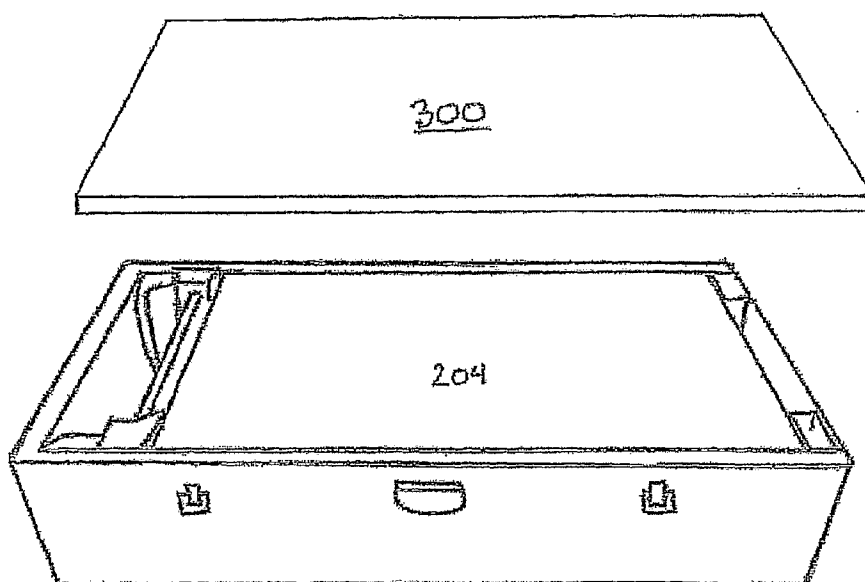
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(54) Title: HANDLING CONTAINER



(57) Abstract: The invention provides a handling container for shipping, storing, or handling a module containing a biopharmaceutical material. The handling container includes an outer shell having four side walls and a bottom end wall having an inner surface and defining an open compartment, a removable lid for closing the open compartment and one or more padding.

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HANDLING CONTAINER

FIELD OF THE INVENTION

[0001] The invention provides an apparatus for shipping, storage and handling of frozen products. More particularly, the invention provides a handling container for shipping, storing, and handling liquid or frozen biopharmaceutical material.

BACKGROUND OF THE INVENTION

[0002] As the biotechnology industry matures, companies continue to increasingly focus on improving flexibility associated with manufacturing biopharmaceuticals while reducing associated costs. Single-use disposable technologies have been developed to address these needs. In recent years, single-use technologies have gained increasing acceptance by the industry as manufacturers recognize the advantages of disposable products, which include reduction of expensive cleaning validation procedures in addition to reduced capital expenditure.

[0003] One single use technology that has been well received by the market is the patented CELSIUS™ single-use freeze-thaw system (See, US Patent Nos. 6,453,683; 6,694,646; 6,698,213; 6,786,054 and 6,945,056) marketed by Integrated Biosystems, Inc. (Napa, CA). The CELSIUS™ system provides a system for controlled freezing, storing and thawing of a biopharmaceutical material at the manufacturing scale (e.g., volumes of ~ 2 – 20 L per container). The technology is particularly beneficial because it allows for greater flexibility in a manufacturing schedule by decoupling production operations and allowing intermediates and products to be stored and transported under defined, stable, validatable conditions. Additionally, the ability to ship and/or store an intermediate can help the manufacturer make the most efficient use of its facilities. For example, an intermediate might be produced in one facility and shipped to another facility for further processing. This is often encountered in the case of transfer of bulk product to an off-site fill-finish facility.

[0004] At the heart of the CELSIUS™ system is a module that includes a flexible container and a rigid protective structural frame (CELSIUS-PAKS™) as shown in Figure 1. While the protective structural frame is essential to the patented freeze-thaw process,

its unique shape and size can present difficulties when storing and/or shipping the biopharmaceutical material.

[0005] EnviroCooler® (Huntington Beach, CA) provides a thermally-controlled insulated shipping container that can be used for shipping CELSIUS-PAKS™. The EnviroCooler® technology is described in detail in United States Patent No. 5,924,302, the disclosure of which is incorporated by reference herein. Briefly, the EnviroCooler® shipping container includes a cardboard shipping carton that is lined with a rigid insulating material such as injection molded rigid polyurethane and one or more cavities for holding a cooling element.

[0006] Although functional, the EnviroCooler® shipping container has many drawbacks. One major drawback is the size of the container. To ship a CELSIUS-PAKS™ module (approximate dimensions: 7.8 inches x 10.9 inches x 36.4 inches) a shipping container with outer dimensions of 25.9 inches x 32.3 inches x 55.8 inches is used. A container of this size poses many logistic problems, not limited to expenses associated with shipping a container of this size. For instance, storage space required for these containers may be a challenge. Since they are designed to hold just a single CELSIUS-PAKS™ module, many EnviroCooler® shipping containers will be needed to ship out a single manufacturing lot. Another drawback associated with the EnviroCooler® shipping container is durability and cleanability due to its outer cardboard shipping carton and internal polyurethane construction.

[0007] Accordingly, there remains a need for an improved handling container for shipping, storing, and handling liquid and/or frozen biopharmaceutical materials.

SUMMARY OF THE INVENTION

[0008] The invention provides a handling container for shipping, storing, and handling frozen biopharmaceutical products. In one embodiment, the invention provides a handling container for shipping, storing, or handling a module, wherein the module comprises a frame and a flexible container suitable for containing a biopharmaceutical material. According to this embodiment, the handling container includes an outer shell having four side walls and a bottom end wall having an inner surface and defining an

open compartment, a removable lid for closing the open compartment and one or more padding.

[0009] The outer shell and lid of the handling container can be constructed of any suitable material. In one embodiment, the outer shell and lid of the handling container are constructed from an impact resistant material. The outer shell and lid of the handling container may be insulated or non-insulated. Insulated materials suitable for constructing the outer shell and lid include, but are not limited to plastic, wood and cardboard. Non-insulated materials suitable for constructing the outer shell and lid include, but are not limited to metals.

[0010] In one embodiment, the outer shell and lid may include one or more latching mechanisms. According to this embodiment, if two or more latching mechanisms are used, the latching mechanisms may be placed symmetrically or asymmetrically on the outer shell and lid of the handling container. Latching mechanisms suitable for use with the handling container are known and include, but are not limited to recessed, multipoint, pawl, compression, bolt, or draw latches. In one embodiment, draw pull latches are attached to the outer shell and fasten to padlock eyes and strikers attached to the lid. In another embodiment, the outer shell and/or lid may contain one or more handles.

[0011] The handling container of the invention includes padding. In one embodiment of the invention, the handling container includes a support padding. According to this embodiment, the support padding is positioned in the open compartment of the outer shell such that that lower surface of the support padding is in contact with the inner surface of the bottom end wall and the upper surface of the support padding is configured to contact at least 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95% or 100% of the surface area of the flexible container when the module is housed within the handling container.

[0012] In another embodiment, the padding of the handling container includes a support padding and bottom end wall padding. According to this embodiment, the bottom end wall padding is positioned between the bottom end wall and the support padding.

[0013] In another embodiment, the padding of the handling container includes a support padding and at least one side wall padding. According to this embodiment, the side wall padding is positioned between the inner surface of the side wall and the module housed within the handling container.

[0014] In another embodiment, the padding of the handling container includes a support padding and a compression padding. According to this embodiment, the compression padding is configured to contact at least 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95% or 100% of the surface area of the flexible container when the module is housed within the handling container and the upper surface of the compression padding is configured to contact the lid when the lid is placed over the open compartment of the outer shell.

[0015] In still another embodiment, the padding of the handling container includes a support padding, a compression padding and a top frame padding. According to this embodiment, the top frame padding is positioned between the top of the compression padding and the frame when the module is housed within the handling container.

[0016] In one embodiment, the padding of the handling container includes a support padding, a bottom end wall padding, at least one side wall padding, a compression padding and a top frame padding. Padding suitable for use in the invention is known and includes, but is not limited to foams, gels, air bags, fibers, paper, cork, and fabrics. According to this embodiment, the materials that may be used to construct the padding include, but are not limited to low density polyethylene (LDPE), expanded polystyrene (EPS), polyurethane foams, polyvinyl acetate and rigid polyurethane. In one embodiment, the padding is constructed from low density polyethylene (LDPE).

According to this embodiment, the LDPE has a density between about 1.2 to about 4.0, about 1.5 to about 3.0, or about 2.0 to about 2.5 pounds per cubic foot. In another embodiment, the padding has a thickness between about 0.15 inches to about 3.0 inches. In a more preferred embodiment, the support padding and the top compression padding have a thickness between about 1.5 inches to about 3.0 inches, about 1.75 inches to about 2.5 inches, or about 2.0 inches to about 2.25 inches. In still another preferred embodiment, the bottom end wall padding, the side wall padding, and the top frame

padding have a thickness between about 0.15 inches to about 1 inch, about 0.20 inches to about 0.45 inches, or about 0.25 inches to about 0.40 inches.

[0017] In one embodiment, one or more of the bottom end wall padding, support padding, and side wall padding are constructed as a single unit. According to this embodiment, the single unit can be formed using any suitable process. In one embodiment, the padding material is formed using die-cutting. In one embodiment, the single unit is formed using injection molding.

[0018] In one embodiment, the handling container is used in connection with one or more cooling elements. Cooling elements suitable for use with the handling container include, but are not limited to ice bags, gel packs, freezer blocks, and dry ice. In one embodiment the cooling element is placed inside the handling container. In another embodiment, the cooling element is located on the exterior of the handling container. In one embodiment, the cooling element is a powered cooling element. Powered cooling elements suitable for use in the invention include, but are not limited to walk-in freezers, refrigerated handling containers, and commercially available freezers

BRIEF DESCRIPTION OF THE FIGURES

[0019] Figure 1 is a perspective view of an example of a CELSIUS-PAKS™ module used in connection with the CELSIUS™ system.

[0020] Figure 2 is a perspective view of an outer shell of a handling container according to the invention.

[0021] Figure 3 is a perspective view of a handling container according to the invention which includes padding.

[0022] Figure 4 is an exploded view of the padding shown in Figure 3.

[0023] Figure 5 is a perspective view of a handling container according to the invention containing the flexible freeze-thaw container of Figure 1.

[0024] Figure 6 is a perspective view of a handling container according to the invention in which the flexible freeze-thaw container of Figure 1 is enveloped within the padding shown in Figure 3 and a compression padding.

[0025] Figure 7 is a perspective view of a handling container according to the invention in its assembled condition with a lid.

[0026] Figure 8 is a top view of two handling containers according to the invention, in which the latching mechanisms are off-set.

DETAILED DESCRIPTION

[0027] The invention provides a handling container suitable for storing, shipping, and/or handling a module configured to receive and contain frozen and/or liquid biopharmaceutical materials. The handling container of the invention can be used for the storage and/or shipping of a frozen or liquid biopharmaceutical material. --

Module

[0028] An example of a module 10 suitable for use in connection with the invention is shown in Figure 1. The module 10 includes a flexible container 20 and a frame 30. Suitable modules and frames are described in detail in United States Patent Nos. 6,453,683; 6,694,646; 6,698,213; 6,786,054 and 6,945,056, the disclosures of which are hereby incorporated by reference herein.

[0029] Briefly, the flexible container 20 is configured to receive and contain frozen and/or liquid biopharmaceutical materials. Examples of biopharmaceutical materials include, but are not limited to, solutions or formulations containing proteins, amino acids, peptides, DNA, RNA, nucleic acids, antibodies, antibody fragments, enzymes, enzyme fragments, vaccines, viruses, viral fragments, cell suspensions, cell fragment suspensions, tissue fragments suspensions, cell aggregates suspensions, biological tissues in solution, organs in solution, embryos in solution, cell growth media, serum, biologicals, blood products, preservation solutions, fermentation broths, and cell culture fluids with and without cells, and/or mixtures of the above. In one embodiment, the biopharmaceutical material is prepared by a manufacturing process that includes a cell culture or fermentation process, a purification process and/or a fill-finish process. The flexible container 20 can be used to ship or store a biopharmaceutical material at any stage in the manufacturing process, i.e., including but not limited to starting materials, including media and other reagents, intermediates, including in-process samples and holds, and the resulting drug product, including the bulk drug product and final drug product.

[0030] The flexible container 20 is configured to be received in a frame 30. Briefly, the frame 30 is formed to receive and support flexible container 20 to provide additional rigidity and support to flexible container 20, for example, to facilitate handling, storage, and/or temperature control thereof. The biopharmaceutical material may be frozen or thawed while in flexible container 20, when flexible container 20 is received in frame 30.

Handling container

[0031] The handling container of the invention includes an outer shell, a lid, and one or more padding.

Outer Shell

[0032] The handling container of the invention includes an outer shell 100 and a removable lid 400. An example of an outer shell 100 suitable for use in connection with the invention is shown in Figure 2. An example of a lid 400 suitable for use in connection with the outer shell 100 is shown in Figure 7. The outer shell 100 and lid 400 provide structure to the handling container and protection to the biopharmaceutical materials contained within the handling container. The outer shell 100 and lid 400 can be constructed of any suitable material. In one embodiment, the outer shell 100 and/or lid 400 is constructed from an impact-resistant material. As used herein, the term "impact resistant" refers to a material that is resistant to fracture or breakage under stress due to impact. A wide variety of impact-resistant materials are known and include, for example, plastic, metal, and wood. Because the brittleness of a material can be affected by temperature, the outer shell 100 and/or lid 400 is preferably constructed from a material that is able to resist fracture or breakage at low temperatures (e.g., less than -20°C). Since dry ice is commonly used when shipping frozen materials, ideally the outer shell and lid are resistant to fracture or breakage at temperatures below -70°C.

[0033] In one embodiment, the outer shell 100 and/or lid 400 is constructed from a non-insulating material. As used herein, the term "non-insulating" material refers to a material having a high thermal conductivity and a low thermal resistance. In one embodiment, the non-insulating material is metal. Metals suitable for construction of an outer shell 100 and lid 400 are known to one of skill in the art. Examples of non-

insulating metals, include, but are not limited to stainless steel, aluminum, and tin or other alloys. An outer shell 100 or lid 400 constructed from a non-insulating material may be desirable, for example, when the cooling element is provided external to the handling container.

[0034] In another embodiment, the outer shell and/or lid is constructed from an insulating material. As used herein, the term “insulating” material refers to a material with a low thermal conductivity and a high thermal resistance. Examples of insulating materials include, but are not limited to, plastic, wood, cardboard, Examples of plastics include, but are not limited to natural high density polyethylene (HDPE), low density polyethylene (LDPE), polyvinyl Chloride (PVC), Polystyrene (PS), polycarbonate (PC), nylon, polyurethane, and polypropylene (PP). An outer shell 100 or lid 400 constructed from an insulating material may be desirable, for example, to reduce thermal loss when the handling container is configured to accommodate the cooling element internal to the handling container.

[0035] Generally, the outer shell 100 is in the shape of an open container, with a bottom end wall 103 and one or more side walls 104 that define an inner surface 101 and an outer surface 102. The bottom end wall 103 and inner surface 101 of side walls 104 define an open compartment configured to receive a module 10 containing a biopharmaceutical material. In one embodiment, the outer shell 100 is in the shape of an open box, with four side walls 104 and a bottom end wall 103. In one embodiment, the outer shell 100 is in the shape of a rectangular open box.

[0036] In some instances, it may be desirable to include one or more latching mechanisms 110 on the outer surface 102 of the outer shell 100 and lid 400 of the handling container. In one embodiment, the latching mechanisms 110 are placed symmetrically on the outer shell 100 and lid 400 of the handling container. In an alternate embodiment, the latching mechanisms 110 are placed asymmetrically on the outer shell 100 and lid 400 of the handling container. Placing the latching mechanisms 110 asymmetrically on the outer surface 102 of the outer shell 100 and lid 400 can be desirable, particularly when multiple handling containers are located adjacent one another. As shown in Figure 8, the off-set latching mechanisms 110 interdigitate such that space between adjacent handling containers can be reduced. In one embodiment, the

outer shell and/or lid of the handling container includes one or more handles 120 to facilitate carrying of the handling container.

Padding

[0037] The handling container also includes padding 200 to protect the frame 30 and the biopharmaceutical material contained within the flexible container 20. As used herein, the term padding is used to refer to a material that provides protection for the module when the module is housed within the shipping container. Examples of the type of protection provided for by the padding include, but are not limited to, protection against shock, vibration and/or impact. In one embodiment, the padding is included to reduce vibrations and/or to protect the flexible container 20 and frame 30 of module 10 against impact encountered during storage or shipping. The padding can be constructed from any suitable material. Examples of suitable padding materials include foams, gels, air bags, fibers, paper, cork, fabrics, etc. In one embodiment, the padding is constructed from a material that remains pliable, that is, does not become brittle at temperatures encountered during shipping or storage of the biopharmaceutical material. In one embodiment, the padding material has a brittleness temperature of less than -25°C, -30°C, -35°C, -40°C, -45°C, -50°C, -55°C, -60°C, -65°C, -70°C, -75°C, -80°C, -85°C. Examples of suitable padding materials include, but are not limited to low density polyethylene (LDPE), expanded polystyrene (EPS), polyurethane foams, polyvinyl acetate and rigid polyurethane. Both high and low density padding can be used. The padding material can be formed using any suitable process, including die-cutting or injection molding.

[0038] In one embodiment, the padding is constructed from an insulating material. The use of an insulating material may be advantageous to reduce radiant thermal loss when the handling container is configured to accommodate a cooling element. In another embodiment, the padding is constructed from a non-insulating material.

[0039] The thickness of the padding can vary depending upon the desired protection, amount of insulation, and density of the padding. Although thicker padding will generally offer increased protection and insulation, it may increase the cost and size of the handling container. Similarly, a padding having a higher density may offer more

protection and insulation, with less thickness, but may increase the cost of the handling container. These factors can be taken into consideration when designing a handling container according to the invention.

Bottom End Wall Padding

[0040] In one embodiment, the handling container includes a bottom end wall padding 201 that has an upper surface 220 and a lower surface 221. In one embodiment, the bottom end wall padding 201 is configured to be received within the opening of the outer shell 100 such that the lower surface 221 of the bottom end wall padding contacts the inner surface 101 of the bottom end wall 103 of the outer shell 100. The bottom end wall padding 201 is configured to protect the module 10 from vibration and shock encountered during storage and shipping. In one embodiment, the bottom end wall padding 201 is constructed from a low density polyethylene (LDPE) foam having a density between about 1.2 to about 4.0, about 1.5 to about 3.0, or about 2.0 to about 2.5 pounds per cubic foot and having a thickness between about 0.15 inches to about 1 inch, about 0.20 inches to about 0.45 inches, or about 0.25 inches to about 0.40 inches.

Support Padding

[0041] In one embodiment, the handling container includes a support padding 202 that has an upper surface 210 configured to contact and support the surface of the flexible container 20 of the module 10 when the module 10 is housed within the handling container and a lower surface 211 configured to contact the upper surface 220 of the bottom end wall padding 201 or the inner surface 101 of the bottom end wall 103 of the outer shell 100. In one embodiment, the support padding 202 is configured to protect the flexible container 20 from being damaged during storage or shipping. Therefore, in some instances, it may be desirable to construct the support padding 202 from a material that remains pliable at temperatures at which the biopharmaceutical material may be shipped or stored.

[0042] In one embodiment, the support padding 202 is configured such that the upper surface 210 of the support padding is in contact with at least 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95% or 100% of the surface area of the flexible container 20 when the module 10 is housed within the handling container. It should be noted that the surface area of the upper surface 210 of the support padding 202 can be greater than

100% of the surface area of the flexible container 20, such that the upper surface 210 of the support padding 202 also contacts the frame 30 of the module 10. The thickness of the support pad 202 can vary depending upon the desired amount of protection and the size of the module 10 and frame 30. Generally, the support pad 202 has a thickness sufficient to extend at least from the surface of the flexible container 20 to the upper surface 220 of the bottom end wall padding 201 or the inner surface 101 of the bottom end wall 103 of the outer shell 100. In one embodiment, the support padding 202 is constructed from a low density polyethylene (LDPE) foam having a density between about 1.2 to about 4.0, about 1.5 to about 3.0, or about 2.0 to about 2.5 pounds per cubic foot and having a thickness between about 1.5 inches to about 3.0 inches, about 1.75 inches to about 2.5 inches, or about 2.0 inches to about 2.25 inches.

Side Wall Padding

[0043] In one embodiment, the handling container includes one or more panels for side wall padding 203. The side wall padding 203 is configured to reduce vibrations, to protect the module 10 from shock or impact during storage and shipping, and to prevent shifting of the module 10 within the handling container 100. In one embodiment, the side wall padding 203 is constructed from a low density polyethylene (LDPE) foam having a density between about 1.2 to about 4.0, about 1.5 to about 3.0, or about 2.0 to about 2.5 pounds per cubic foot and having a thickness between about 0.15 inches to about 1 inch, about 0.20 inches to about 0.45 inches, or about 0.25 inches to about 0.40 inches.

[0044] In one embodiment, one or more of the bottom end wall padding 201, support padding 202, and side wall padding 203 are constructed as separate units. In another embodiment, the bottom end wall padding 201, support padding 202, and side wall padding are constructed as a single unit.

Compression padding

[0045] In one embodiment, the handling container includes a compression padding 204. The compression padding 204 is configured to provide additional support and protection to the module 10 during shipping and to reduce shifting of the module 10 within the handling container. In some instances, the compression padding 204 increases the durability of the handling container such that the handling containers can be stacked

one on top of another without damage to the module 10 inside, even when a less sturdy material is used for the outer shell 100. The thickness of the compression padding 204 can vary, depending upon the size of the module 10 or frame 30 and, for example, the desired amount of protection. In one embodiment, the compression padding 204 is constructed from a low density polyethylene (LDPE) foam having a density between about 1.2 to about 4.0, about 1.5 to about 3.0, or about 2.0 to about 2.5 pounds per cubic foot and having a thickness between about 1.5 inches to about 3.0 inches, about 1.75 inches to about 2.5 inches; or about 2.0 inches to about 2.25 inches.

Top Frame Padding

[0046] The handling container may or may not include a top frame padding. In one embodiment, the handling container includes a top frame padding 300 configured to rest on top of the module 10 and compression padding 204 when the module 10 is packed within the handling container. In another embodiment, the top frame padding 300 is omitted from the handling container. The inclusion of a top frame padding within the handling container may depend upon the construction material of the outer shell and/or lid. Construction of the outer shell and/or lid with a material with greater structural integrity, for example, but not limited to, a metal such as stainless steel or other metal alloys, will provide sufficient protection to a module housed within the handling container and therefore may decrease the need for a top frame padding. Alternatively, a handling container constructed from a material with less structural integrity, for example, cardboard, plastic or aluminum, may increase the need for a top frame padding. As used herein, the term "structural integrity" refers to the ability of a material to resist distortion when placed under stress. The top frame padding is configured to protect the module 10 from vibration and shock encountered during storage, shipping and handling. In one embodiment, the top frame padding 300 is constructed from a low density polyethylene (LDPE) foam having a density between about 1.2 to about 4.0, about 1.5 to about 3.0, or about 2.0 to about 2.5 pounds per cubic foot and having a thickness between about 0.15 inches to about 1 inch, about 0.20 inches to about 0.45 inches, or about 0.25 inches to about 0.40 inches.

Lid

[0047] The handling container also includes a removable lid 400. When the lid 400 is placed over the open compartment defined by the outer shell 100 as shown in Figure 7, the module 10 is enclosed between the padding 200 and 300, in particular between the bottom end wall support padding and the top support padding of the handling container. In one embodiment, the lid 400 is fastened to the outer shell 100 using one or more latching mechanisms 110. Many suitable latching mechanisms 110 are known, including but not limited to recessed, multipoint, pawl, compression, bolt, or draw latches. In one embodiment, draw pull latches are attached to the outer shell 100 and fasten to padlock eyes and strikers attached to the lid 400.

Cooling Elements

[0048] In one embodiment, the handling container is used in connection with one or more cooling elements designed to maintain the biopharmaceutical material contained within the flexible container 20 at a desired temperature. Cooling elements of various sizes and shapes can be used depending upon the material being shipped or stored, the desired temperature of the product and the desired duration of storage. Suitable cooling elements include ice bags, gel packs, freezer blocks, liquid nitrogen, and dry ice. In one embodiment, the cooling element is placed inside the handling container. In another embodiment, the cooling element is located on the exterior of the handling container. According to this embodiment, the cooling element and the handling container are placed in a second container. In addition, powered cooling elements such as, but not limited to walk-in freezers, refrigerated handling or shipping containers, commercially available freezers and refrigerated trucks, can be used to maintain the biopharmaceutical material in the handling container at a desired temperature. The handling container of the invention can be used to store or ship a frozen biopharmaceutical product at a temperature less than 0°C, -10°C, -25°C, -30°C, -35°C, -40°C, -45°C, -50°C, -55°C, -60°C, -65°C, -70°C, -75°C, -80°C, -85°C.

[0049] The handling containers of the invention can be configured to fit within commercially available freezers. Examples of commercially available freezers suitable for storing the handling containers include Revco® (Thermo Electron Corp.), Innova® (New Brunswick Scientific Corp.), Forma Scientific, and Ultra Low Temperature freezers (NuAire Corp.) Commercially available freezers for use with the invention are

capable of storing handling containers within a range of ± 5 , 10, or 15°C of a set point at about -4°C, about -30°C, about -40°C and -86°C. Multiple handling containers can be stored within a freezer either by stacking multiple containers or by placing the handling containers adjacent to each other on shelves. Additionally, multiple handling containers can be shipped in commercially available coolers, for example, but not limited to Thermosafe Model 870 or an Envirotainer.

[0050] As used herein, the term “about” is used to indicate a range within the standard margin of error acceptable to one of skill in the art.

[0051] Although the description and specific examples shown in the drawings contain much specificity, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of the invention. The invention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the invention as defined by the appended claims. The entire disclosure of each document cited (including patents, patent applications, journal articles, abstracts, manuals, books, or other disclosures) in the disclosure is hereby incorporated by reference herein.

What is claimed is:

1. A handling container for shipping, storing, or handling a module, wherein the module comprises a frame and a flexible container suitable for containing a biopharmaceutical material, the handling container comprising:
 - (a) an outer shell having four side walls and a bottom end wall with each side wall and bottom end wall having an inner surface and defining an open compartment;
 - (b) a lid removably positionable for closing the open compartment; and
 - (c) at least one support padding having an upper and lower surface, wherein the support padding is positioned in the open compartment such that the lower surface of the support padding is in contact with the inner surface of the bottom end wall and the upper surface of the support padding is configured to contact at least 50% of the surface area of the flexible container when the module is housed within the handling container.
2. The handling container of claim 1, further comprising a bottom end wall padding, wherein the bottom end wall padding is positioned between the bottom end wall and the support padding.
3. The handling container of claim 2, wherein the bottom end wall padding is selected from the group consisting of:
 - (a) foam;
 - (b) gel;
 - (c) air bag;
 - (d) fiber;
 - (e) paper;
 - (f) cork;
 - (g) fabric; and
 - (h) a combination of one or more of (a) – (g).

4. The handling container of claim 3, wherein the bottom end wall padding is constructed from a material selected from the group consisting of:
 - (a) low density polyethylene (LDPE);
 - (b) expanded polystyrene (EPS);
 - (c) polyurethane foam;
 - (d) rigid polyurethane;
 - (e) polyvinyl acetate; and
 - (f) a combination of one or more of (a) – (e).
5. The handling container of claim 4, wherein the bottom end wall padding comprises a low density polyethylene (LDPE) having a density between about 1.2 and about 4.0 pounds per cubic foot.
6. The handling container of claim 5, wherein the bottom end wall padding has a thickness between about 0.15 inches to about 1 inch.
7. The handling container of claim 2, wherein the bottom end wall padding and the support padding comprise a single unit.
8. The handling container of claim 7, wherein the single unit comprises injection molded polyurethane integrally forming the bottom end wall padding and the support padding.
9. The handling container of claim 1, further comprising at least one side wall padding, wherein the side wall padding is positioned between the inner surface of the side wall and the module.
10. The handling container of claim 9, wherein the side wall padding is selected from the group consisting of:
 - (a) foam;
 - (b) gel;

- (c) air bag;
- (d) fiber;
- (e) paper;
- (f) cork;
- (g) fabric; and
- (h) a combination of one or more of (a) – (g).

11. The handling container of claim 10, wherein the side wall padding is selected from a material selected from the group consisting of:

- (a) low density polyethylene (LDPE);
- (b) expanded polystyrene (EPS);
- (c) polyurethane foam; and
- (d) rigid polyurethane;
- (e) polyvinyl acetate; and
- (f) a combination of one or more of (a) – (e).

12. The handling container of claim 11, wherein the side wall padding comprises a low density polyethylene having a density between about 1.2 and about 4.0 pounds per cubic foot.

13. The handling container of claim 12, wherein the side wall padding has a thickness between about 0.15 inches to about 1 inch.

14. The handling container of claim 9, wherein the side wall padding comprises injection molded polyurethane.

15. The handling container of claim 9, further comprising a bottom end wall padding.

16. The handling container of claim 15, wherein the side wall padding, bottom end wall padding and support padding comprise a single unit.

17. The handling container of claim 15, wherein the single unit comprises injection molded polyurethane integrally forming the side all padding, bottom end wall padding and support padding.
18. The handling container of claim 1, further comprising a compression padding having an upper and lower surface, wherein the lower surface of the compression padding is configured to contact at least 50% of the surface area of the flexible container when the module is housed within the handling container and the upper surface of the compression padding is configured to contact the lid when the lid is placed over the open compartment of the outer shell.
19. The handling container of claim 18, wherein the compression padding is selected from the group consisting of:
- (a) foam;
 - (b) gel;
 - (c) air bag;
 - (d) fiber;
 - (e) paper;
 - (f) cork;
 - (g) fabric; and
 - (h) a combination of one or more of (a) – (g).
20. The handling container of claim 19, wherein the compression padding is constructed from a material selected from the group consisting of:
- (a) low density polyethylene (LDPE);
 - (b) expanded polystyrene (EPS);
 - (c) polyurethane foam; and
 - (d) rigid polyurethane;
 - (e) polyvinyl acetate; and

- (f) a combination of one or more of (a) – (e).
21. The handling container of claim 20, wherein the compression padding comprises a low density polyethylene having a density between about 1.2 and about 4.0 pounds per cubic foot.
22. The handling container of claim 21, wherein the compression padding has a thickness between about 1.5 inches to about 3.0 inches.
23. The handling container of claim 18, wherein the compression padding comprises injection molded polyurethane.
24. The handling container of claim 7, further comprising a top frame padding, wherein the top frame padding is positioned between the top of the compression padding and the frame when the module is housed within the handling container.
25. The handling container of claim 24, wherein the top frame padding is selected from the group consisting of:
- (a) foam;
 - (b) gel;
 - (c) air bag;
 - (d) fiber;
 - (e) paper;
 - (f) cork;
 - (g) fabric; and
 - (h) a combination of one or more of (a) – (g).
26. The handling container of claim 25, wherein the top frame padding comprises a material selected from the group consisting of:
- (a) low density polyethylene (LDPE);

- (b) expanded polystyrene (EPS);
- (c) polyurethane foam; and
- (d) rigid polyurethane;
- (e) polyvinyl acetate; and
- (f) a combination of one or more of (a) – (e).

- 27. The handling container of claim 26, wherein the top frame padding comprises a low density polyethylene having a density between about 1.2 and about 4.0 pounds per cubic foot.
- 28. The handling container of claim 27, wherein the top frame padding has a thickness between about 0.15 inches to about 1 inch.
- 29. The handling container of claim 24, wherein the compression padding and the top frame padding comprise a single unit.
- 30. The handling container of claim 29, wherein the single unit comprises injection molded polyurethane integrally forming the compression padding and the top frame padding.
- 31. The handling container of claim 1, wherein the outer shell is constructed from an impact-resistant material.
- 32. The handling container of claim 31, wherein the impact resistant material is selected from the group consisting of:
 - (a) plastic;
 - (b) metal;
 - (c) wood; and
 - (d) a combination of one or more of (a) – (c).

33. The handling container of claim 1, wherein the outer shell is constructed from a non-insulating material.

34. The handling container of claim 33, wherein the non-insulating material is metal.

35. The handling container of claim 1, wherein the outer shell is constructed from an insulating material.

36. The handling container of claim 35, wherein the insulating material is selected from the group consisting of:

- (a) plastic;
- (b) wood;
- (c) cardboard; and
- (d) one or more of (a) – (c).

37. The handling container of claim 1, wherein the support padding is selected from the group consisting of:

- (a) foam;
- (b) gel;
- (c) air bag;
- (d) fiber;
- (e) paper;
- (f) cork;
- (g) fabric; and
- (h) a combination of one or more of (a) – (g).

38. The handling container of claim 37, wherein the support padding is comprised of a material selected from the group consisting of:

- (a) low density polyethylene (LDPE);
- (b) expanded polystyrene (EPS);

- (c) polyurethane foam; and
- (d) rigid polyurethane;
- (e) polyvinyl acetate; and
- (f) a combination of one or more of (a) – (e).

39. The handling container of claim 38, wherein the support padding comprises a low density polyethylene having a density between about 1.2 and about 4.0 pounds per cubic foot.

40. The handling container of claim 39, wherein the support padding has a thickness between about 1.5 inches to about 3.0 inches.

41. The handling container of claim 1, wherein the outer shell includes at least one handle.

42. The handling container of claim 1, wherein the outer shell includes at least one latching mechanism for securing the lid to the outer shell.

43. The handling container of claim 42, wherein the outer shell includes a first and a second latching mechanism for securing the lid to the outer shell.

44. The handling container of claim 43, wherein the first and second latching mechanisms are placed asymmetrically on the outer shell of the handling containers.

45. The handling container of claim 1, further comprising a cooling element.

46. The handling container of claim 45, wherein the cooling element is configured for placement within the open compartment.

47. The handling container of claim 46, wherein the cooling element is selected from the group consisting of:

- (a) ice bags;
- (b) gel packs;
- (c) freezer blocks;
- (d) dry ice; and
- (e) a combination of one or more of (a) – (d).

48. A handling container for shipping, storing, or handling a module, wherein the module comprises a frame and a flexible container suitable for containing a biopharmaceutical material, the handling container comprising:

- (a) an outer shell having four side walls and a bottom end wall with each side wall and bottom end wall having an inner surface and defining an open compartment;
- (b) a lid removably positionable for closing the open compartment; and
- (c) padding,

wherein the padding comprises:

- (i) at least one support padding having an upper and lower surface, wherein the support padding is positioned such that the lower surface of the support padding is in contact with the inner surface of the bottom end wall and the upper support padding surface is configured to contact at least 50% of the surface area of the flexible container when the module is housed within the handling container;
- (ii) a bottom end wall padding, wherein the bottom end wall padding is positioned between the bottom end wall and the support padding;
- (iii) at least one side wall padding, wherein the side wall padding is positioned between the inner surface of the side wall and the module;
- (iv) a compression padding having an upper and lower surface, wherein the lower surface of the compression padding is configured to contact at least 50% of the surface area of the flexible container when the module is housed within the handling container and the upper surface of the

compression padding is configured to contact the lid when the lid is placed over the open compartment of the outer shell; and

- (v) a top frame padding, wherein the top frame padding is positioned between the top of the compression padding and the frame when the module is housed within the handling container.

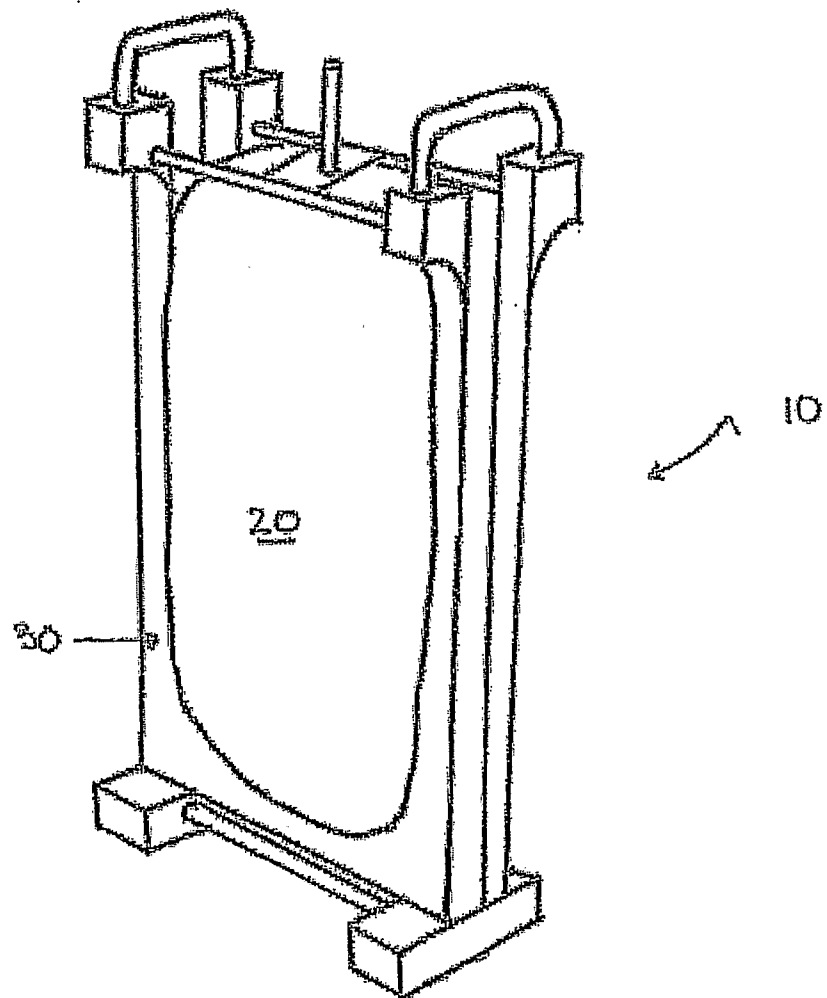


FIG. 1

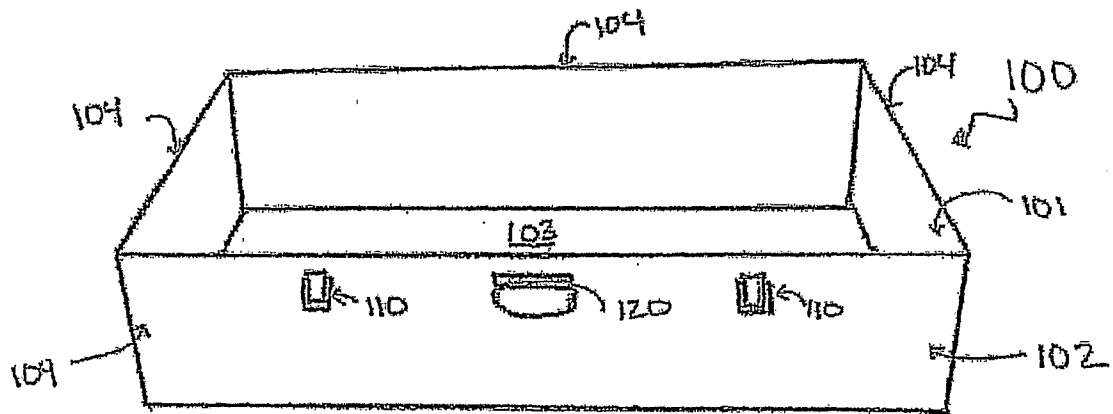


FIG. 2

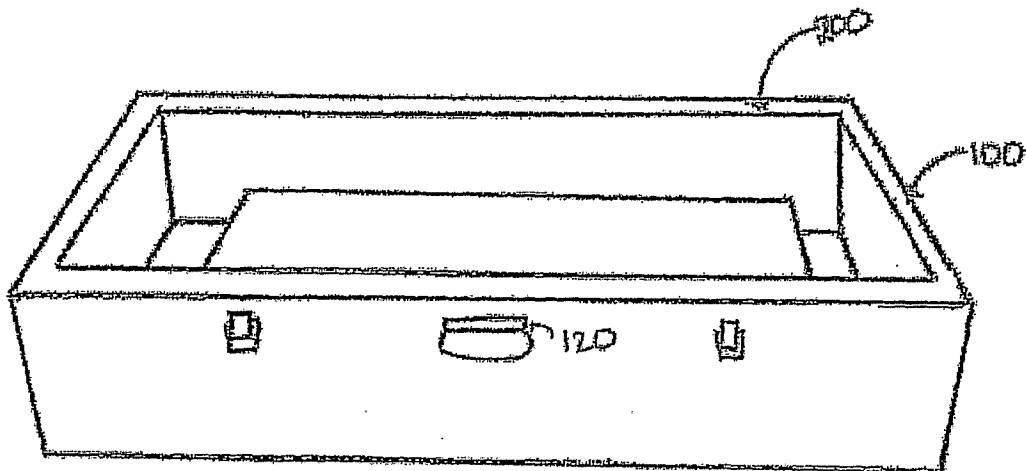


FIG. 3

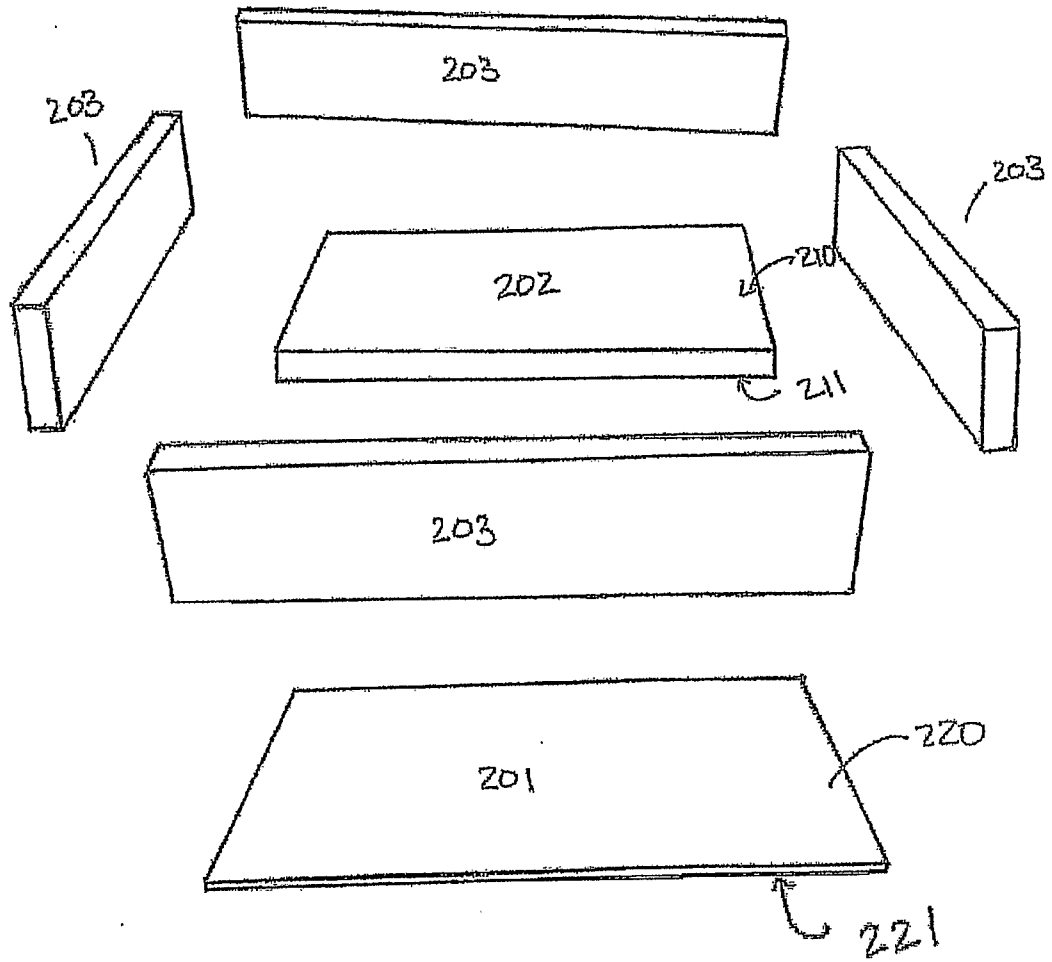


FIG. 4

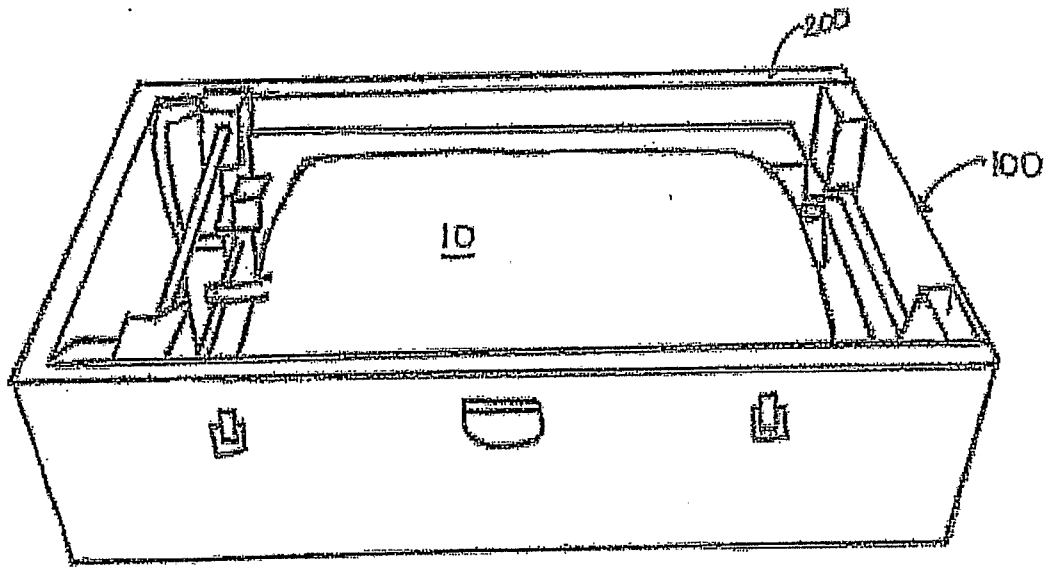


FIG. 5

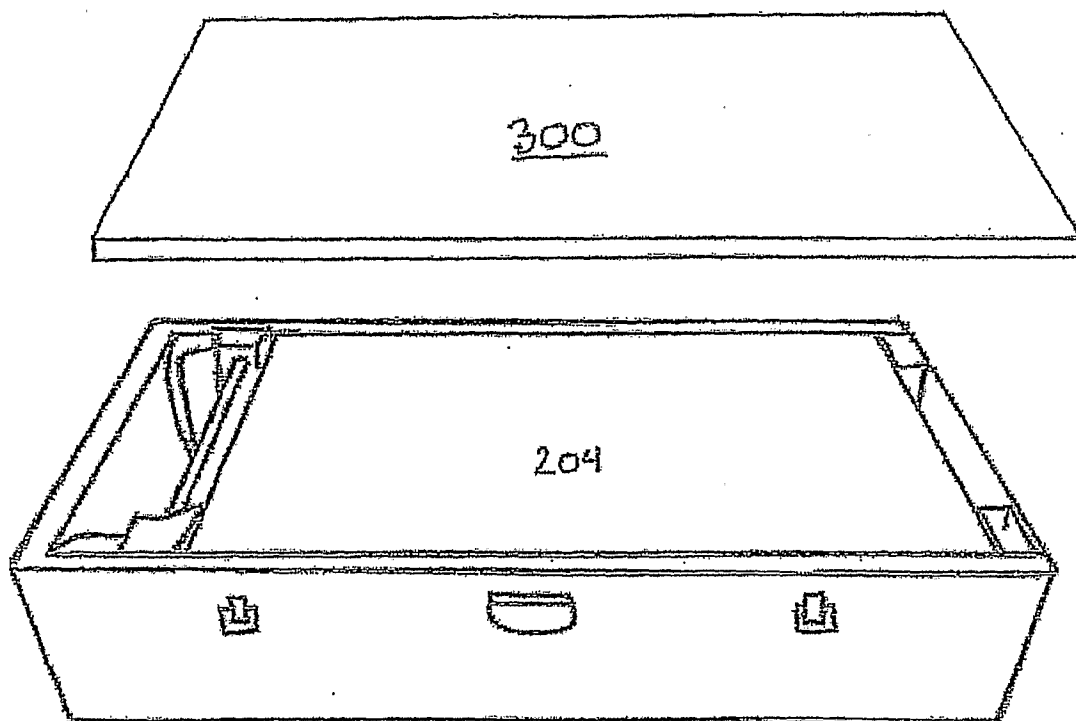


FIG. 6

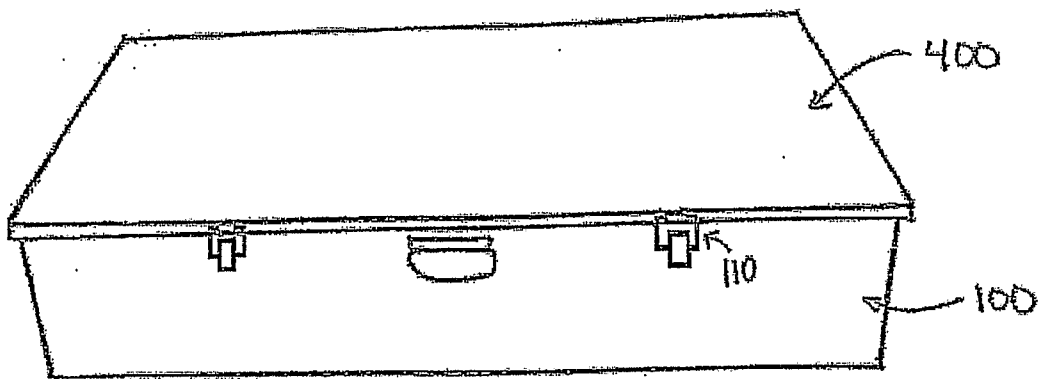


FIG. 7

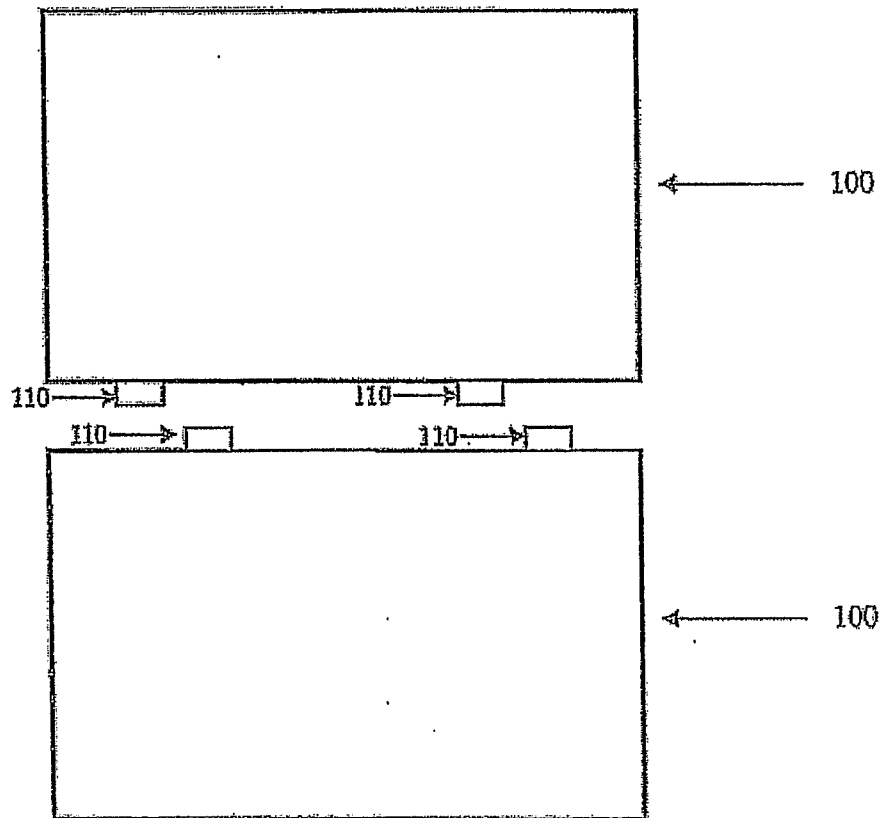


FIG. 8