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(54) **SHIPPING SYSTEM AND CONTAINER FOR
TRANSPORTATION AND IN-STORE
MAINTENANCE OF TEMPERATURE
SENSITIVE PRODUCTS**

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filed on Jan. 12, 2007.

(60) Provisional application No. 60/758,367, filed on Jan.
12, 2006. Provisional application No. 60/817,992,
filed on Jun. 30, 2006.

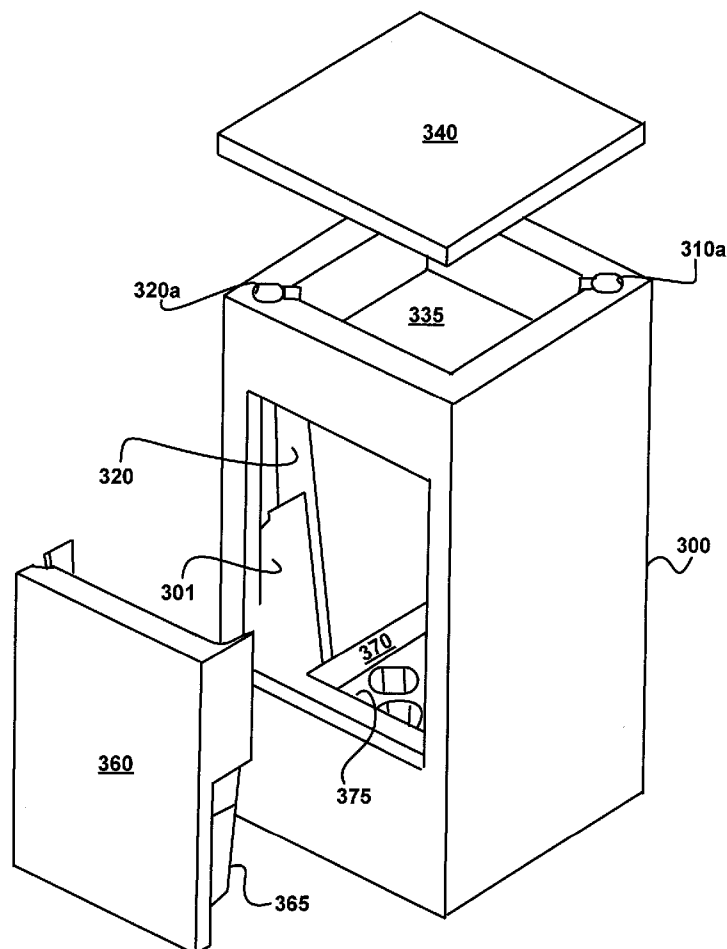
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(52) **U.S. Cl.** **220/592.2; 62/529**

(57) **ABSTRACT**

A shipping container for cooling a product contained therein is provided. The shipping container includes at least one compartment including a frozen material. A heat exchanger, can be provided within the shipping container, to transfer heat from the main volume of the shipping container to the frozen material stored in the at least one compartment



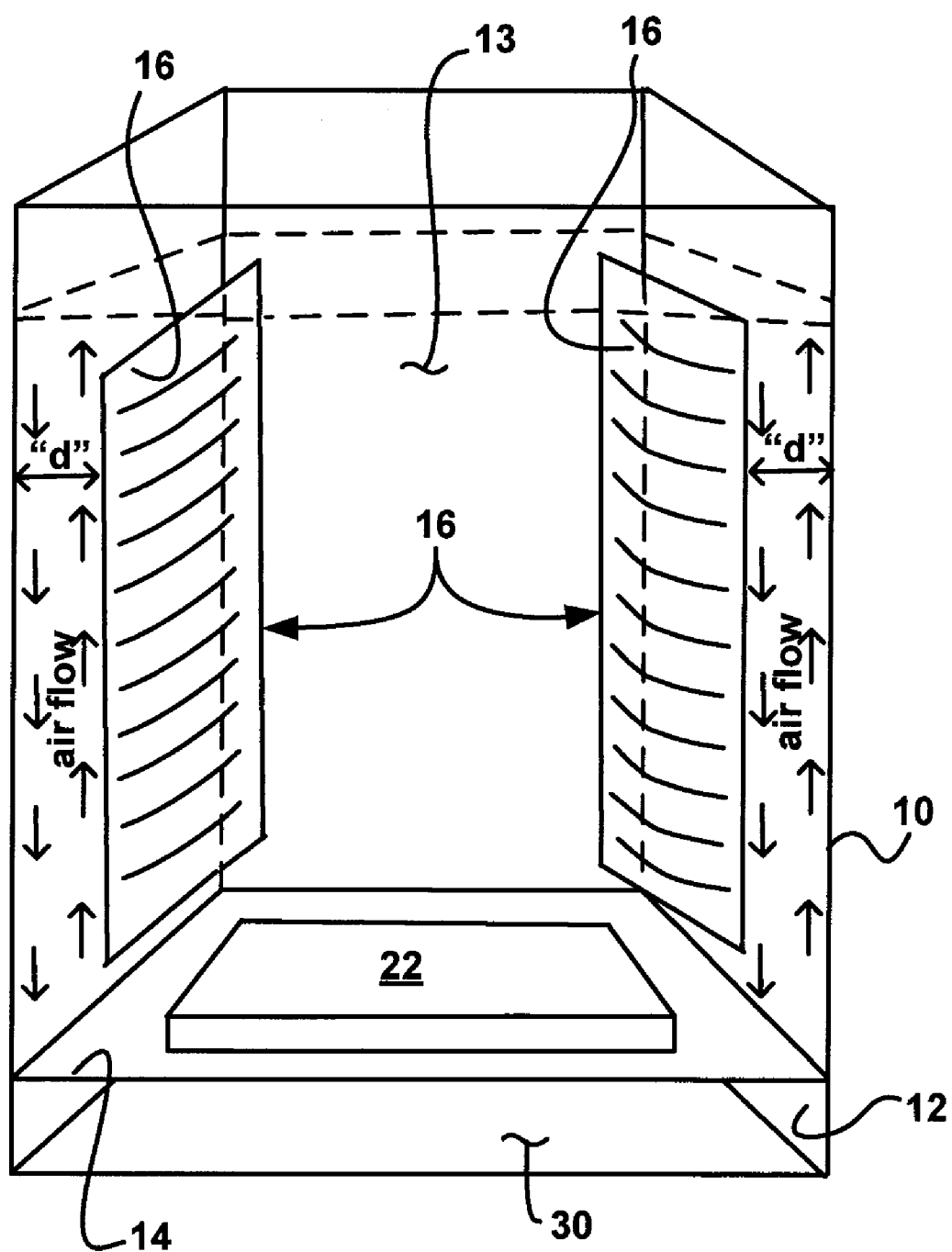


FIG. 1

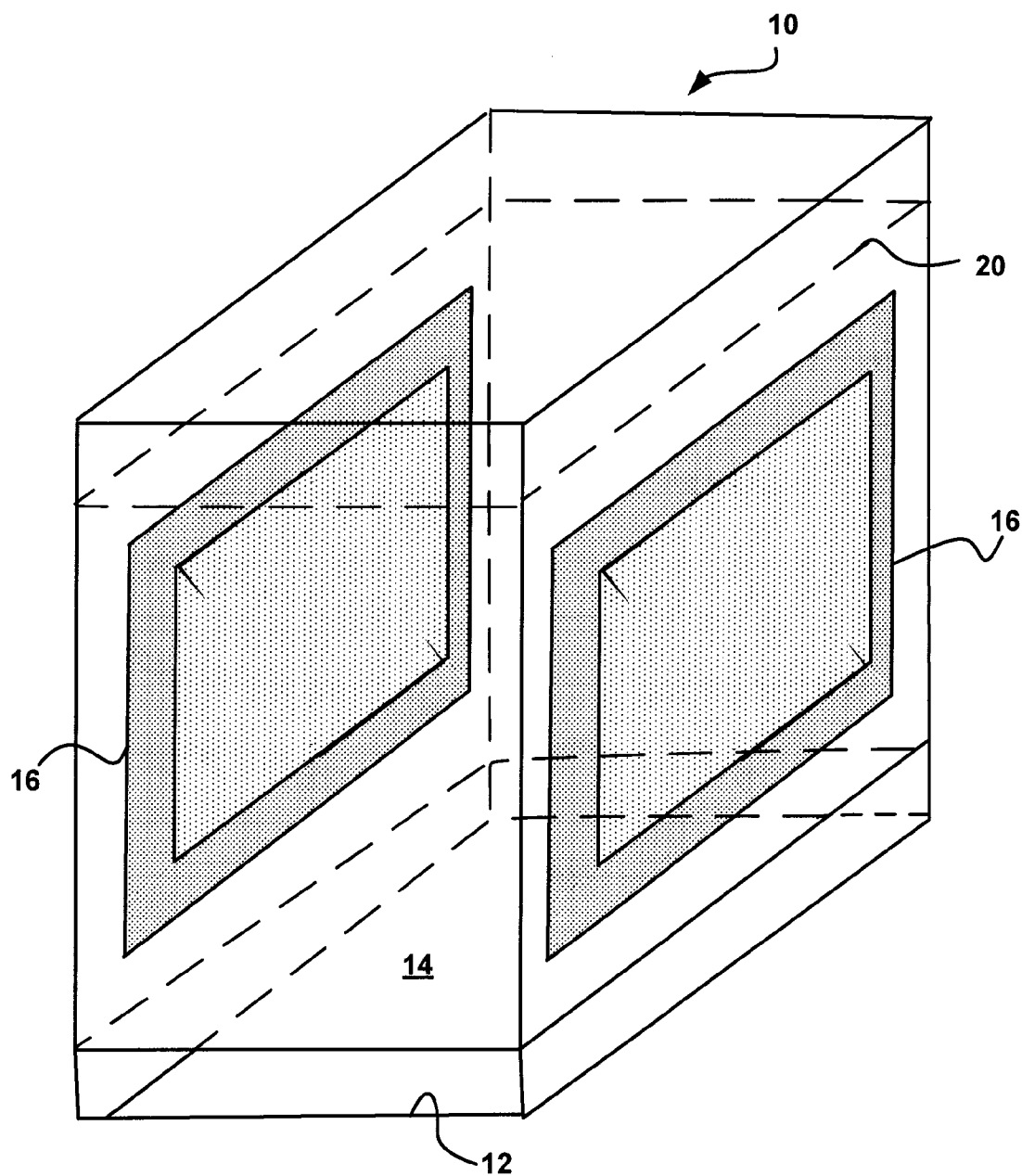
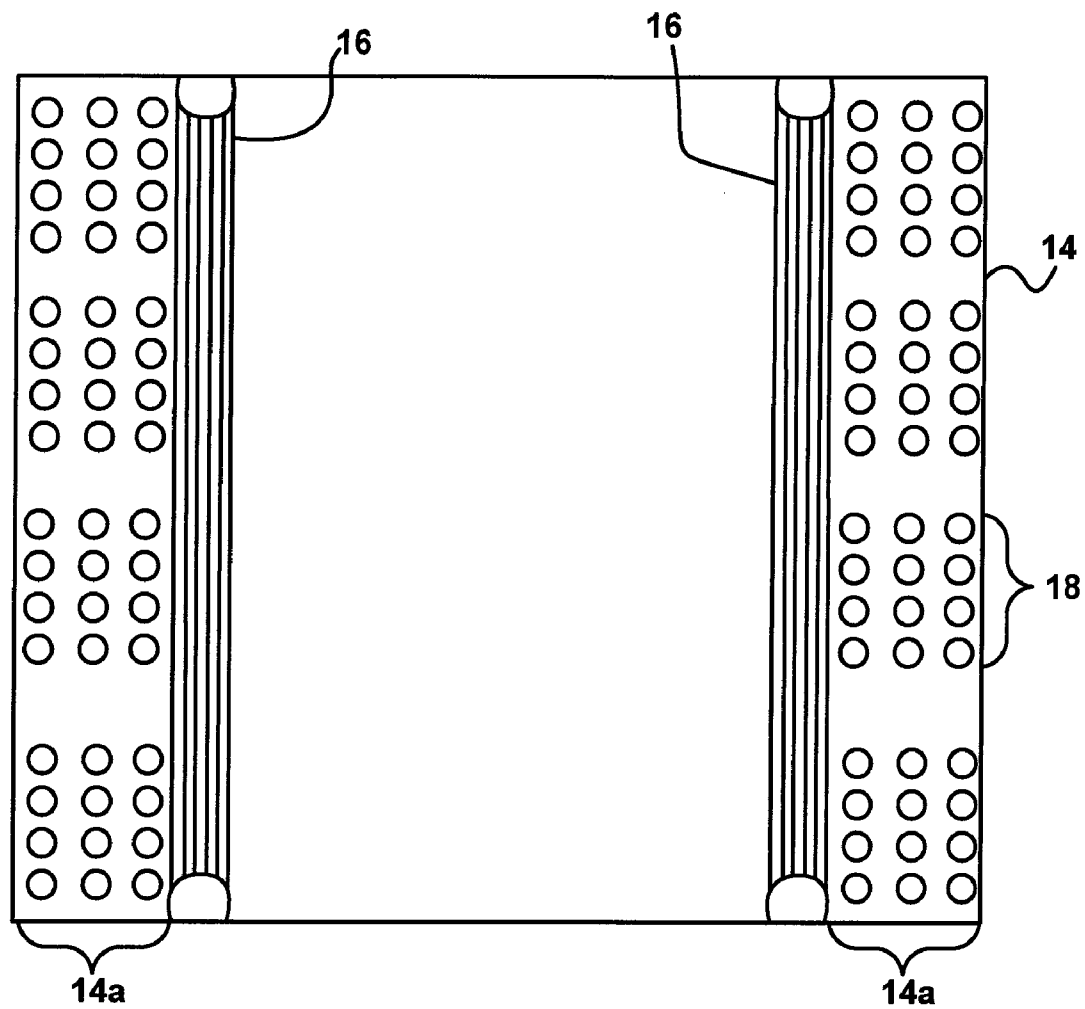


FIG. 2



FLOOR PANEL

FIG. 3

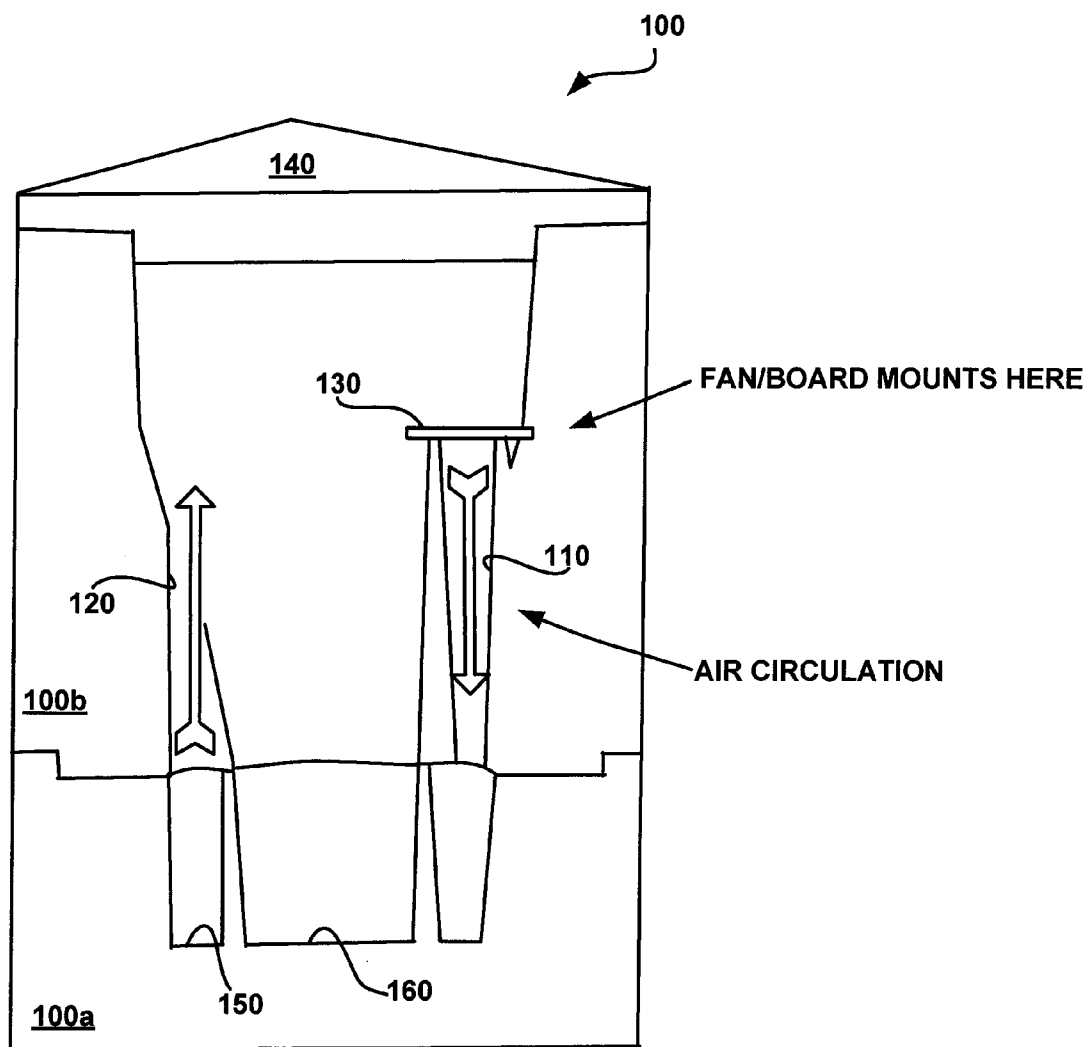


FIG. 4

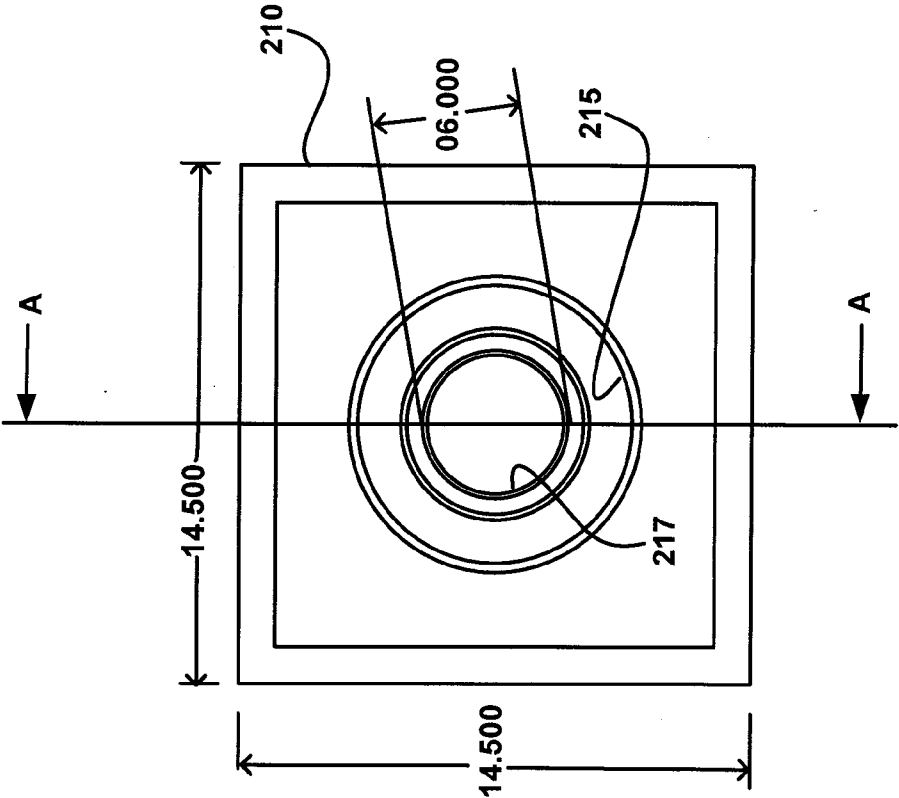
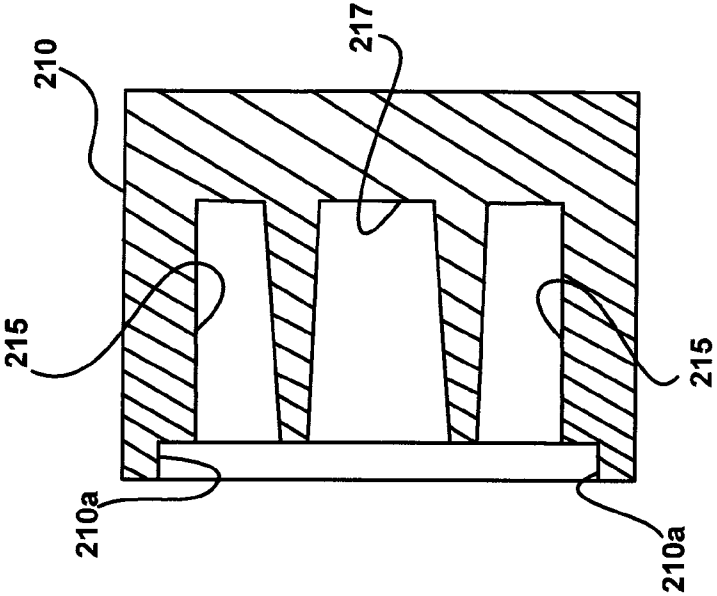


FIG. 5A



Section A-A

FIG. 5B

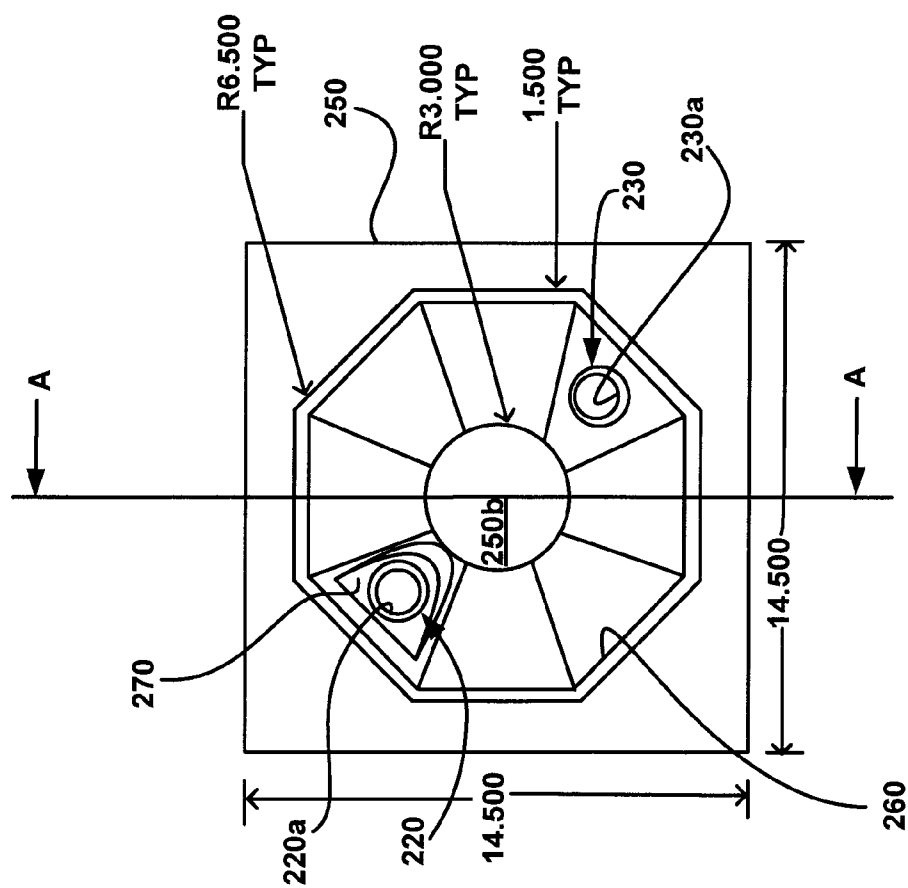


FIG. 6A

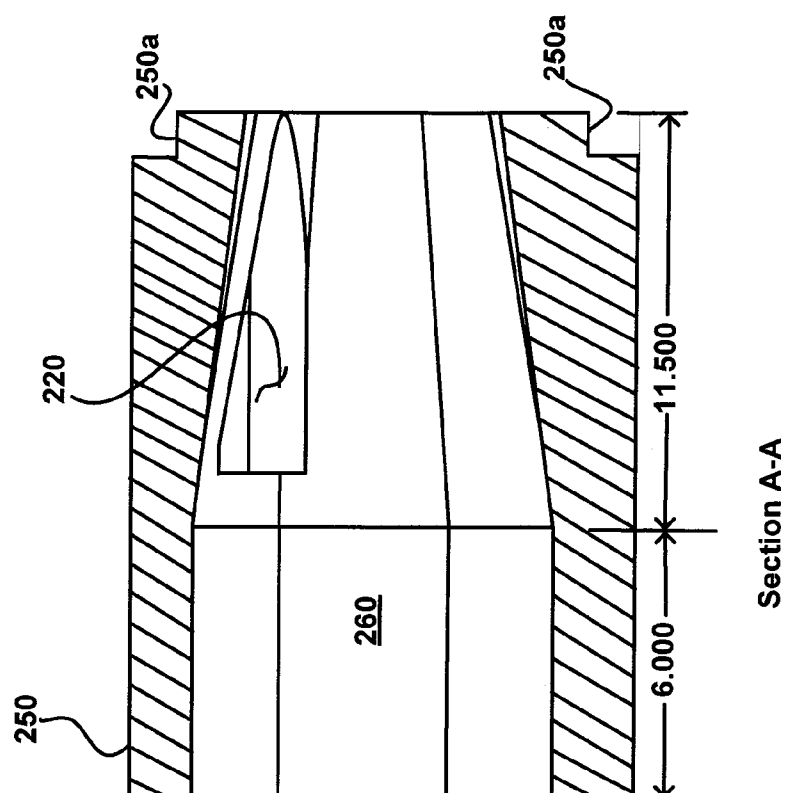


FIG. 6B

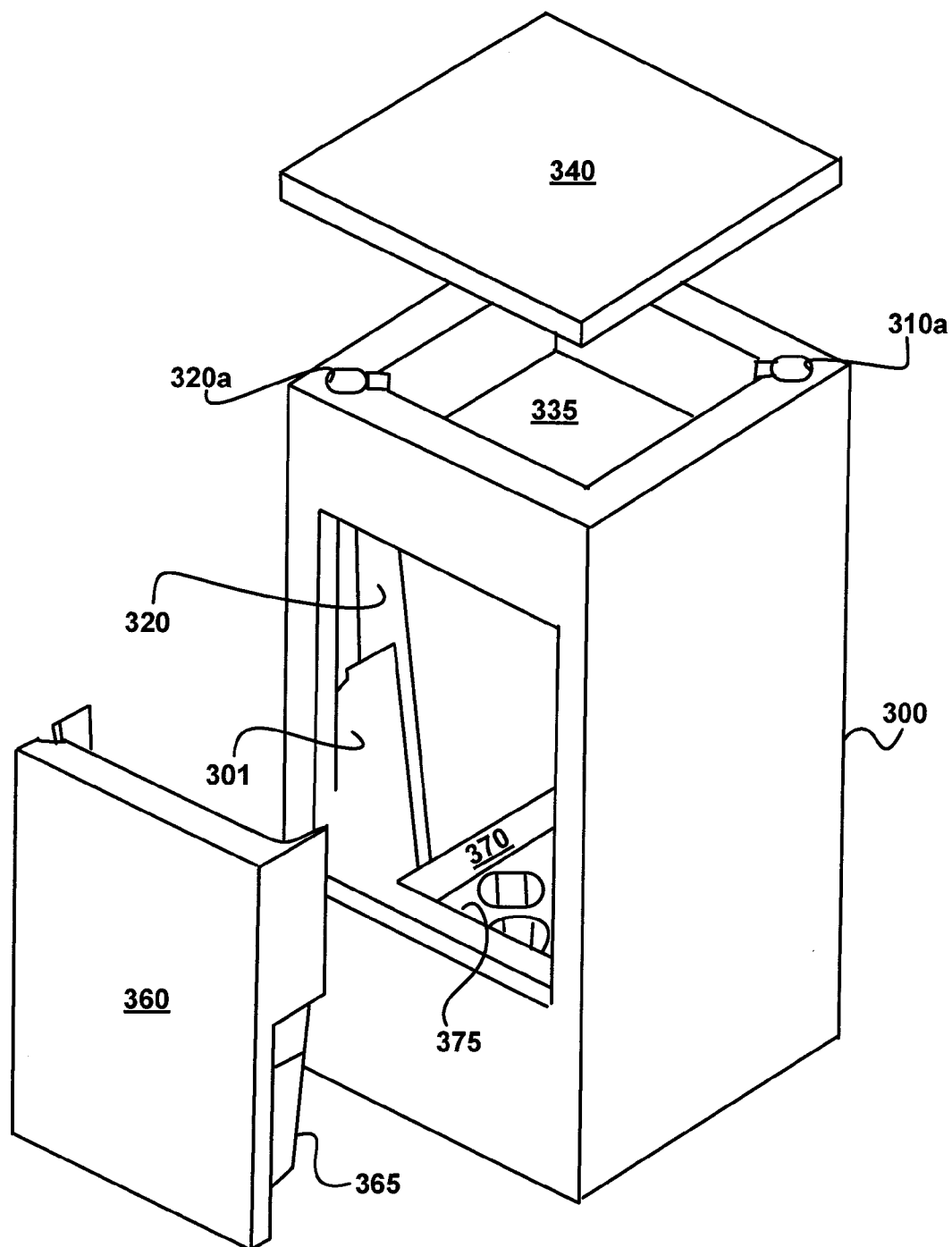


FIG. 7

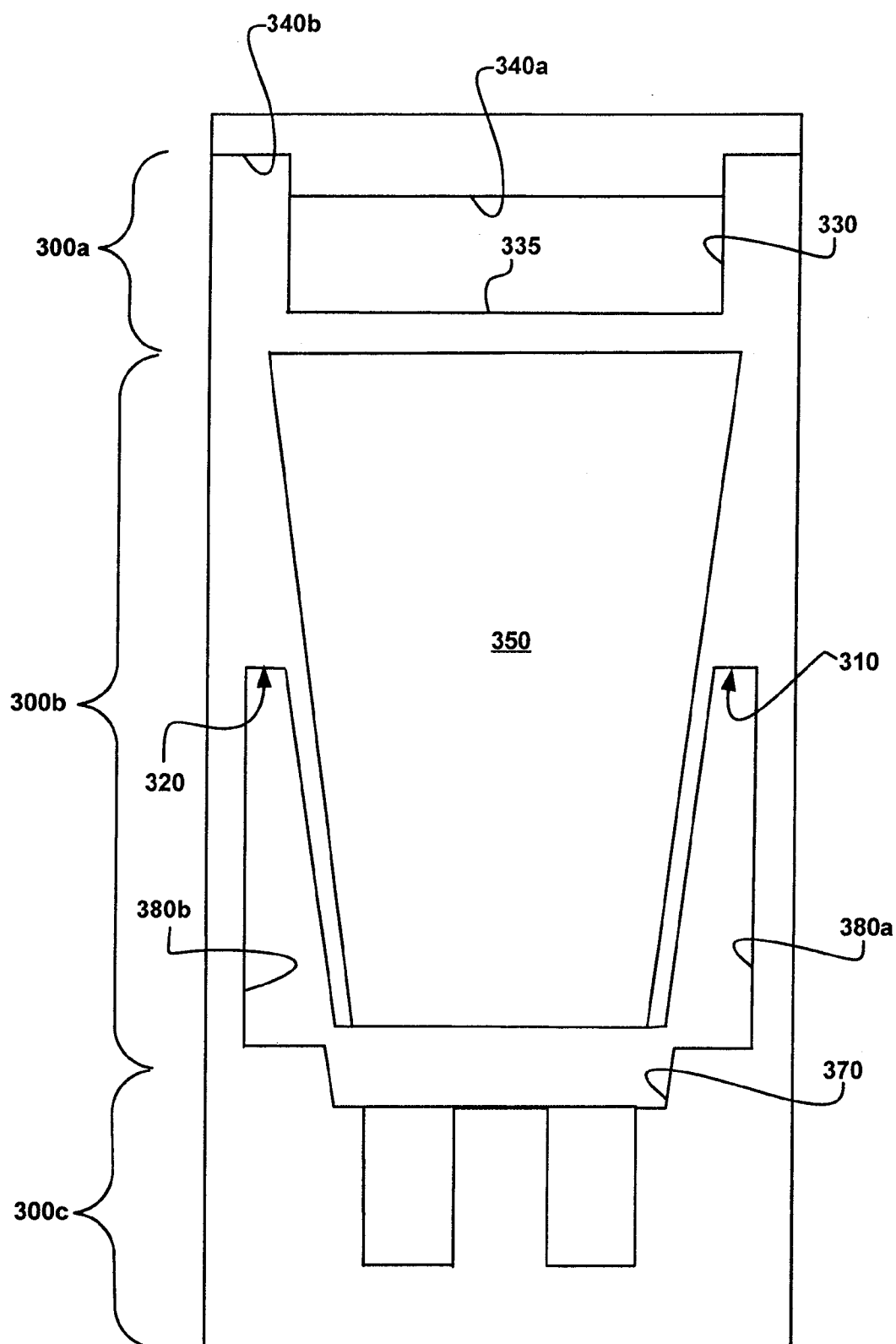


FIG. 8

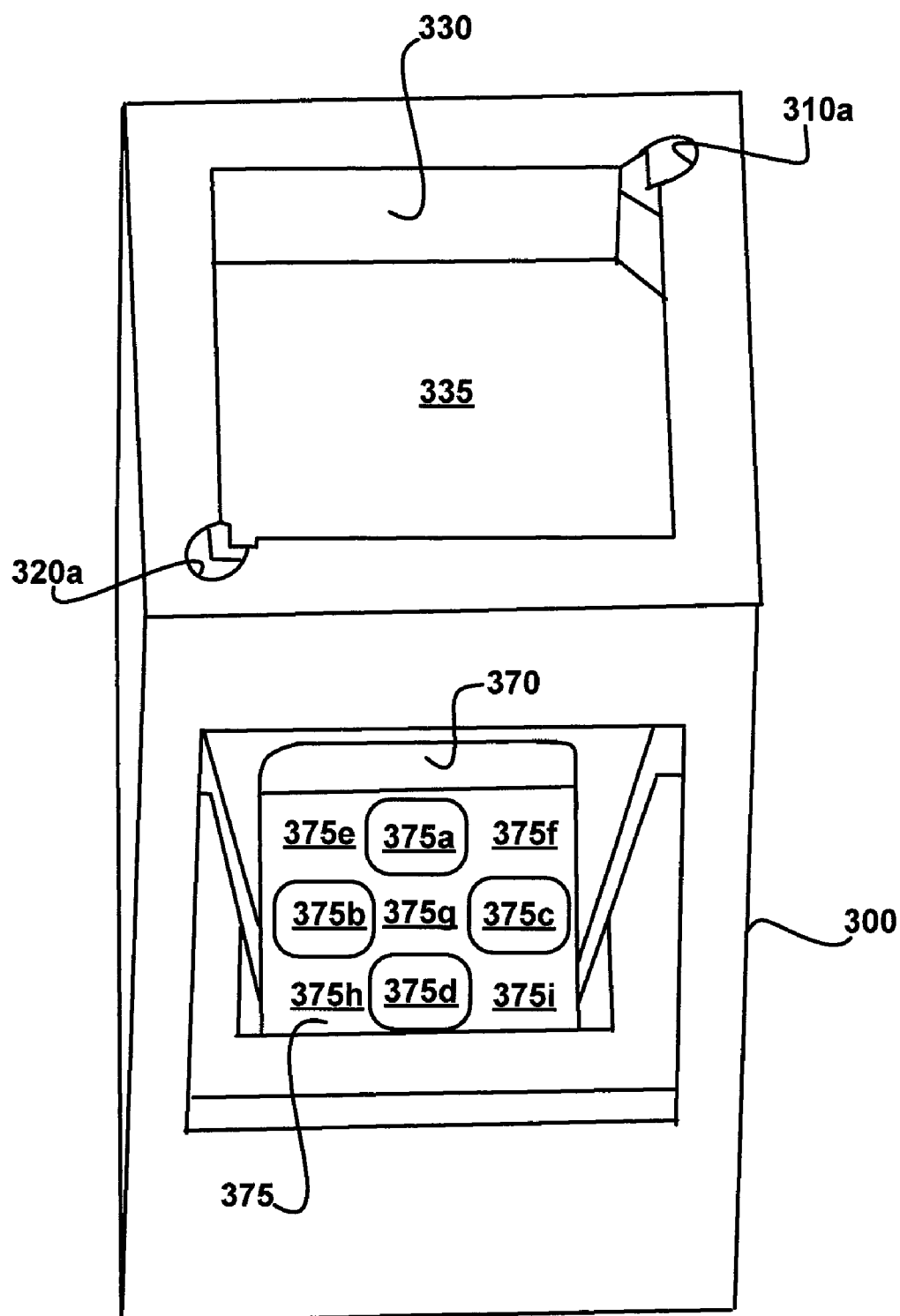


FIG. 9

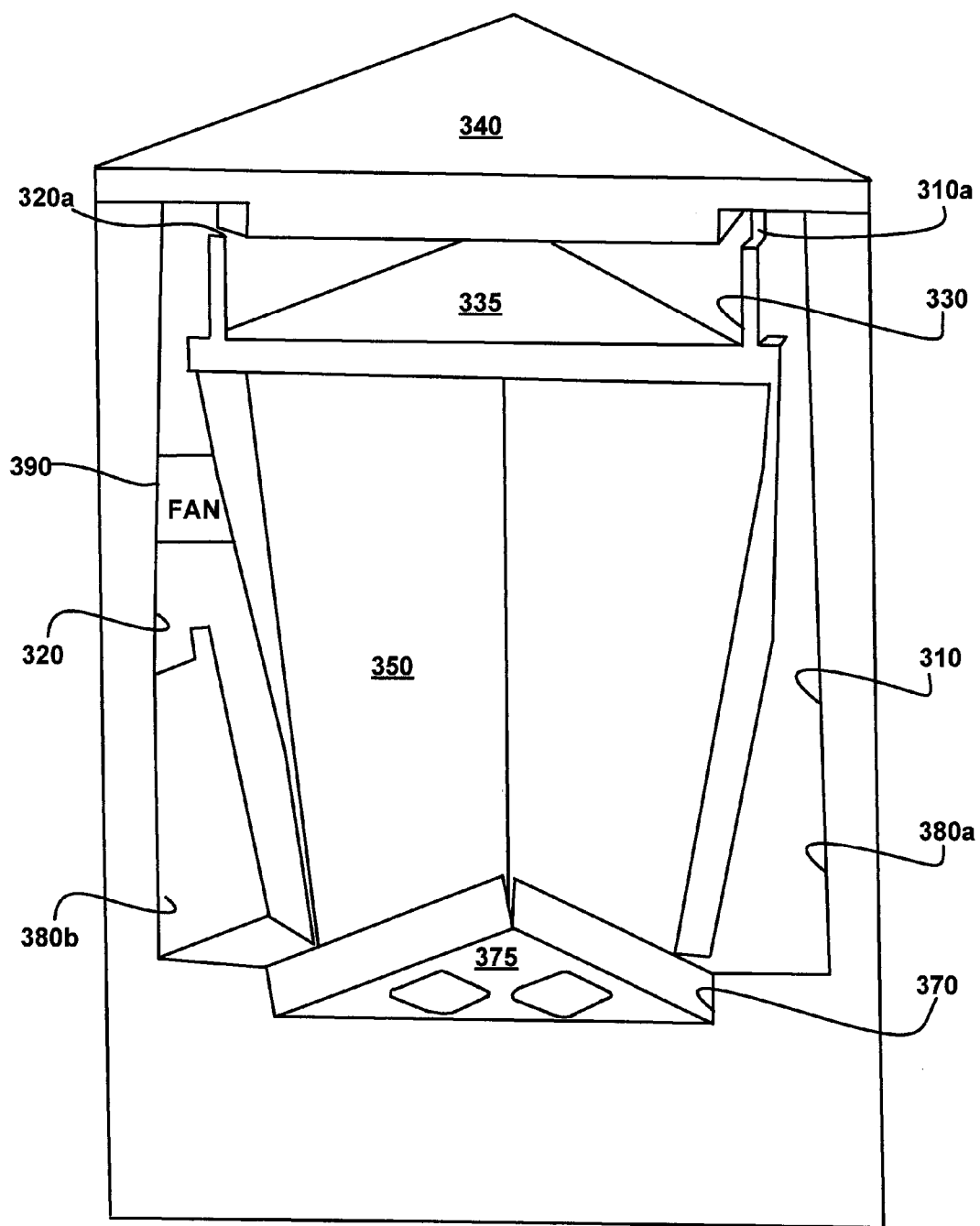


FIG. 10

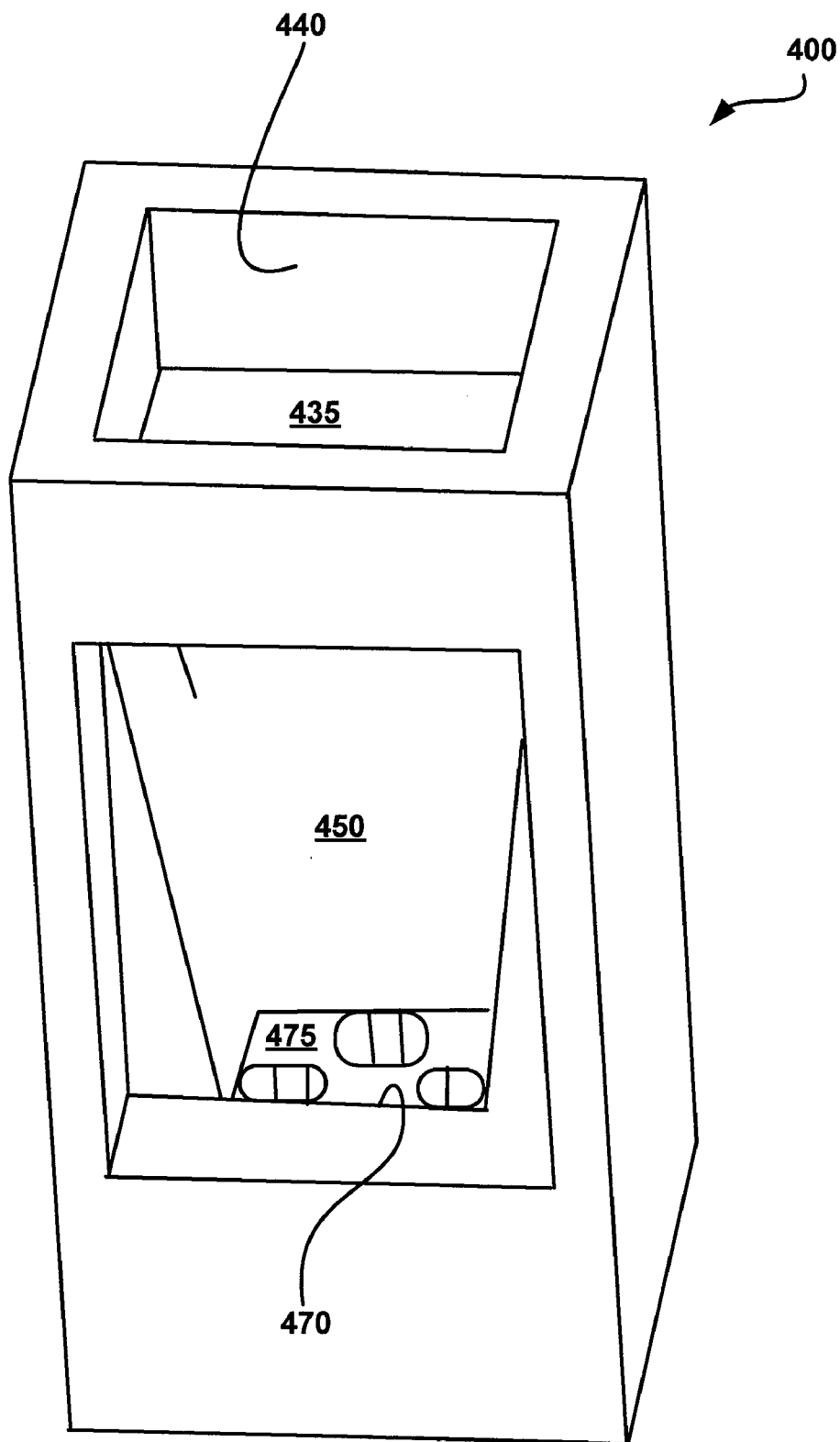


FIG. 11

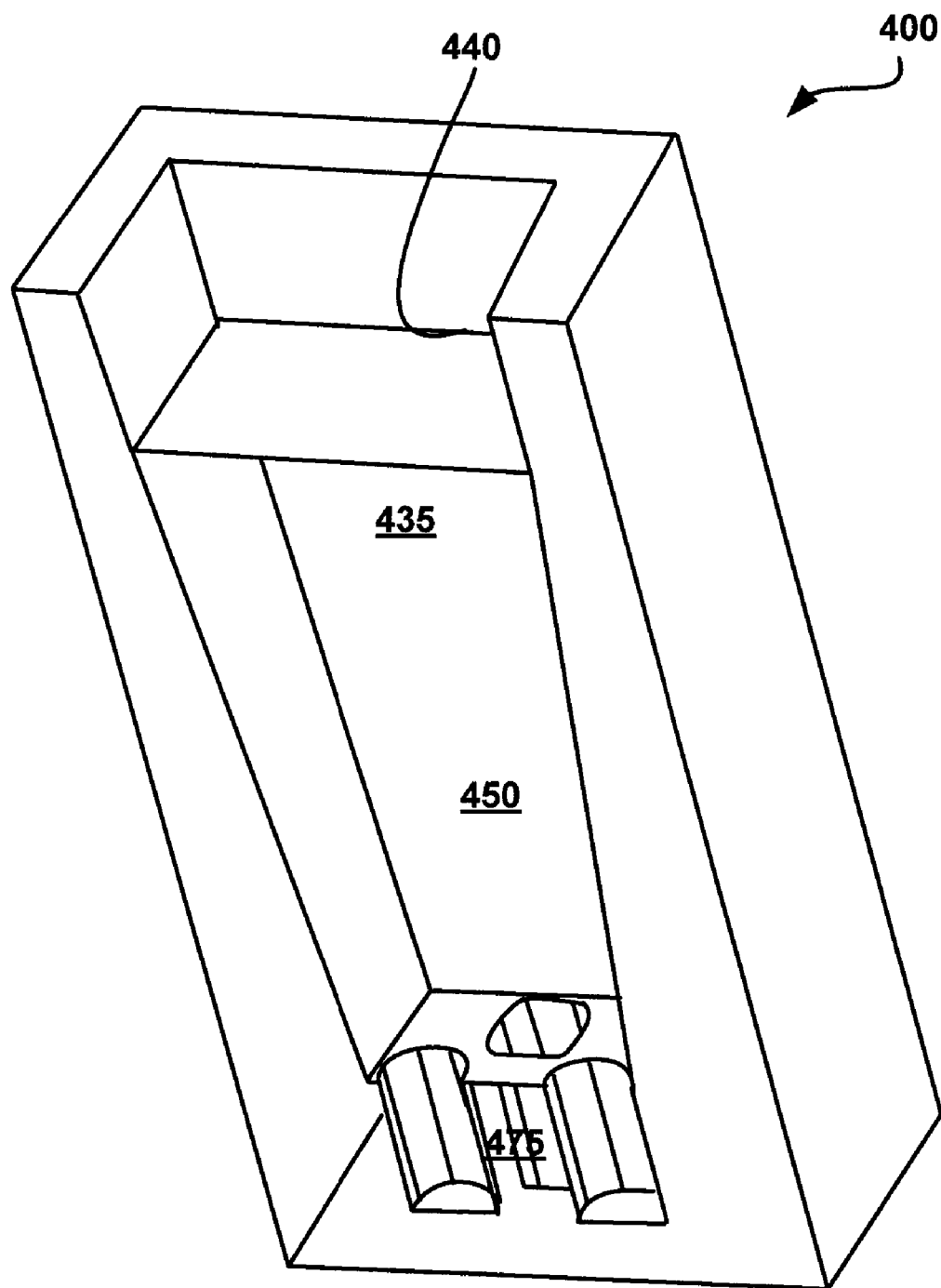


FIG. 12

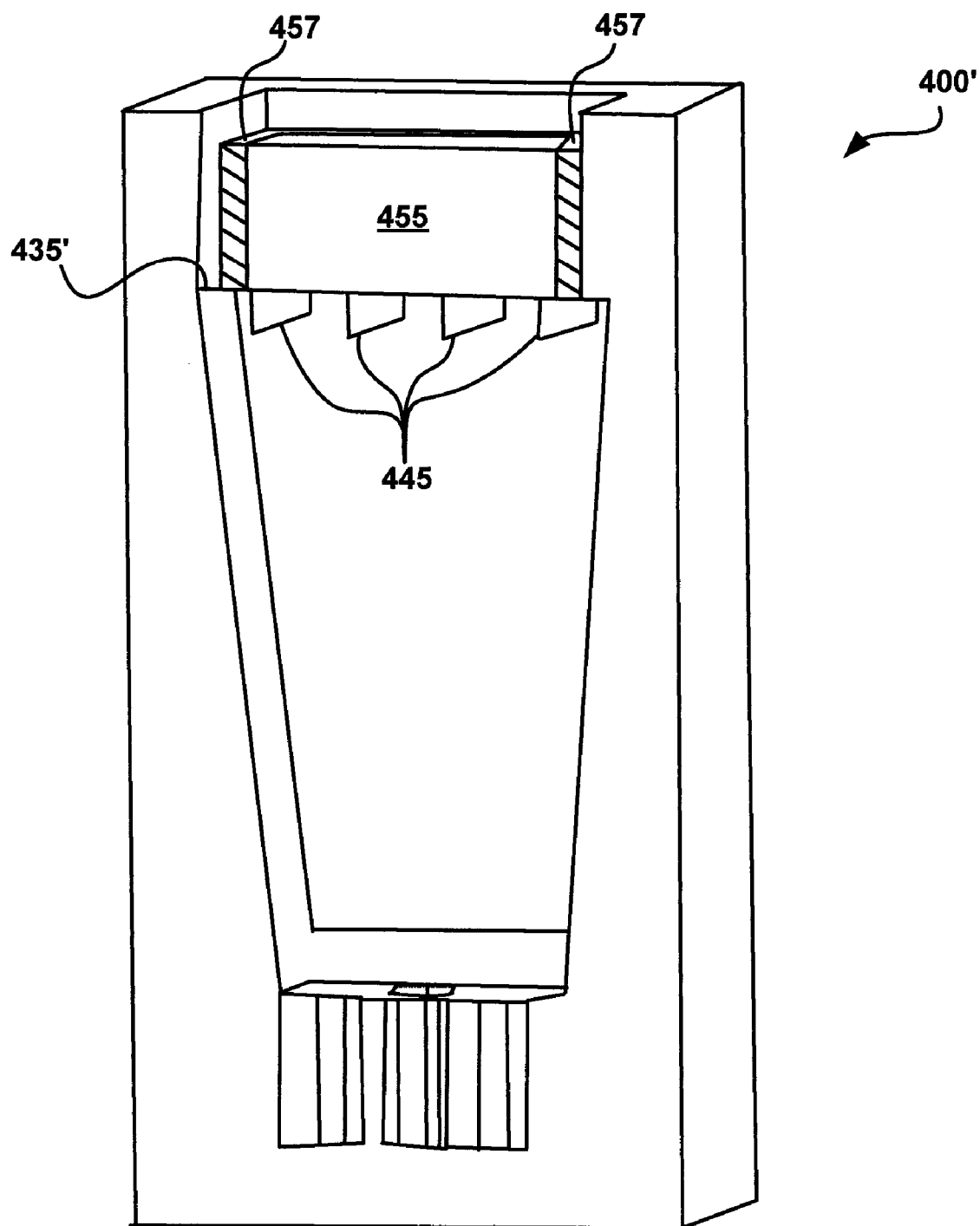


FIG. 13

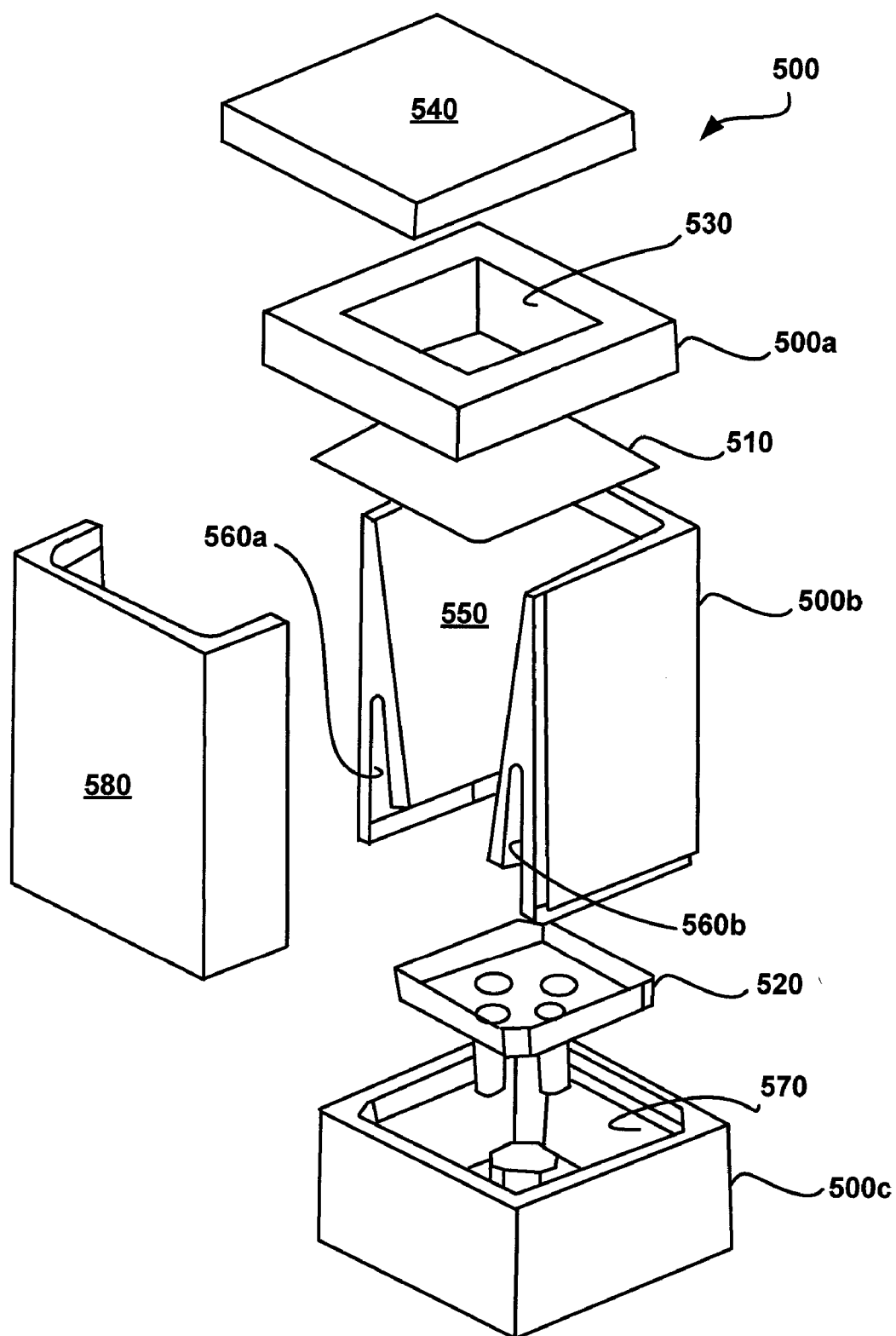
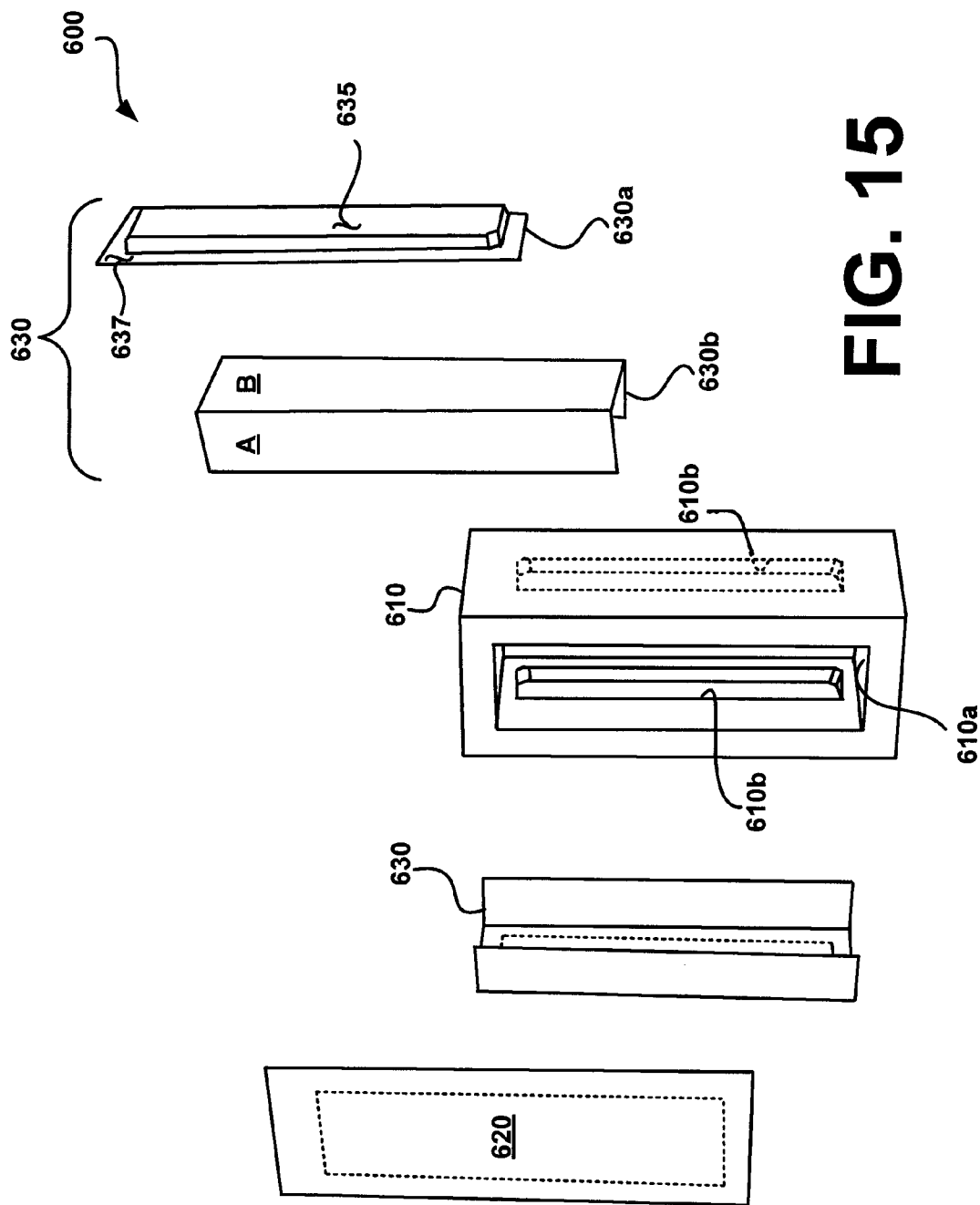


FIG. 14



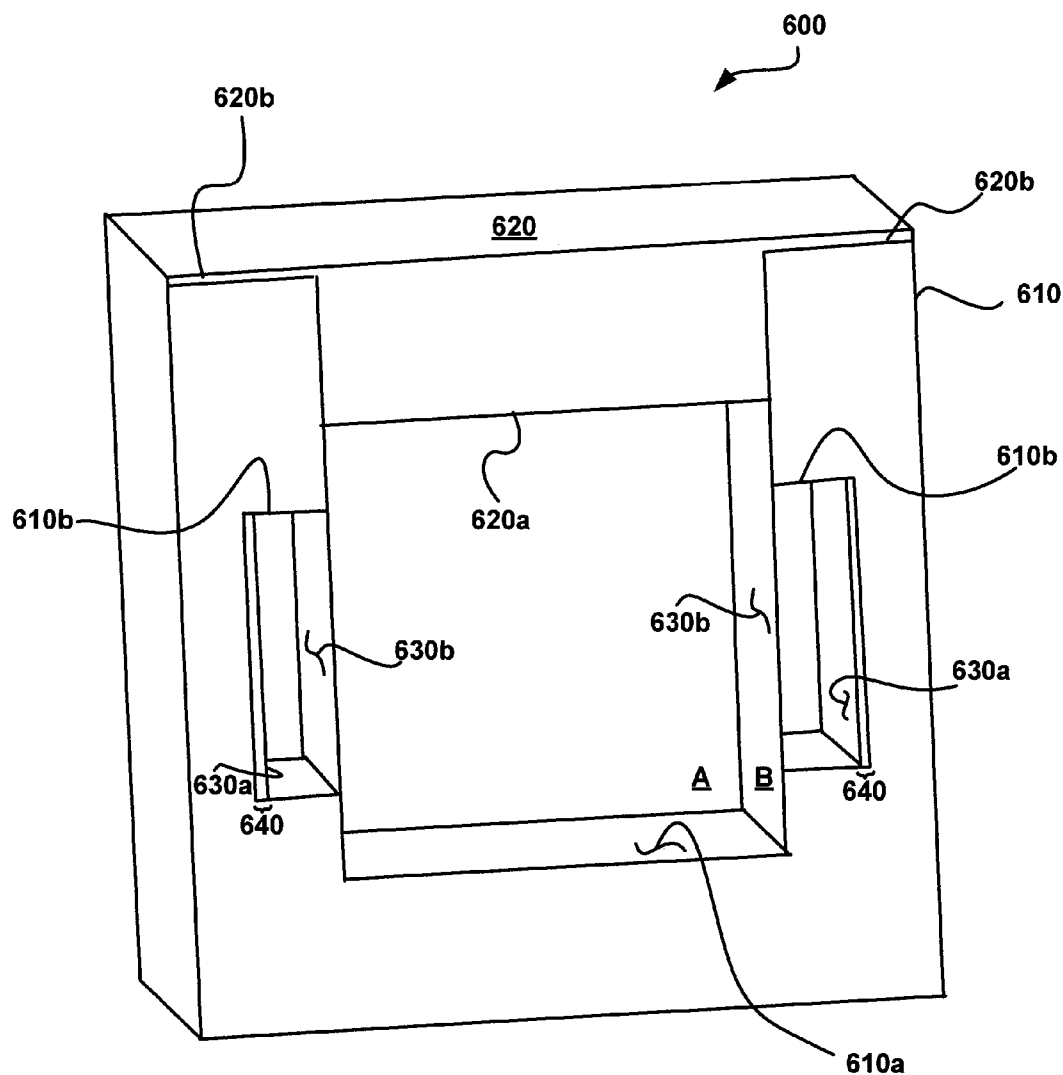


FIG. 16

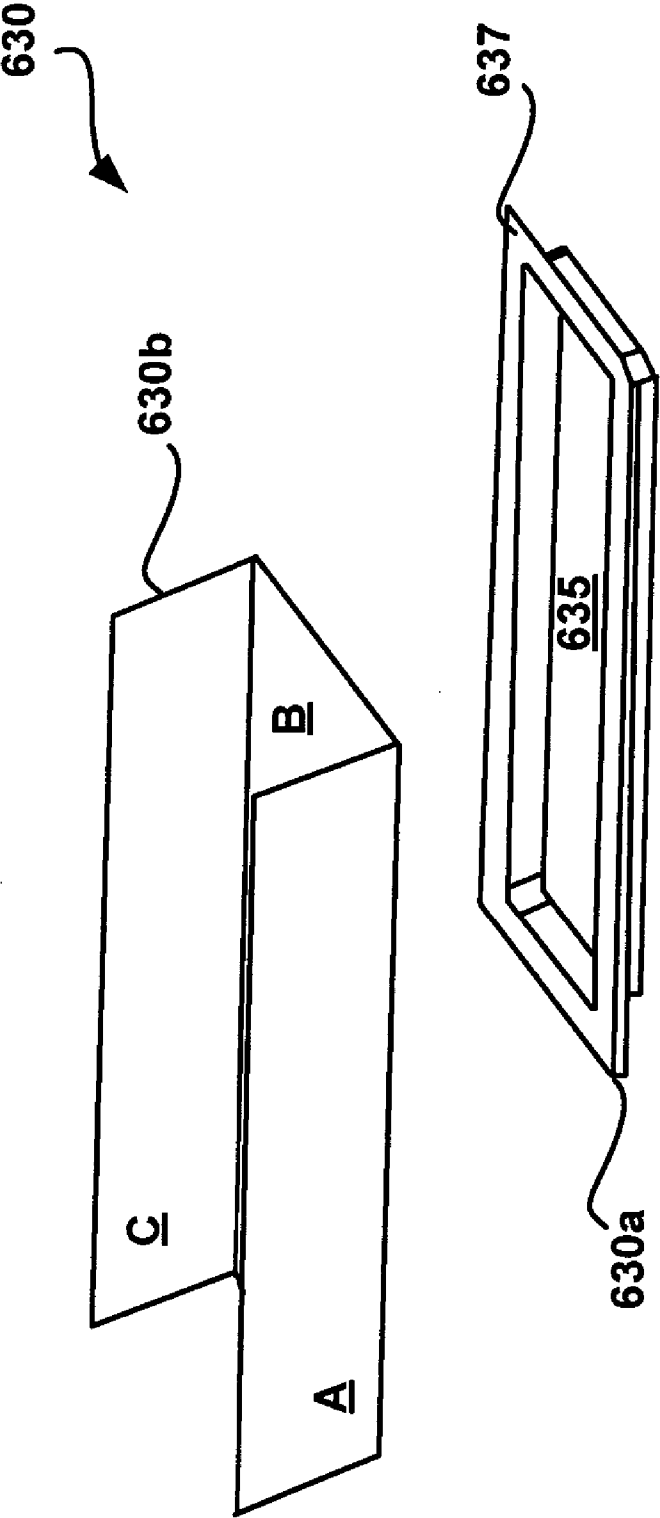


FIG. 17

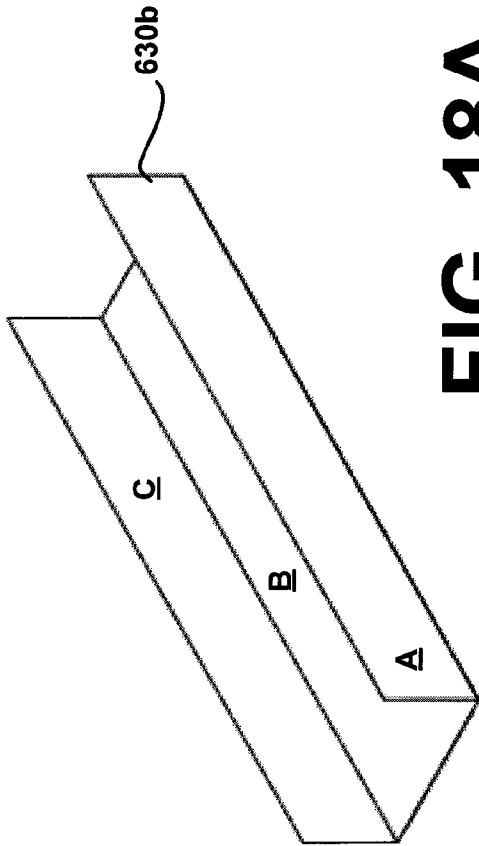


FIG. 18A

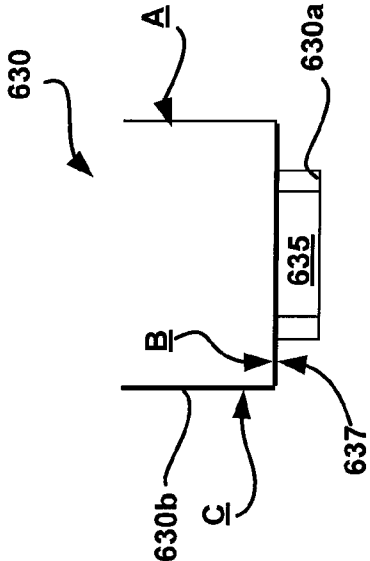


FIG. 18C

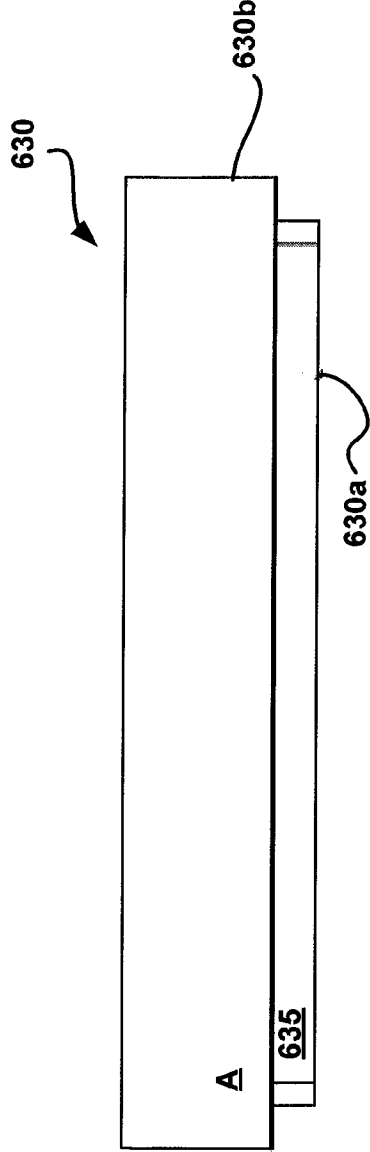


FIG. 18B

SHIPPING SYSTEM AND CONTAINER FOR TRANSPORTATION AND IN-STORE MAINTENANCE OF TEMPERATURE SENSITIVE PRODUCTS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application is a continuation-in-part of, and claims priority from, co-pending U.S. patent application Ser. No. 11/652,892, filed on Jan. 12, 2007, which application claims priority from provisional patent application Ser. No. 60/758,367, filed on Jan. 12, 2006, and from provisional patent application Ser. No. 60/817,992, filed on Jun. 30, 2006, both now expired, and both entitled SHIPPING SYSTEM AND CONTAINER FOR TRANSPORTATION AND IN-STORE MAINTENANCE OF TEMPERATURE SENSITIVE PRODUCTS.

FIELD OF THE INVENTION

[0002] The invention relates to the field of containers for transporting temperature sensitive products. More particularly, the invention relates to a container, system and method for transporting temperature sensitive products wherein the container maintains those products during transit, as well as after arrival at the product's destination.

BACKGROUND OF THE INVENTION

[0003] Temperature sensitive products are currently shipped in boxes with dry ice or frozen gel packs that keep the temperature sensitive product cold for about three days of shipping.

[0004] For example, flowers are shipped in buckets filled with water and ice and are enclosed in large corrugated cardboard cartons, and shipped in refrigerated cargo trucks to their final destination. Once at the flowers' final destination, the cartons must be reopened and the cut end of the flower stems immediately placed in water or some other hydrating material to extend the life of the flowers. For every hour that the flower is at room temperature in which the cut end of the flower is not in liquid, the presentation lifetime of the flower is reduced by one day.

[0005] However, three day shipping is more expensive than, for example, third class shipping. The cost of shipping the temperature sensitive products could be greatly reduced if longer shipping times were possible. As such, what is needed is a container and system for transporting temperature sensitive products that extends the shipping lifetime of the temperature sensitive product.

[0006] Further, the repacking of the product at the distribution center is labor intensive, adding a further cost to that of shipping the product. Transporting the products in refrigerated trucks adds yet another cost to that of shipping the temperature sensitive products. What is additionally needed is a container and system that reduces the amount of labor necessary for preparing a temperature sensitive product for shipping and which maintains the product within a desired temperature range for a longer period of time.

[0007] What is further needed is a container that prolongs the lifetime of the product, once the container reaches room temperature.

SUMMARY OF THE INVENTION

[0008] A shipping container is provided that will provide a predetermined amount of cold air to a temperature sensitive product, over time, to maintain the product within a predetermined temperature range.

[0009] This and other objects and advantages of the present invention will become more readily apparent in the description which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a perspective view of a shipping container in accordance with one embodiment of the present invention.

[0011] FIG. 2 is an isometric view of a shipping container in accordance with one embodiment of the present invention.

[0012] FIG. 3 is an elevated top plane view of one portion of a shipping container, in accordance with one particular embodiment of the present invention.

[0013] FIG. 4 is a perspective drawing of a shipping container according to another embodiment of the instant invention.

[0014] FIG. 5A is a top plan view of the lower section of a particular shipping container according to the embodiment of FIG. 4.

[0015] FIG. 5B is a side cross-sectional view of the lower section of the particular shipping container of FIG. 5A.

[0016] FIG. 6A is a top plan view of the upper section of a particular shipping container according to the embodiment of FIG. 4.

[0017] FIG. 6B is a side cross-sectional view of the upper section of the particular shipping container of FIG. 6A.

[0018] FIG. 7 is an isometric exploded view of a shipping container in accordance with one particular embodiment of the present invention.

[0019] FIG. 8 is a cross-sectional view of the shipping container of FIG. 7.

[0020] FIG. 9 is a perspective view taken from the top front of a portion of the shipping container of FIG. 7.

[0021] FIG. 10 is a further cross-sectional view, taken from corner to corner, of the shipping container of FIG. 7.

[0022] FIG. 11 is an isometric partial view of a shipping container in accordance with another embodiment of the present invention.

[0023] FIG. 12 is a further cross-sectional view of the shipping container of FIG. 11.

[0024] FIG. 13 is a cross-sectional view of a shipping container in accordance with still another embodiment of the present invention.

[0025] FIG. 14 is an exploded view of a shipping container in accordance with yet another embodiment of the present invention.

[0026] FIG. 15 is an exploded perspective view of a shipping container in accordance with still another embodiment of the present invention.

[0027] FIG. 16 is a cross-sectional view of the shipping container of FIG. 15.

[0028] FIG. 17 is an exploded perspective view of one embodiment of a pan and foil assembly that can be used with the shipping container of FIG. 15.

[0029] FIG. 18A is a perspective view of a foil sheet for use with the pan and foil assembly of FIG. 17.

[0030] FIG. 18B is a side plan view of one particular pan and foil assembly that can be used with the shipping container of FIG. 15.

[0031] FIG. 18C is an end view of the pan and foil assembly of FIG. 18B.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0032] Referring now to FIGS. 1-3, there is shown one particular preferred embodiment of a shipping container 10 made in accordance with the present invention. The shipping container is made from a material that permits it to be used for transporting a product that needs to be cooled during shipping to a customer or end-recipient. Additionally, it is desirable for the material of the shipping container 10 to provide some insulation. For example, in a preferred embodiment the shipping container 10 is made from a light-weight multicellular closed foam material such as STYROFOAM®. Alternatively, the shipping container 10 can be manufactured from another material, such as paper board or corrugated cardboard.

[0033] Shipping container 10 is constructed to be of a size to hold fresh-cut flowers for transport to a customer. Container 10 can be manufactured as a double walled construction, such that internal cavities may hold elements, such as ice, gel packs, etc., which can be used to maintain the innermost cavity and items shipped therein, at a desired temperature during the shipping process.

[0034] Alternatively, in accordance with one preferred embodiment of the present invention, referring to FIGS. 1-3, the shipping container 10 includes a compartment or area 12 at the bottom of the container 10 for receiving a frozen material 30 such as ice or, more preferably, dry ice. Alternatively, the shipping container 10 can include a tray located internally at the bottom of the container 10, which tray will hold a specific amount of frozen material 30, i.e., a specific sized block of dry ice. A floor panel 14 can be placed over the compartment 12 or tray at the bottom of the shipping container. The remainder of the interior of the shipping container 10, above the floor panel 14, defines a central chamber 13. In one preferred embodiment, the floor panel 14 is additionally made from a light-weight, multicellular, closed foam material, such as STYROFOAM®, although other materials may be used. As will be described herebelow in connection with FIG. 3, floor panel 14 is additionally provided with air holes therein, to allow ventilation.

[0035] Further, in a preferred embodiment of the invention shown in FIGS. 1 and 2, liquid-containing members 16, which in the present embodiment are achieved using the vertical plastic casings 16, may be provided on two of the sides of the shipping container. Although, the present embodiment is described herein as including two compartments or vertical plastic casings, this is in no way meant to

be limiting. For example, as few as one compartment or vertical casing may be provided for use in the shipping container. Alternatively, three or more vertical plastic casings may be used, if desired. Additionally, the liquid containing member of the present invention need not be limited to a plastic casing, as other types of liquid containing members are known and may be used.

[0036] The vertical plastic casings 16 of the present invention are constructed to contain a liquid substance, therein. For reasons that will be described in connection with another embodiment of the present invention this liquid substance can be either any suitable liquid for maintaining the interior of the shipping container 10 cold, or may be a liquid that is nourishing for the plants or flowers that will be shipped in the shipping container 10. For example, the liquid may be water, a plant nutrient immersed in a liquid, and/or some other liquid. Further, the liquid containing members (16 of FIGS. 1-3) of the present invention, are sized to fit into the central chamber and would resemble removable wall panels for the central chamber.

[0037] In one preferred embodiment, the vertical casings are gel packs that slide into tracks formed in the interior walls of the shipping container 10, and thus, are maintained by the tracks in a desired relationship with the walls of the shipping container 10. In the embodiment shown in FIGS. 1 and 2, the vertical plastic casings 16, are spaced a distance "d", away from the sides of the box. This spacing allows air to circulate between the vertical plastic casings 16 and the inner walls of the shipping container 10 to provide ventilation between the vertical plastic casings 16 and the sides of the box 10. Additionally, the sizing of the vertical plastic casings 16 is, in the most preferred form, chosen to be the width and height of the interior chamber, such that the air circulating in the distance "d", does not circumvent the liquid containing members 16.

[0038] Referring more specifically, to FIG. 3, there is shown in more particular detail, the floor panel 14 with the gel packs 16 spaced thereon. In the particular embodiment of FIG. 3, the channels or air holes 18 through the floor panel 14 are provided only in the portions of the floor panel 14a corresponding to the spacing "d". This insures that the circulation of cool air from the dry ice or other frozen material in the compartment/tray 12 will be limited in circulation to the back side of the vertical plastic casings 16. Additional air holes or channels 18 can be provided, if desired. However, one advantage to the use of the air holes 18 only in the areas 14a, is that this limits the release of the cold air throughout the shipping container, thus providing a time-release effect on the cooling. The number and size of the holes 18 used can be varied to further control the timed release of the cool air from the chamber/tray 12 and limit the melting of the frozen material contained therein. Further, the thickness of the floor panel 14 can be chosen, if desired, so as to insulate the inner chamber of the shipping container from direct cooling from the frozen material 30, so that the items to be shipped, (e.g., fresh-cut flowers) placed inside the shipping container 10 do not, themselves, freeze. Rather, the inner chamber of the shipping container 10 will be maintained at a proper temperature by the cooling properties of the liquid contained, and possibly frozen, within the vertical plastic casings 16, and chilled air provided via holes 14a.

[0039] As a result, the combination of the present product will allow the items to be shipped, such as fresh-cut flowers, to be kept at a constant cool temperature during shipment, which will extend the perishable life of the product. More specifically, the cool air will circulate behind the vertical plastic casings 16, cooling the liquid therein, which will, in turn, keep the main chamber of the shipping container containing the fresh cut flowers or other items cool. The release of the cold air through only the air holes 18, will extend the lifetime of the frozen material 30. Thus, the shipping container 10 of the present invention can be shipped for longer periods of time before the shipped items are in danger of spoilage. For example, where prior art systems would use overnight or two day air transportation to provide fresh flowers to a distribution center, where they were repacked and sent in refrigerated trucks to the customer, the present system maintains the cold of the shipping container without freezing or spoiling the flowers without the need for the intervening distribution center or refrigerated truck. More specifically, the present invention prolongs the lifetime of the fresh flowers by slowing the degeneration of the frozen material 30 and prolonging the period of coolness in the shipping container 10. This permits the items, fresh-cut flowers in the present example, to be shipped in the shipping container 10 by regular mail or transport, thus avoiding: 1) the excessive cost of shipping via an overnight or two/three day carrier; 2) the cost of the intervening distribution center, and the labor required therein; and 3) the cost of shipping the flowers by refrigerated truck. Instead, using the shipping container 10 of the present invention, fresh cut flowers or other items can be shipped from the farm or other originating location, directly to the customer, inexpensively.

[0040] Additionally, in another embodiment of the present invention, particularly adapted to the shipment of a product benefiting from hydration at some stage of the process, such as fresh-cut flowers, the shipping container 10 of the present invention can be further used to keep the product in a state ready for sale, in the customer's location, without requiring the customer's immediate attention.

[0041] Referring back to FIG. 1, in the present embodiment, a wet pack or sponge 22 is located in the center of the box, on top of the floor panel 14. This wet pack 22 will then house the fresh flowers that are being shipped.

[0042] For example, the surface of one or more of the vertical plastic casings 16, may contain perforations on the side facing into the center compartment of the shipping container 10, i.e., throughout the plastic sheeting, or just at the lower portion of the plastic sheeting. While the frozen material 30 continues to provide cool air to the liquid containing members, the liquid contained therein remains viscous or frozen, and does not exit through the perforations. As the shipping container reaches room temperature, the liquid in the vertical plastic casings is able to melt and is directed into the wet pack 22. Thus, instead of the flowers arriving and possibly sitting in the warm room without moisture on the cut stems, the liquid from the gel packs 16, as the temperature within the chamber rises, will melt and provide liquid to the wet pack sponge 22. This liquid is absorbed by the cut end of the flower stems which rest upon the sponge 22, thus keeping the flowers hydrated until the customer is ready to work with them.

[0043] Additionally, the shipping container 10 may also include a perforated edge 20 on the top or on a side panel, which allows the customer, upon receipt of the product, to open the package and place the flowers directly on display.

[0044] Referring now to FIG. 4, there is shown another embodiment of a shipping container 100 in accordance with the invention. The shipping container 100 operates on the same principle as the above-described embodiments. More particularly, temperature control is achieved by circulating air from the central section 100b of the shipping container into the bottom section 100a of the shipping container 100, via channels 110 and 120. A channel 150, which may be circular in cross section, is used to store a frozen material in the bottom portion of the shipping container 100. The channels 110 and 120 are in fluid communication with the channel 150 to permit the air to be circulated, as described herein. A chamber 160 in the bottom portion 100a can be used to receive a portion of the cargo stored in the shipping container, and/or some other material such as water or a wetted sponge. Alternately, the chamber 160 may be merged with the channel 150, if desired, and more frozen material can be stored.

[0045] Note that, although two channels are shown in connection with the present preferred embodiment, more channels can be used, if desired. A lid 140 is fitted to the top of the shipping container 100, thus providing a closed system for the circulation of air through the shipping container 100. The air, thus circulated, comes into thermal contact with a frozen material stored in the bottom section 100a of the container 100. The frozen material of the present invention can be wet ice, dry ice, a chilled gel pak and/or other type of cooling material.

[0046] The shipping container of FIG. 4 includes a fan 130, or other similar device, to promote and regulate air circulation through the shipping container. More particularly, air from the article storage portion of the shipping container 100 is pulled into the channel 110 by the fan 130, wherein warmer air is removed from the central section 100b of the shipping container into the lower or bottom section 100a. Although shown as two separate, mating parts 100a and 100b, it should be noted that the bottom section 100a and central section 100b of the shipping container 100 can also be made as a single integrated unit.

[0047] The frozen material stored in the lower portion 100a of the shipping container 100 then cools the air. Additionally, the fan 130 drives cooler air from the lower section 100a of the shipping container into the central portion of the shipping container. Thus, cool air is recirculated through the shipping container in order to keep the contents of the central portion 100b of the shipping container 100 cool. The fan 130 is preferably battery operated and thermostatically regulated. Thus, the fan 130 can be set to turn on only when the temperature of the central portion of the shipping container reaches a predetermined temperature. Cycling of the fan will prolong the battery life, and thus prolong the time at which the cargo will be maintained at a desired temperature in the shipping container 100. In one preferred embodiment, the temperature in the central portion of the shipping container 100 is desirably maintained between 2-8° C. The desired temperature range can be adjusted to optimize the transportation temperature of the particular cargo. For example, in one particular embodi-

ment of the invention wherein the cargo stored in the central portion of the shipping container **100** is cut flowers, the optimum temperature internal to the cargo portion of the shipping container may be 2-8° C. Thus the fan **130** may operate when the thermostat registers a temperature outside the desired range. However, the instant invention is not limited to use with cut flowers, but may be used for transporting any perishable cargo (i.e., meat, produce, blood plasma, etc.). As such, the thermostat may be set to control the fan for lower or higher temperatures for other perishable products shipped in the shipping container **100** (i.e., lower temperatures for frozen products, etc.). The materials used to make the shipping container **100**, as well as the frozen material selected, can be balanced by the temperature characteristics desired for transporting a particular cargo. In one particularly preferred embodiment, the shipping container is designed to maintain the internal temperature of the central portion of the shipping container **100** at 33-40° F. for a period of between 72-120 hours at an ambient outside temperature of 33-85° F. In a more preferred embodiment, the shipping container is designed to maintain the internal temperature of the central portion of the shipping container **100** at 33-40° F. for a period of between 72-120 hours at an ambient outside temperature of 33-85° F. using wet ice as the frozen material.

[0048] Additionally, the shape and size of the cargo volume of the shipping container **100** can be adjusted according to the item to be shipped.

[0049] Note that, other devices can be used for keeping the central portion of the shipping container cool and still be in accordance with the instant invention. For example, the instant invention can include other heat exchange devices in place of the fan **130**. For example, a shipping container in accordance with the present invention can maintain the temperature in the refrigerated volume using a heat pipe, heat pump, thermo-siphon, thermo-loop or any similar means for moving heat energy from the refrigerated volume into the frozen material.

[0050] Further, as stated above, wet ice may be used as the frozen material in the shipping container **100**. Note that, in all embodiments of the instant invention, the use of wet ice can additionally be used to produce humidity in the central cargo portion of the shipping container **100**. For example, in the embodiment of FIG. 4, as warmer air is driven by the fan **130** from the central portion of the shipping container **100** into the lower portion, wet ice stored in the lower portion melts upon thermal contact with the warmer air. When air is blown from the lower portion **100a** of the shipping container **100** to the central portion **100b**, this melted liquid humidifies the air and, correspondingly the cargo portion of the shipping container **100**. This humidity can be advantageous when shipping certain products, such as produce, live plants and/or cut flowers, thus, further extending the lifetime of such products.

[0051] Referring now to FIGS. 5A-6B, there are shown two of the three components making up one particular shipping container **200** in accordance with the embodiment of FIG. 4. More particularly, the shipping container **200** is a refrigerated box including three major sections, each section being constructed from an insulating material such as, thermal insulating foam, a multicellular closed foam material, or other similar material.

[0052] The shipping container **200** includes a bottom section **210**, a center section **250** and a top (such as, top **140** of FIG. 4). As described above, the bottom section **210** of the shipping container **200** is designed to receive frozen material into a cavity or channel **215**, which in the present embodiment is circular in cross section. The frozen material may be ice or some other means for absorbing heat energy at a sufficiently low temperature. In one preferred embodiment, the bottom **210** also includes a chamber or volume **217** for holding water or some other means for receiving and hydrating flower stems. Note that such a chamber may be omitted for shipping containers used to transport other types of perishable items. Alternately, frozen material can additionally be placed in the chamber **217**.

[0053] The center section **250** of the shipping container **200** includes a cavity or void volume **260** (i.e., the refrigerated volume), preferably formed therein. The void volume **260** is sized to contain and constrain the perishable cargo/products, thus surrounding the cargo with an insulating material. The top or lid section allows the cargo/products to be retained within the void volume **260** of the center section. Additionally, the top or lid is used to thermally seal the void volume **260**, as well as the entire shipping container **200**.

[0054] The lower or bottom section **210** is designed to mate with the center section **250** to form the body of the shipping container **200**. Note that the tapered base portion **250a** of FIG. 6B is designed to snap into a receiving portion **210a** of FIG. 5b and be maintained therein in a friction fit. When mated, the channel portions **220** and **230** in the center section communicate with the channel **215** in the bottom section to recirculate air throughout the void volume **260** and into contact with the frozen material in the bottom section **210**. Note that, in the instant embodiment an opening **250b** permits the cargo stored in the center section to extend into the chamber **217** of the bottom section. As such, one particular embodiment, flower stems from cut flowers (or plant roots, if live plants are being shipped) can be passed into the chamber **217**, which can include water or a wet sponge (or even soil, if live plants are being shipped), as described in connection with the embodiment of FIGS. 1-3. Alternately, additional frozen material may be placed in the chamber **217**, and/or the chamber **217** may be merged with the channel **215** to put a greater volume of frozen material in circulation path. Further, if desired, the chamber **217** can be omitted. Additionally, if desired, the opening **250b** may be omitted or provided with a floor section to separate the void volume **260** from the chamber **217** (which may be filled with additional frozen material) and provide a base for cargo stored in the void volume **260**.

[0055] As in the preferred embodiment of FIG. 4, a fan **270**, or other heat exchanger device, is located in or near the void volume **260** in direct communication with one of the channels, i.e., channel **220**, in order to force warmer air from the void volume **260** in the center section **250** into thermal contact with the frozen material in the bottom section **210**. The opening **230a** of the other channel **230** into the void volume **260** is left open, so that cool air from the bottom section **210** can be, likewise forced up the channel **230** and into the void volume **260** of the center section **250**. As noted above, additional channels may be provided to increase the airflow from the bottom section **210** into the center section **250**. However, in the present embodiment, two channels are preferred.

[0056] Note that, the void volume **260** of the center section **250** can be particularly shaped to receive and frictionally hold a particularly shaped cargo, such as a bucket, pot or box. Additionally, the channels **220** and **230** extend through the insulating material to open into a wider portion of the void volume **260** as openings **220a** and **230a** in the insulating material. In this way, the air is circulated into an uppermost portion of the void volume **260**.

[0057] Referring now to FIGS. 7-10, there is shown yet another embodiment of a shipping container **300** in accordance with the instant invention. The shipping container **300** operates on the same principle as the above-described embodiments. More particularly, temperature control is achieved by circulating moist, cold air from the top section **300a** of shipping container **300**, through the central section **300b** of the shipping container **300**, and into the bottom section **300c** of the shipping container **300**, via channels **310** and **320**. As with the previous embodiments, most preferably, the shipping container **300** is made from a rigid insulating material, such as polyurethane, polystyrene, other types of insulating foam, corrugated cardboard, etc.

[0058] One main difference between the shipping container **300** of the instant embodiment and the shipping containers of the previous embodiments is that, in the present embodiment, the frozen material is stored at the top of the shipping container **300**, rather than in the bottom section. More particularly, the top section **300a** of the shipping container **300** includes a top cavity **330** for receiving a frozen material, such as wet ice, dry ice, a frozen gel pack, etc. In the embodiment shown in the figures, the top cavity **330** is square in cross-section. However, this is not meant to be limiting, as it can be seen that other cross-sectional shapes could be provided and still work with the instant invention.

[0059] A bottom wall **335** of the frozen material cavity **330** separates the upper section **300a** from the central section **300b**. The bottom wall **335** can be chosen to be any material, as desired. However, in the preferred embodiment of the present invention, the bottom wall **335** is a thermal conductive, heat exchanger plate, upon which the frozen material is directly placed. Thus, an additional heat transfer mechanism is used to cool the perishable items in the central section **300b**. More particularly, the air below the bottom wall **335** is cooled by natural convection, and therefore falls to the bottom of the void volume. As such, in the instant embodiment, in addition to air flow through the channels **310**, **320**, air is circulated in the void volume by natural convection. The bottom wall **335** can be made from a thin member or membrane, such as a thin sheet of metal or rigid plastic. In a most preferred embodiment, the bottom wall **335** is a thin sheet of steel. In one preferred embodiment, the thickness of the thin member is chosen within the range of about 10-60 mils. In a more preferred embodiment, the thin member is chosen to be about 20 mils in thickness.

[0060] In one particular embodiment of the instant invention, if the frozen material is chosen to be wet ice, or another frozen material that melts to produce a liquid, the frozen material can be placed within the frozen material cavity **330**, leaving a void around the periphery of the frozen material. Then, if desired, a liquid absorbing material, such as potassium polyacrylamide hydrogel, which material absorbs hundreds of times its weight in liquid, can be placed in the void

left around the frozen material. An amount of the liquid absorbing material sufficient to absorb all of the liquid produced as the frozen material melts, is placed in the void around the frozen material. Thus the liquid is held in a gel or non-fluid state, so that liquid will not leak from the frozen material chamber **330**. The liquid absorbing gel additionally inhibits the flow of heat. As such, when placed around the periphery of the frozen material, the gel serves to better insulate the frozen material as it melts, thus allowing the frozen material to maintain intimate contact with the thermal exchanging bottom wall **335**, and maximize the cooling effect in the void volume **350**.

[0061] The uppermost open portion of the cavity **330** can be sealed by an upper lid **340**, a portion **340a** of which is sized to be received in the uppermost portion of the top cavity **330**, as shown more particularly in FIG. 8. A upper lid **340** additionally includes a flange portion **340b**, surrounding the portion **340a**, which further seals and insulates the top cavity **330**, by abutting the uppermost surfaces of the walls of the top section **300a**. The shipping container **300**, including the upper lid **340**, can be made from a rigid insulating material, such as polyurethane, polystyrene or other type of insulating foam or material.

[0062] The central section **300b** of the shipping container **300** includes a void volume **350**, into which perishable items, such as flowers, live plants, food products, etc., can be placed. If desired, the void volume **350** of the central section **300b** can be particularly shaped to receive and frictionally hold a particularly shaped cargo, such as a bucket, pot or box.

[0063] Because, of the location of the frozen material chamber at the top of the shipping container **300**, in the embodiment shown in FIG. 7, the void volume **350** is accessible via an opening **301** in one side of the central section **300b**. Once the perishable item(s) have been inserted into the void volume **350**, a compartment lid **360** can be used to close and seal the opening **301**. As shown more particularly in FIG. 7, the compartment lid **360** can, optionally, include support portions **365**, which are shaped to complete the curvature of the void volume and/or support the perishable items in a predefined position. Both the upper lid **340** and the compartment lid **360**, are designed to mate with the shipping container **300** so as to frictionally resist disengagement from the shipping container **300**, as well as, to provide an insulating, water-resistant seal.

[0064] In the present preferred embodiment, wherein plants and/or flowers are being shipped, the bottom section **300c** includes a well cavity **370**, for receiving water and/or the stems/roots of the articles to be shipped. If other perishable items are being shipped in the shipping container **300**, it can be seen that other modifications can be made to the bottom section **300c** to accommodate those items.

[0065] If plants/flowers are being shipped, if desired, water or another nutrient carrying material and/or a wetted sponge can be placed in the well chamber **370**, thus feeding the roots/stems of the items being transported. Additionally, if desired, the bottom section **300c** of the shipping container **300** can be molded to include, or can include an insert **375**, which permits the height of flower/plant bundles to be staggered. For example, referring more particularly to FIG. 9, the stems/root balls of four flower/plant bundles can be placed in the openings **370a**, **370b**, **370c**, **370d**, while the

stems of five flower/plant bundles can be supported by the solid portions **370e**, **370f**, **370g**, **370h**, **370i**. Staggering the flowers/plants in this way allows for the maximum utilization of the volume for plant/flower blossoms in the top portion of the central section **300b**.

[0066] Additionally, the water/nutrient fill line in the well chamber **370** is chosen to ensure that the roots/stems supported by the solid portions **370e**, **370f**, **370g**, **370h**, **370i** will also be maintained in water/nutrients. Note however, if the frozen material is able to keep the perishables sufficiently cold, water/nutrients may be omitted from the well chamber **370**. As stated above, the channels **310** and **320** run from the top section **300a**, through the central section **300b** and into the bottom section **300c**. More particularly, the channels **310** and **320** include openings into the frozen material cavity **330**, the void volume **350** and the well chamber **370**, thus permitting the air to be circulated, as described elsewhere herein.

[0067] Optionally, a battery powered fan **390**, or other heat exchanger device, can be located in communication with one of the of the channels, i.e., channel **320**, to pull warmer air from the void volume **350** up the channel **320**, which opens into the frozen material cavity at opening **320a**, and blow the air across the frozen material stored in the top section **300a**. Additionally, the fan circulates the chilled, humid air, back down into the void volume **350**, via the opening **310a** to the channel **310**. As noted elsewhere herein, additional channels may be provided to increase the airflow from the top section **300a** into the void volume **350**. However, in the present embodiment, two channels are preferred.

[0068] Additionally, in the present preferred embodiment, the central portion further includes the volumes or reservoirs **380a** and **380b**, which are in communication with both the well chamber **370** and the channels **310** and **320**, and which are separated from the void volume **350**. The reservoirs **380a** and **380b** are sized to hold most, if not all, of the water/nutrient contained in the well chamber **370** when the shipping container **300** is placed on any side, or on its top, preventing the water/nutrient from leaking out of the box or into the void chamber **350**.

[0069] Note that the top section **300a**, the bottom wall **335**, the central section **300b**, the bottom section **300c** and the insert **375** can all be formed of a single molded article. However, preferably, at least each of the top section **300a**, the bottom wall **335**, the central section **300b** and the bottom section **300c** are formed as separate articles that are fixed together using friction or, preferably, a weld or an adhesive, such as mastic. The portion **375** can additionally be formed integrally with the bottom section **300c**, or may be formed as a separate insert, which is fit into the well chamber **370** by friction, by weld or by adhesive.

[0070] Referring now to FIGS. **11** and **12**, there is shown a shipping container **400**, in accordance with another preferred embodiment of the present invention. The shipping container **400** is similar to the shipping container **300**, in that it is made from an insulating material and contains a frozen material cavity **430**, including a frozen material (**455** of FIG. **13**), which, optionally, can be surrounded along its periphery by a liquid absorbing material (**457** of FIG. **13**), and is sealed by an upper lid (not shown), a central section including a void volume **450** sized to receive a perishable item, and, if the shipping container is for shipping plants or flowers, a

well chamber including a support portion **475**. A compartment lid (not shown), similar to the compartment lid **360** of FIG. **7**, is additionally provided.

[0071] However, the embodiment of FIGS. **11** and **12** differs from that of FIGS. **7-10**, in that the present embodiment does not include air circulation channels between the frozen material cavity **430** and the void volume **450**. Rather, the instant embodiment, relies purely on air circulation caused by natural convention, to maintain the cool temperature in the void volume **450**. More particularly, a thin, heat conducting, thermal exchanger or membrane **435** is provided between the frozen material contained in the frozen material cavity **430**, and the void volume **450**. As discussed above, a thin sheet of metal, such as steel, or a thin rigid sheet of plastic may be used as the thermal exchanger **435**. Thus, warmer air rises to the top of the void volume **450** and is cooled at the bottom surface of the thermal exchanger **435**, thus causing chilled, air to fall back to the bottom of the void volume **450**. If the air is maintained suitably cold and has a high relative humidity, no further water or liquid nutrient need to be provided in the well cavity **470**, if flowers or plants are being transported. Alternately, a liquid or liquid soaked sponges may be provided in the well cavity **470**. Additionally, the well cavity **470** can include a support portion **475** to stagger the items being shipped, as described above in connection with portion **375** of FIGS. **7-10**.

[0072] Referring now to FIG. **13**, there is shown a further embodiment of a shipping container **400'**, made in accordance with the present invention. The shipping container **400'** is virtually identical to the shipping container **400**, with the exception that a thermally conductive heat exchanger **435'**, including heat transfer fins **445**, has been provided in place of the heat exchanger **435** of FIG. **12**. The heat transfer fins **445** have been added to the bottom of the heat transfer sheet or baffle, i.e., on the side of the heat exchanger present in the void volume **450**, to further enhance the heat transfer (i.e., provide a more heat exchanging surface area) between the air in the void volume and the frozen material disposed on the top of the heat exchanger **435'** in the frozen material cavity.

[0073] Referring now FIG. **14**, there is shown a further preferred embodiment of a shipping container **500**, in accordance with the present invention. The shipping container **500** is made from insulating materials, as previously described herein. Further, the shipping container **500** is shown as being constructed from multiple components, for example, having a separate top section **500a**, central section **500b**, bottom section **500c**, heat exchanger **510** and support **520**, mated together through fiction, a weld, adhesive or a combination of the above. Note that, if desired, the sections of the shipping container **500**, including the support **520** and a thin, rigid heat exchanger baffle **510**, can be molded as a unitary piece. As with the embodiments of FIGS. **7**, **11** and **13**, the shipping container **500** includes a frozen material chamber **530**, in which a frozen material is placed directly on the heat exchanger baffle **510**, sealed by an upper lid **540**. The bottom surface of the heat exchanger baffle **510** is located within a void volume **550**, in which perishable items are also located. The void volume **550** is sealed by a volume lid or door **580**. The support **520** can, of course, be omitted if not useful to the shipping of the perishable items contained within the void volume **550**.

[0074] In the present embodiment, channels (not shown), located between the frozen material cavity 530 and the well chamber 570, permit liquid from the melting frozen material to flow down into the well chamber 570. If flowers or plants are being shipped, this liquid is used to hydrate the stems or roots of the plants or flowers. Additionally, shipping container 500 includes volumes 560a and 560b, within the central portion, which, in the event the shipping container 500 is tipped onto its side, collects the liquid from the well chamber, thus preventing the items in the void volume 550 from getting wet.

[0075] It is important to note that, in the embodiments of FIGS. 7, 11, 13 and 14, the heat transfer mechanism using a heat exchange sheet or baffle (335, 435, 435') is independent of any water or any liquid contained in a well chamber (370, 470) of the shipping container. Rather, both the heat transfer mechanism and the well chamber can be employed, in various combinations, to maximize the lifetime of the perishable items.

[0076] Referring now to FIGS. 15, 16, 17 and 18A-18C, there is shown a further embodiment of a shipping container 600, made in accordance with the present invention. The shipping container 600 is made from insulating materials, as previously described herein. Further, the shipping container 600 includes a body 610, a lid 620 and at least one cooling material pan assembly 630. As shown more particularly in FIGS. 15 and 16, one particular preferred embodiment includes two cooling material pan assemblies 630. Note that, if desired, more or fewer pan assemblies 630 can be used, and the body 610, correspondingly, would be adapted to hold them.

[0077] The body 610 includes a void volume 610a, in which perishable items are also located. The void volume 610a is sealed by a volume lid or door 620. As shown more particularly in FIG. 16, the volume lid 620 of the present embodiment includes a body portion 620a that nests tightly into the top portion of the volume void 610a, and a flange portion 620b, surrounding the body portion 620a, to help seal the void volume 610a and maintain the cool air therein. In the present embodiment, the body portion 620a is received and held in the void volume 610a in a friction fit. However, this is not meant to be limiting, as other methods and devices can be used to retain the lid 620 in contact with the body 610.

[0078] Additionally, as shown in FIGS. 15 and 16, the body 610 includes the chambers or volumes 610b, which open into the void volume 610a. The volumes 610b are each seized to receive a pan assembly 630, therein. However, in the present preferred embodiment, the depth of the volumes 610b are greater than the depth of the cooling material pan assemblies 630. Thus, in this particular embodiment, when the pan or tray portions 630a of the pan assemblies 630 are nested in the volumes 610, there exists an air gap 640 between the bottom surfaces of the pan portions 630a and the back walls (i.e., the wall facing the opening into the void volume 610a) of the volumes 610a. More particularly, when a cooling material receiving chamber portion 635 of the pan portion 630a of the cooling material pan assembly 630 is fitted into the volume 610b, a lip or flange 637 on the pan portion 630a remains outside the volume 610b, in contact with the surface of one wall of the void volume 610. The flange 637 thus maintains the pan portion 630a, and result-

antly, the bottom surface of the chamber 635, above the bottom surface of the volume 610b, creating the air gap 640. The air gap 640 separates the bottom of the pan 630a from the back wall of the volume to minimize heat transfer from the body into the pan portions, and thus to the ice or other frozen material stored in the pan portion 630a.

[0079] As shown more particularly in FIGS. 17 and 18A-18C, each of the cooling material pan assemblies 630 includes a pan portion 630a, including a cooling material or frozen material chamber 635, and a foil portion 630b. Additionally, the cooling material/frozen material chamber 635 is surrounded by a flange, permitting the pan portion 630a to be maintained in contact with the foil 630b. A heat exchanger material, such as foil, is used to line the void volume 610a of the shipping container 600. In the present particular embodiment, each the cooling material pan assembly 630 includes one pan or tray portion 630a and one heat exchanger sheet portion 630b, folded into three sections A, B and C. Note that this is not meant to be limiting, as other sheet configurations could be used. For example, the void volume can be lined with separate heat exchanger sheets, only two of which are in contact with the pan portions 630a. Alternately, the heat exchanger sheets 630b can be folded into sections A and B, only, such that one section of each sheet covers only one pan portion 630a, while the other section covers one of the wall of the void volume or the bottom of the body section 620a of the lid 620.

[0080] However, in the present preferred embodiment, each sheet 630b is folded into three sections, A, B and C, wherein the section B covers the flange portion 637 and the opening to the frozen material chamber 635 of the pan portion 630a. The remaining sections A and C can be overlapped in the void volume 610a, such that a section from each of the two sheets 630b covers the bottom wall of the void volume 610a and the bottom surface of the body portion 620a of the lid 620. Note that, in such a configuration, the sheets 630b do not cover the end walls of the void volume 610a. Additional heat exchanger sheets can be provided to cover these end walls, or they can be left uncovered. Alternately, the sheets 630b can be cut so as to have an additional portion (which may be formed with one or both of the sections A and/or C) that can be used to cover the end walls.

[0081] In the most preferred embodiment, the pan portions 630a are made from a plastic, polymer or other insulating material. However, if desired, the pan portions 630a can be made of a metal and/or foil material, such as aluminum. Additionally, in the most preferred embodiment, the heat exchanger sheet 630b will be a thermally conductive metal foil sheet, such as aluminum foil. However, instead of a foil material, the heat exchanger sheet 630b can be made of another type of material. For example, the heat exchanger sheet 630b can be made of a rigid or flexible plastic, metal and/or other type of foil material. In practice, the thermally conductive sheets 630b line the walls of the void volume, so as to transfer heat into ice or other frozen material stored in the pan portions 630a. Thus, the sheets 630b act as heat exchangers in the system. Additionally, the sheets 630b help maintain a uniformly low temperature throughout the void volume 610a.

[0082] In one particular preferred embodiment of the invention of FIGS. 15-18C, the sheet 630b is sealed to the

pan portion **630a**, prior to insertion into the volumes **610b**. As such, any liquid produced by the melting of the ice or other frozen material remains within the chamber **635**, and does not flow into the void volume **610a** of the shipping container **600**.

[0083] In one particular embodiment of the present invention, in order to produce the pan assembly **630**, ice or another frozen material can be placed into the chamber **635** of the pan portions **630a**, after which, the sheet **630b** is sealed to the flange **637** of the pan portion **630a**, entrapping the cooling material, ice or other frozen material therein. Alternately, water or another liquid can be placed into the chamber **635**, prior to the sheet **630b** being sealed over the flange **637** of the pan portion **630a**. Subsequently, the water or other liquid sealed therein, can be frozen or cooled within the pan assembly **630**. When using the “U” shaped sheet, as shown in FIGS. 17, 18A and 18C, the pan portion **630a** is preferably sealed to the middle or “B” section of the sheet **630b**. The sheet **630b** can be sealed to the flange **637** of the pan portions **630a** in known ways, such as by adhesive and/or sonic welding.

[0084] The shipping container can be used by preparing the pan assemblies **630**, such that they include a chilled and/or frozen material sealed within the chamber **635**. Each pan assembly **630** is then placed within one of the volumes **610b** of the shipping container **600**. The chamber **635** of the pan assembly is, preferably, sized to be received and maintained within the volume in a friction fit, while the flange **637** overhangs the volume **610b**, contacting the walls of the void volume **610a**, surrounding the opening to the volume **610b**. In the presently preferred embodiment, one foil section A or C from each of the pan assemblies **630b** overlaps onto the floor of the void volume **610a** of the shipping container **600**. Prior to overlapping/closing the remaining foil section A or C of each pan assembly **630**, a perishable item to be shipped can be placed on top of the overlapped sheet sections on the bottom surface of the void volume **610a**. After the perishable item is placed and/or secured within the void volume **610a**, the remaining sheet sections A or C of the pan assemblies can be overlapped, placed and or folded over the perishable item.

[0085] The body section **620a** of the lid **620** would then be placed into the void volume **610a**, over the latter described, overlapped, sheet sections, until the lid **620** securely closes the shipping container **610** (i.e., the flanges **620b** of the lid **620** contacting the upper end surfaces of the walls of the shipping container **600**).

[0086] As described in connection with the previous embodiments, the void volume **610a** can be made into any desired shape to accommodate any particular item to be shipped. Additionally, as stated above, if desired, more or fewer pan assemblies **630** can be used, by providing more or fewer volumes **610b** within the body **610** of the shipping container.

[0087] Note that the described embodiments are exemplary and that the above invention is not meant to be limited only to its preferred embodiments. It can be seen that other modifications can be made to the preferred embodiments and still be within the spirit of the present invention.

What is claimed is:

1. A shipping container, comprising:

a container housing, including a plurality of interior walls defining a central interior chamber;

at least one cooling material chamber formed in an interior wall of said container housing for receiving a cooling material, said at least one cooling material chamber opening into said central interior chamber; and

a heat exchanger, in communication with at least said interior wall, between said at least one cooling material chamber opening and said central interior chamber.

2. The shipping container of claim 1, wherein said heat exchanger is a thermally conductive member disposed between said at least one cooling material chamber opening and said central interior chamber.

3. The shipping container of claim 2, wherein said thermally conductive member is one of a rigid sheet of plastic and a sheet of metal.

4. The shipping container of claim 1, wherein the cooling material is a frozen material.

5. The shipping container of claim 4, wherein the frozen material is ice.

6. The shipping container of claim 1, wherein said at least one cooling material chamber is sized to receive a pan therein, said pan including a pan chamber for receiving the cooling material.

7. The shipping container of claim 6, wherein said pan chamber is surrounded by a flange.

8. The shipping container of claim 7, wherein said flange is in communication with said heat exchanger.

9. The shipping container of claim 7, wherein said flange is sealed to a portion of said heat exchanger, such that the cooling material contained within said pan chamber is sealed therein.

10. The shipping container of claim 1, wherein said heat exchanger is a foil sheet.

11. The shipping container of claim 1, wherein said heat exchanger is a foil sheet, folded into a “U”-shaped configuration.

12. The shipping container of claim 1, wherein said at least one cooling material chamber is sized to receive a pan therein, said pan including a pan chamber for receiving the cooling material, said pan chamber being surrounded by a flange in communication with said heat exchanger.

13. The shipping container of claim 12, wherein said flange is sealed to the heat exchanger, such that a cooling material contained within said pan chamber is sealed therein.

14. The shipping container of claim 13, wherein said flange remains in said central interior chamber when said pan chamber is disposed in said cooling material chamber.

15. The shipping container of claim 14, wherein the depth of said pan chamber is less than the depth of said cooling material chamber, such that a bottom surface of said pan chamber does not contact a bottom surface of said cooling material chamber when said pan chamber is disposed in said cooling material chamber.

16. A shipping container, comprising:

a container housing, including a plurality of interior walls defining a central interior chamber;

a lid formed to close an opening into said central interior chamber;

a first cooling material chamber formed in a first interior wall of said container housing for receiving a cooling material;

said first cooling material chamber opening into said central interior chamber;

a first heat exchanger, in communication with at least said first interior wall, between said first cooling material chamber opening and said central interior chamber; and

17. The shipping container of claim 16, further including:

a second cooling material chamber formed in a second interior wall of said container housing for receiving a cooling material;

said second cooling material chamber opening into said central interior chamber; and

a second heat exchanger member in communication with at least said second interior wall, between said second cooling material chamber opening and said central interior chamber.

18. The shipping container of claim 17, further including:

a first pan removably disposed within said first cooling material chamber, said first pan including a first pan chamber for receiving the cooling material, said first pan chamber being surrounded by a first flange in communication with said first heat exchanger; and

said first flange remaining in said central interior chamber when said first pan chamber is disposed in said first cooling material chamber.

19. The shipping container of claim 18, further including:

a second pan removably disposed within said second cooling material chamber, said second pan including a second pan chamber for receiving the cooling material, said second pan chamber being surrounded by a second flange in communication with said second heat exchanger; and

said second flange remaining in said central interior chamber when said second pan chamber is disposed in said second cooling material chamber.

20. The shipping container of claim 18, wherein the depth of said first pan chamber is less than the depth of said first cooling material chamber, such that a bottom surface of said first pan chamber does not contact a bottom surface of said first cooling material chamber when said first pan chamber is disposed in said first cooling material chamber.

21. The shipping container of claim 19, wherein said first flange is sealed to said first heat exchanger and said second flange is sealed to said second heat exchanger.

22. The shipping container of claim 21, wherein each of said first heat exchanger and said second heat exchanger is “U” shaped, and wherein said first flange is sealed to the middle portion of said first heat exchanger and said second flange is sealed to the middle portion of said second heat exchanger.

23. A container for transporting plants or flowers, comprising:

a container housing, including interior walls defining a central interior chamber for receiving the plants or flowers;

at least one cooling material chamber formed in an interior wall of said container housing for receiving a cooling material, said at least one cooling material chamber opening into said central interior chamber; and

a heat exchanger, in communication with at least said interior wall, between said at least one cooling material chamber opening and said central interior chamber.

24. A shipping system, comprising:

a container housing, including a plurality of interior walls defining a central interior chamber; and

an insert removably received within said central interior chamber in communication with at least one of said plurality of interior walls;

said insert including:

a pan portion a pan chamber for receiving a cooling material; and

a heat exchanger in communication with at least a portion of said pan portion.

25. The shipping system of claim 24, wherein said pan portion includes a flange surrounding said pan chamber, said flange being in communication with said heat exchanger.

26. The shipping system of claim 25, wherein said heat exchanger is sealed to said flange.

27. The shipping system of claim 25, wherein said heat exchanger is a metal sheet.

28. A cooling insert for insertion into a shipping container, the cooling insert comprising:

a pan portion a pan chamber for receiving a cooling material therein, and a flange surrounding an opening to said pan chamber; and

a heat exchanger sealed to said flange.

* * * * *