

TITLE**PRESSURE-BASED PACKAGING SYSTEM AND METHOD**FIELD OF THE INVENTION

[001] The present invention relates to the field of packaging of products by way of pressure-based and friction-fit containment systems and methods.

BACKGROUND

[002] Typical packaging requires using a number of different containment pieces with a number of different surfaces to hold an article, typically a fragile or easily breakable object, in place while shipping, handling, and putting on display. These containment pieces tend to be plastic, Styrofoam, cardboard, bubble wrap, or combinations of the same. Additionally, these containment pieces create large amounts of waste when no longer used, are difficult to dispose without negative environmental impacts, and/or require the primary box holding the articles to use more material itself to prevent either one of the article or the containment piece from coming loose or falling out in operation.

[003] Fragile or easily broken objects pose unique issues for consumers since their value is tied to their appearance and lack of fractures or other signs of damage from the factory to the point of sale. Thus, consumers desire packaging that allows them to fully view their fragile articles to ensure purchase of undamaged merchandise. Likewise, firms that package and/or sell such articles would desire easier means to conduct quality control on the end products leaving the factory or packaging center.

[004] A drawback to current article packaging solutions is the failure to present a number of non-identical articles in an aesthetically appealing arrangement within the package itself. This limitation is even more evident in the lack of such presentation-friendly packaging for fragile or easily damaged articles.

[005] There is a need for a solution that resolves one or more of the aforementioned issues in whole or in part.

SUMMARY

[006] An exemplary pressure-based packaging system may comprise a walled structure with an inner surface, an outer surface, and a floor. In this exemplary pressure-based packaging system, one or more openings may exist in the walled structure from the inner surface to the outer surface.

This exemplary pressure-based packaging system may have a lower frame bounded on a plurality of sides by the inner surface of the walled structure and the lower frame has an upper surface, a lower surface, and spaces between the upper and lower surface of this lower frame. This exemplary pressure-based packaging system may also have an upper frame bounded on a plurality of sides by the inner surface of the walled structure and the upper frame has an upper surface, a lower surface, and spaces between the upper and lower surface. This exemplary pressure-based packaging system may be configured so that the spaces in the lower frame are either parallel with or concentric with the spaces in the upper frame.

[007] An exemplary pressure-based packaging system may comprise a walled structure with an inner surface, an outer surface, a floor, and a cover for the walled structure. In this exemplary pressure-based packaging system, one or more openings may exist in the walled structure from the inner surface to the outer surface. This exemplary pressure-based packaging system may have a lower frame bounded on a plurality of sides by the inner surface of the walled structure and the lower frame has an upper surface, a lower surface, and spaces between the upper and lower surface of this lower frame. This exemplary pressure-based packaging system may also have an upper frame bounded on a plurality of sides by the inner surface of the walled structure and the upper frame has an upper surface, a lower surface, and spaces between the upper and lower surface. This exemplary pressure-based packaging system may be configured so that the spaces in the lower frame are either parallel with or concentric with the spaces in the upper frame.

[008] An exemplary pressure-based packaging system may comprise a walled structure with an inner surface, an outer surface, and a floor. In this exemplary pressure-based packaging system, one or more openings may exist in the walled structure from the inner surface to the outer surface. This exemplary pressure-based packaging system may have a lower frame bounded on a plurality of sides by the inner surface of the walled structure and the lower frame has an upper surface, a lower surface, and spaces between the upper and lower surface of this lower frame. This exemplary pressure-based packaging system may also have an upper frame bounded on a plurality of sides by the inner surface of the walled structure and the upper frame has an upper surface, a lower surface, and spaces between the upper and lower surface. This exemplary pressure-based packaging system may be configured so that the spaces in the lower frame are either parallel with or concentric with the spaces in the upper frame and at least one of the spaces in the upper structure is a cavity from the upper surface to the lower surface.

[009] An exemplary pressure-based packaging system may comprise a walled structure with an inner surface, an outer surface, and a floor. In this exemplary pressure-based packaging system, one or more openings may exist in the walled structure from the inner surface to the outer surface. This exemplary pressure-based packaging system may have a lower frame bounded on a plurality of sides by the inner surface of the walled structure and the lower frame has an upper surface, a lower surface, and spaces between the upper and lower surface of this lower frame. This exemplary pressure-based packaging system may also have an upper frame bounded on a plurality of sides by the inner surface of the walled structure and the upper frame has an upper surface, a lower surface, and spaces between the upper and lower surface. This exemplary pressure-based packaging system may be configured so that the spaces in the lower frame are either parallel with or concentric with the spaces in the upper frame and a majority of the sides of the upper frame that are bounded by the walled structure are substantially collinear with the sides of the lower frame that are bounded by the walled structure.

[010] An exemplary pressure-based packaging system may comprise a walled structure with an inner surface, an outer surface, and a floor. In this exemplary pressure-based packaging system, one or more openings may exist in the walled structure from the inner surface to the outer surface. This exemplary pressure-based packaging system may have a lower frame bounded on a plurality of sides by the inner surface of the walled structure and the lower frame has an upper surface, a lower surface, and spaces between the upper and lower surface of this lower frame. This exemplary pressure-based packaging system may also have an upper frame bounded on a plurality of sides by the inner surface of the walled structure and the upper frame has an upper surface, a lower surface, and spaces between the upper and lower surface. This exemplary pressure-based packaging system may be configured so that the spaces in the lower frame are either parallel with or concentric with the spaces in the upper frame. In this exemplary pressure-based packaging system, each of the upper frame and the lower frame is recyclable.

DESCRIPTION OF THE DRAWINGS

[011] Figure 1 is an isometric view of exemplary pressure-based package containing articles.

[012] Figure 2 is an exploded view of the exemplary pressure-based package containing articles in Figure 1.

[013] Figure 3 is an isometric view of another exemplary pressure-based package containing articles.

[014] Figure 4A is an isometric view of the exemplary pressure-based package containing articles in Figure 3 without a top containment side.

[015] Figure 4B is a partial transparent isometric view of the exemplary pressure-based package containing articles in the configuration illustrated by Figure 4.

[016] Figure 4C is a partial transparent profile view of the pressure-based containments for an exemplary pressure-based package containing articles.

[017] Figure 5A is a partial transparent isometric view of the pressure-based containments for an exemplary pressure-based package containing articles.

[018] Figure 5B is a partial transparent and exploded view of the pressure-based containments for an exemplary pressure-based package containing articles.

[019] Figure 6A is another partial transparent and exploded view of the pressure-based containments for an exemplary pressure-based package containing articles.

[020] Figure 6B is yet another partial transparent and exploded view of the pressure-based containments for an exemplary pressure-based package containing articles.

[021] Figures 7A-B are exploded views of the pressure-based containments for an exemplary pressure-based package system.

[022] Figure 8A is an isometric view of an exemplary outer containment for articles to be held by an exemplary pressure-based package system.

[023] Figure 8B is an isometric view of an exemplary pressure-based package system holding articles within the outer containment of Figure 8A.

[024] Figure 9 is an exemplary method of design and manufacturing of an exemplary pressure-based package system.

[025] In the drawings like characters of reference indicate corresponding parts in the different and interchangeable and interrelated figures. Parts and components of each figure may be substitutes for other components in other figures to achieve the various methods and embodiments disclosed herein. Methods and protocols disclosed in any embodiment may be run in any order so as to affect their disclosed goals and/or enable performance of the systems as described. Additionally, any one embodiment may utilize any method or protocol described and in any portions, sequences, and combinations thereof.

DETAILED DESCRIPTION

[026] In an embodiment illustratively exemplified by Figure 1, a pressure-based packaging system 100 may be shown with a cover containment component or cover 10, a walled containment component or box 20, and an optional fixation device 11 (such as a formed strap, tie, clamp, or other form of packaging restraint known to those skilled in the art). In an exemplary walled containment 20, one or more openings 21 may be formed through the containment walls to expose one or more articles 40 held within the pressure-based packaging system 100. In an exemplary embodiment, one or more of cover 10, box 20, and fixation device 11 may be made from plastic, metal, cardboard, wood, or any other material suitable for packaging purposes. In a preferred embodiment, cover 10 and box 20 may be made of cardboard, while fixation device 11 may be made of a high caliper paper or plastic. In another exemplary embodiment, cover 10, box 20, and fixation device 11 may individually or in any combination be made out of recyclable materials. While containment 20 may be in the form of a box, it may be contemplated that containment 20 may have any cross-section and/or shape capable of storing contents therein, e.g., cylindrical, hexagonal, square, or triangular.

[027] While Figure 1 shows an exemplary pressure-based packaging system 100 with a fixation device 11, such an exemplary system may be created using fixation devices 11 disposed on one or more of box 20 and/or cover 10 as illustratively provided in Figure 3. Exemplary fixation devices 11 may include non-permeable adhesives, friction-fit, snap fit, Velcro, double sided tapes, rubber gaskets/bands about box 20's outer perimeter, or compression folds or creases.

[028] With reference to the illustrative embodiment of Figure 2, a pressure-based packaging system 100 may contain within box 20 and cover 10 a plurality of items to keep articles 40 substantially immovably in place during handling of the system 100. As shown, in an exemplary pressure-based packaging system 100, an upper pressure frame 30 may be configured to fit over and around different aspects of articles 40 located beneath and next to it within box 20. Opposite upper pressure frame 30 may be lower pressure frame 50, which, like upper pressure frame 30, may be configured to fit under and around different aspects of articles 40 located above and next to it within box 20. As illustratively provided, exemplary pressure frames 30 and 50 may be substantially bounded at their peripheries by sides 22 of box 20. In an exemplary embodiment pressure frames 30 and 50 may be made out of the same or different materials as cover 10, box 20, or fixation device 11. In a preferred embodiment, pressure frames 30 and 50 may be made from

cardboard or high caliper paper. In another preferred embodiment, pressure frames 30 and 50 may be made from recyclable material. In yet another preferred embodiment, pressure frames 30 and 50 may be made from foldable plies with perforated edges and tear points to achieve the pressure-based packaging system 100 disclosed. It may also be appreciated that an exemplary pressure frame 30 and/or 50 may have any thickness, cross-section, and/or shape to fit within a corresponding containment 20, e.g., cylindrical, circular, ovular, triangular, square. Alternatively, a particular frame 30/50 may have a different shape than the shape of the containment 20 into which it may be placed, e.g., triangular frames 30/50 to be placed within a square containment 20 box, circular frames 30/50 to be placed within a hexagonal cross-section containment 20 box.

[029] Referring to the illustrative embodiment of Figure 4A, an exemplary pressure-based packaging system 100 may be shown without a cover 10 and exposing the upper surface 30A pressure frame 30 with articles 41, 42, 43, 44, and 45 disposed therein.

[030] According to the illustrative embodiment of Figure 4A, articles 41 and 45 may be sized so as to be almost as high as the walls of box 20. In one aspect of the pressure-based packaging system 100, an exemplary pressure frame 30 may sufficiently apply pressure at borders 31 to articles 41 and 45 so as to prevent their movement when resting in box 20 and against inner wall 20A of box 20. In a preferred embodiment, border 31 may apply sufficient pressure when loaded into box 20 to conform to the major cross-sectional shape of articles 41 and 45, which in this embodiment is rectilinear, at a position furthest from their center of gravity. In this way, pressure frame 30 may be configured based on the articles it is meant to hold by placing openings found therein at sufficient locations (e.g., at the upper surface 30A of frame 30) and in sufficient geometries to reduce the tendency of articles to move in response to forces on package system 100. One such way, as may be illustrated with border 31 of pressure frame 30, may be to place the border as far away from the article's center of gravity to counteract any undesirable moments or forces causing the article to move during transport.

[031] According to the illustrative embodiment of Figure 4A, articles 42 and 43 may be sized so that their uppermost portions are retained within cylindrical cavities 32 and 33, respectively. Cylindrical cavities 32 and 33 may be preferred retainment mechanisms of an exemplary upper frame 30 where articles, such as articles 42 and 43, have caps, stoppers, covers, or other upper structures that are substantially cylindrical in cross-section and smaller in cross-section than the remainder of the articles 42 and 43, respectively. While Figure 4A illustrates cavities 32 and 33

as cylindrical with circular cross sections, cavities 32 and/or 33 may be any other polygonal cross-section designed to retain a particular article within box 20 in the package system 100. In an exemplary configuration, all contours on the periphery of frame 30 may be deemed a type of border 31 while all openings through frame 30's thickness in its surface 30A may be deemed a type of cavity 32/33.

[032] Referring again to the illustrative embodiment of Figure 4A, upper frame 30 may have a space-saving reduction 37, such as a chamfer or fillet, to minimize waste while maintaining substantial pressure-contact with wall 20A of box 20. While reductions 37 may be shown topographically on the upper surface 30A in upper frame 30, similar reductions 37 may be located orthogonally to the surface 30A for upper frame 30 within box 20.

[033] Referring to the illustrative embodiment shown by Figure 4B, an exemplary box 20 may be shown in transparent to illustrate the interoperation between upper frame 30, lower frame 50, articles 41, 42, 43, 44, 45, and 46, and box walls 20A. According to the illustrative embodiment of Figure 4B, an exemplary upper frame 30 may be nested within walls 20A of box 20 such that peripheral faces 31A of frame 30 are in substantially tight, and preferably friction or pressured, fitting arrangement with walls 20A. As provide for in Figure 4B, articles 41, 42, 44, and 46 are shown in dashed lines to allow for ease of viewing the interior of box 20. Each of the aforementioned articles may be illustrated as retained on a lower surface 30B of upper frame 30 and/or through the space bounded by borders 31 and/or cavities 32/33. For example, annotation 42 points to the dashed lines showing the outline of the upper structure of article 42 that is held within cavity 32 in upper frame 30. As again illustrated, borders 31 retain the outermost surfaces of articles 41 and 45 against walls 20A of box 20.

[034] Referring still to Figure 4B, each of the articles 41, 42, 43, 44, 45, and 46 may be retained on their lower-most surfaces by one or more inserts 52, 53, 54, and 56 in base frame 50 or may be bounded by a border 50B of the base frame 50 so that the lower-most surface of the particular insert remains in substantial contact with the floor 20B of box 20. For example, articles 42, 43, 44, and 46 may be bounded on their lower-most surfaces by inserts 52, 53, 54, and 56 of base frame 50. In an exemplary embodiment, inserts 52, 53, 54, and 56 may be disposed a distance from base frame surface 50A to provide sufficient resistance against movement by the articles during handling of pressure pack system 100. In an exemplary embodiment, inserts 52, 53, 54, and 56 may be bounded by frame surface 50A and ramp surfaces 51, which may act as positioning

and/or removal points of articles 42, 43, 44, and 46 when applying them or removing them from base frame 50.

[035] Figures 5A and 5B provide additional exemplary illustrative views of a pressure packaging system 100 like that in Figure 4B, this time showing upper frame 30 in transparency to view its situation vis-à-vis articles 41, 42, 43, 44, and 45. In addition, lower frame 50 may be further illustrated with fillet edges 55 on junctions between inserts and lower frame face 50A and lower frame border 51A. Figures 6A and 6B may show another vantage point of the pressure packaging system 100 like that in Figures 4B, 5A, and 5B, with the difference being that the articles 41, 42, 45, and 46 may appear in transparency.

[036] In the exemplary embodiment illustrated by Figure 4B, box 20 may provide for two openings in its walls, 21 and 22, through which users can view articles 41, 43, and 44 and 42, 45, and 46, respectively. In this way, the pressure-based packaging system 100 may use its upper frame 30 and base frame 50 to hold articles in place from movement from above and below in such ways to eliminate the need for side-ways containment via box 20. As a result, less material may be needed to construct box 20 and/or box 20 may be more viewer-friendly at the point of sale by allowing consumers to view all goods located within box 20 but without ever having to fully open box 20.

[037] Referring to Figure 4C, which is the cross-section C-C from Figure 4B, an exemplary arrangement of upper frame 30 and lower frame 50 may be shown with articles 42 and 43 disposed therein. An exemplary upper frame 50 may have a top surface 30A, a bottom surface 30B, and borders 31A located therebetween. In an exemplary upper frame 30, there may be passages through its thickness in the form of cavities 33 and 32. In one exemplary embodiment, a cavity 33 may be uniform in cross-section through upper frame 30 whereas another cavity 32 may be smaller at surface 30A and be a larger cavity 32A proximal to surface 30B.

[038] With further reference to Figure 4C, the lower frame 50 may be shown with its inserts 52 and 53 serving as repositories for articles 42 and 43, respectively. Borders 51A may bound lower frame 50 and its underside 50B may provide a series of bends and other extensions to support the frame when situated in box 20. In an exemplary embodiment, lower frame 50 may be a series of folded pieces of cardboard or high-density paper.

[039] Referring to the illustrative embodiment of Figure 7A and Figure 7B, exemplary upper frame 30 and lower frame 50 may be shown in isolation from the pressure-based packaging system.

According to Figures 7A and 7B, upper frame 30 and lower frame 50 may be designed and configured based on the dimensions of the inserts and/or cavities in one or the other. For example, by knowing the maximum lower diameter of an article, maximum upper diameter of the article, and its height, a program may dictate the size and shape of the corresponding insert and ramp in lower frame 50 and corresponding cavity or border in upper frame 30. As may be illustratively shown, each of the borders 31A and 51A may have a substantially collinear correspondence. In certain embodiments, an insert 51 may be concentric with a cavity 32/33 as the case may be for a particular article. Alternatively, an insert 51 may not have any corresponding cavity 32/33 in upper frame 30 by virtue of the thickness of the upper frame 30 which would instead rest atop the article like a seat and not envelop its upper extremity. With particular reference to Figure 7B, an exemplary lower frame 50 may have a structural support 56 disposed on its lower surface 50B to provide support to lower frame 50 when situated within an exemplary box 20.

[040] As illustratively shown in Figures 8A and 8B, an exemplary box 60 may have multiple openings 21, 22, 23, and 24 in its walls while leaving sufficient wall space 60A for bounding an exemplary upper frame 30 and lower frame 50, as previously described. Accordingly, the benefits associated with the pressure-based packaging system may be such that an exemplary box 60 may provide an almost complete view of all of its contents, which will be held in place above and below the openings in its walls through the upper frame 30 and lower frame 50 interaction with the articles contained therein.

[041] Illustrative upper frames 30 and lower frames 50 may be made from folded sheets of cardboard that may be pressed in appropriate locations to form the aforementioned cavities 32/33, inserts 51, and space-saving/size reducing features 37 and 55 on the upper frame 30 and lower frame 50, respectively. The folding and cardboard pressing/manipulation described may be accomplished according to known techniques in the art. In a further exemplary embodiment, automation may be used to determine the resulting upper frame 30 and/or lower frame 50 for any given box 20/60 provided sufficient information is given about the dimensions of the articles and the box 20/60 into which they must fit as well as their orientation and desired viewing scheme from any openings in box 20/60.

[042] In an exemplary embodiment, the pressure between upper frame 30 and lower frame 50 may be sufficiently created through the press-fit interaction between upper frame 30 and walls 20A/60A of an exemplary box 20/60. However, use of cover 10 and/or retainer 11 may enhance

the degree of pressure exerted on an article or articles disposed between upper frame 30 and lower frame 50.

[043] According to an exemplary methodology illustratively provided for in Figure 9, a user-interface, such as a computer or terminal device, may be provided in which the user can define the dimensions of the articles 40 needed for packaging, as well as dimensions of the containment 20, cover 10, and any openings 11 in the same.

[044] Referring to the illustrative methodology of Figure 9, a user provides one or more inputs 901 to the system 900, such as, for example, containment 20 dimensions (size, width, thickness of walls, length), article 40 dimensions (size, width(s), contours), containment openings (size, width, location about containment 20), and/or article 40 position (spacing between articles 40, which article is adjacent to which article, distance between article 40 and containment wall 20A). In an exemplary embodiment, the user interface may allow users to arrange their articles with the dimensions entered in three-dimensional, computer-aided design (“CAD”) renderings. In another exemplary embodiment, the user interface may comprise a topographic and profile view of the articles 40 within the containment 20 based on the user inputs 901.

[045] Alternatively, according to an exemplary embodiment, system 900 may optimize the space of containment 20 for article 40 placement using one or more containment space optimization processes 905. The containment space optimization processes 905 may comprise optimization algorithms and techniques known to those skilled in the art, such as, for example, the dynamic optimization techniques and algorithms described in Ashwini R Kothawade and Manoj E Patil. Review on Cargo Space Optimization Methodologies. International Journal of Computer Applications 162(3):31-34, March 2017; Tom Jose V and Sijo M T, Praveen, “Cargo Loading using Dynamic Programming and Comparative Software Study”, International Journal of Science, Engineering and Technology Research (IJSETR) ISSN: 2278 7798, Volume 2, Issue 2, pp. 1-4, February 2013; M. Zahid Gurbuz, Selim Akyoku, Ybrahim Emiroolu and Aysun Guran, “An Efficient Algorithm for 3D Rectangular Box Packing”, Applied Automatic Systems: Proceedings of selected AAS, Skopje, pp. 131-134, September 2009; E. Kanniga1, S. M. K. Srikanth and M. Sundhararajan, “Optimization Solution of Equal Dimension Boxes in Container Loading Problem using a Permutation Block Algorithm”, Indian Journal of Science and Technology, Volume 7, pp. 22-26, June 2014; H Gehring and A. Bortfeldt, “A Genetic Algorithm for Solving the Container Loading Problem”, Fern University Hagen,

pp. 1-24; and those of U.S. Patent No. 6,721,762, the algorithms and techniques disclosed in each of which being incorporated herein by reference in its entirety. Other similar optimization techniques known to those skilled in the art may be utilized to determine the appropriate spatial location of articles 40 within a containment 20 based on user inputs.

[046] In an exemplary embodiment, system 900 may resort to past placement schemes stored in memory 908 and apply some or all of the same to the containment space optimization process 905. In this way, an exemplary system 900 may resort to previous packaging optimizations that are substantially the same as the instant optimization within a particular range of statistical significance (e.g., the past scheme differs from the current by less than 5% in relevant dimensions).

[047] In another exemplary embodiment, system 900 may also retrieve data on particular articles, including their dimensions and past placement schema, from an Internet of Things (“IoT”) Server 909. For example, the system 900 may have imaging or key work search functionalities, including web crawling capabilities, to extract information needed for containment space optimization 905.

[048] Following completion of optimization routine 905, one or more output spacing schemes 907 may be generated and selected based on user needs. The output spacing schemes may be saved in any form to allow for user appreciation of the three-dimensional placement of the articles 40 within containment 20 identified by dimensions 901. In an exemplary embodiment, the output files may be in one or more of the following formats: STL, OBJ, FBX, COLLADA, 3DS, IGES; STEP, and VRML/X3D. An exemplary system 900 may then retrieve from the chosen output file the maxima and minima perimeter(s) and height(s) of all articles 40 depicted and use these to optimize the dimensions of boundaries 50A, 50B, 51, and article spaces 52-56 of lower frame 50 via step 910. In an exemplary embodiment, the output files may be in one or more of the following formats: STL, OBJ, FBX, COLLADA, 3DS, IGES; STEP, and VRML/X3D. An exemplary system 900 may then retrieve from the chosen output file the maxima and minima perimeter(s) and height(s) of all articles 40 depicted and use these to optimize the dimensions of boundaries 30B, 31, 31A, 32, 32A, and 33 of upper frame 30 via step 920.

[049] In an exemplary embodiment, step 910 takes place before step 920. In another exemplary embodiment, step 920 takes place before step 910. In yet another exemplary embodiment, steps 910 and 920 take place simultaneously. In a still further exemplary embodiment, steps 910 and 920 may start and end at the same time, but are processed intermittently while data analyzed during one optimization is used for optimizing data undergoing the other process. In other words, step

910 and step 920 may both start at the same time, but the finalization of step 910 may require data obtained during step 920 progression and the finalization of step 920 may require data obtained during step 910 progression. In this way, an exemplary system 900 may optimize the lower frame design 50 using the dimensions of upper frame design 30 and vice-a-versa.

[050] In an additional exemplary embodiment, the optimization techniques previously described may be used in steps 910 and 920, with the additional parameter that the size and amount of material utilized to make frames 50 and 30 be reduced wherever possible, such as to make surfaces like 37 that reduce the amount of frame 30 material used in the final packaging 100. Additional elements to consider in the step 910/920 analysis are the dimensions and materials of containment 20, cover 10, and presence of any fixation devices 11. For example, an exemplary optimization routine 910/920 may seek to use more material for frame 30 to allow for greater weight and/or friction fitting within wall 20A of containment 20 where a fixation device 11 is not used.

[051] With reference to Fig. 9, the exemplary steps 905, 910, and 920 may be implemented via software and algorithms as previously described. In the illustrative methodology shown in Fig. 9, step 930 may be realized with a physical implementation of the data outputs from steps 905, 910, and 920 using known manufacturing techniques in the art, such as, for example, cardboard or wood etching, automated perforation, automated cutting, CNC machinery, 3D printing, and sequenced deposition techniques. Such methods are known in the art, for example, as disclosed in U.S. Patent Application Publication No. 2007/0199648, which is incorporated herein by reference.

[052] While Fig. 9 provides an exemplary methodology for practicing the design and manufacturing method of the aforementioned pressure package system 100 and its constituent parts, other means of design and assembly of these parts may be accomplished with reference to other manufacturing techniques applicable to the materials comprising the components, such as, containment 20, lower frame 50, and upper frame 30.

[053] Many further variations and modifications may suggest themselves to those skilled in art upon making reference to above disclosure and foregoing interrelated and interchangeable illustrative embodiments, which are given by way of example only, and are not intended to limit the scope and spirit of the interrelated embodiments of the invention described herein.

The invention claimed is:

1. A pressure-based packaging system, comprising:
a walled structure with an inner surface, an outer surface, and a floor, wherein an opening exists in the box structure from the inner surface to the outer surface;
a lower frame bounded on a plurality of sides by the inner surface of the walled structure, wherein the lower frame has an upper surface, a lower surface, and spaces between the upper and lower surface; and
an upper frame bounded on a plurality of sides by the inner surface of the walled structure, wherein the upper frame has an upper surface, a lower surface, and spaces between the upper and lower surface,
wherein the spaces in the lower frame are either parallel with or concentric with the spaces in the upper frame.
2. The pressure-based packaging system of Claim 1, further comprising a cover that detachably holds the upper frame adjacent its upper surface via the walled structure.
3. The pressure-based packaging system of Claim 1, wherein at least one of the spaces in the upper structure is a cavity from the upper surface to the lower surface.
4. The pressure-based packaging system of Claim 1, wherein a majority of the sides of the upper frame that are bounded by the walled structure are substantially collinear with the sides of the lower frame that are bounded by the walled structure.
5. The pressure-based packaging system of Claim 1, wherein each of the upper frame and the lower frame is recyclable.
6. The pressure-based packaging system of Claim 1, wherein the walled structure has a plurality of openings through its inner surface and outer surface.
7. The pressure-based packaging system of Claim 1, wherein a perimeter of the upper frame substantially mirrors the perimeter of the lower frame.
8. A pressure-based packaging system, comprising:
a walled structure with an inner surface, an outer surface, and a floor, wherein an opening exists in the box structure from the inner surface to the outer surface;
a lower frame bounded on a plurality of sides by the inner surface of the walled structure, wherein the lower frame has an upper surface, a lower surface, and spaces between the upper and lower surface; and

an upper frame bounded on a plurality of sides by the inner surface of the walled structure, wherein the upper frame has an upper surface, a lower surface, and spaces between the upper and lower surface,

wherein the spaces in the upper frame are either parallel with or concentric with the spaces in the lower frame.

9. The pressure-based packaging system of Claim 8, further comprising a cover that detachably holds the upper frame adjacent its upper surface via the walled structure.

10. The pressure-based packaging system of Claim 9, wherein at least one of the spaces in the upper structure is a cavity from the upper surface to the lower surface.

11. The pressure-based packaging system of Claim 10, wherein a majority of the sides of the upper frame that are bounded by the walled structure are substantially collinear with the sides of the lower frame that are bounded by the walled structure.

12. The pressure-based packaging system of Claim 11, wherein each of the upper frame and the lower frame is recyclable.

13. The pressure-based packaging system of Claim 8, wherein the walled structure has a plurality of openings through its inner surface and outer surface.

14. A pressure-based packaging system, comprising:
a walled structure with an inner surface, an outer surface, and a floor, wherein an opening exists in the box structure from the inner surface to the outer surface;
a lower frame bounded on a plurality of sides by the inner surface of the walled structure, wherein the lower frame has an upper surface, a lower surface, and spaces between the upper and lower surface; and

an upper frame bounded on a plurality of sides by the inner surface of the walled structure, wherein the upper frame has an upper surface, a lower surface, and spaces between the upper and lower surface,

wherein a perimeter of the upper frame substantially mirrors the perimeter of the lower frame.

15. The pressure-based packaging system of Claim 14, further comprising a cover that detachably holds the upper frame adjacent its upper surface via the walled structure.

16. The pressure-based packaging system of Claim 15, wherein at least one of the spaces in the upper structure is a cavity from the upper surface to the lower surface.

17. The pressure-based packaging system of Claim 16, wherein a majority of the sides of the upper frame that are bounded by the walled structure are substantially collinear with the sides of the lower frame that are bounded by the walled structure.

18. The pressure-based packaging system of Claim 17, wherein each of the upper frame and the lower frame is recyclable.

19. The pressure-based packaging system of Claim 18, wherein the walled structure has a plurality of openings through its inner surface and outer surface.

20. The pressure-based packaging system of Claim 19, wherein the spaces in the upper frame are either parallel with or concentric with the spaces in the lower frame.