INFLATABLE SHIPPING CONTAINER

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Appl. No.: 12/786,252
Filed: May 24, 2010

ABSTRACT

An inflatable, reusable cargo containing and protecting device suitable for use in shipping, which is inflatable by compressed air. A plurality of air chambers forms the exterior frame of the container while high strength webbing forms the interior. The air chambers may comprise neoprene, PVC, HYPAION®, or other similar material that is formable, pliable, foldable, abrasion resistant, and which can be used to form airtight structures. A high strength, foldable, pliable material in a webbed or solid format forms the interior. The non-rigid material may comprise ballistic nylon, PVC or other suitable material and may be stitched, epoxied, chemically welded, or otherwise attached to the air chambers. A user may store a large number of the devices in a deflated and folded state, requiring only minimal space. When required, the devices are inflated, packed and shipped. At the receiving end, the devices may be deflated and folded for storage or return, either way taking advantage of the low weight and small volume required.
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RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Application No. 61/182,306, filed on May 29, 2009. The entire teachings of the above application are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to an inflatable shipping container that after use, can be deflated and folded to a very small volume for storage or return to the shipper.

BACKGROUND OF THE INVENTION

[0003] Shipping containers are subject to many utility demands. They must be capable of withstanding rough handling, varying climate conditions, abrasion, and impact from various sources such as happens when other nearby containers shift during transit. Containers featuring these characteristics strive to provide varying degrees of shock absorption. Along with these basic durability requirements, shipping containers must also provide the maximum strength and capacity for the least amount of weight. Ideally, storage space requirements for containers not in use should be minimal.

[0004] Due to rising cost and dwindling resources, many entities whose distribution channel model allows, are going away from single-use containers, such as common cardboard or cardboard boxes. Although these types of single-use containers represent a relatively low unit cost, they have limited durability characteristics as previously described and do not have a long shelf life in other than a climate-controlled environment. Instead, reusable, durable containers that when collapsed occupy very little space are favored.

[0005] Foldable shipping containers are commercially and conceptually well known. For example, U.S. Pat. No. 5,664,678 issued to Budowski describes a collapsible shipping container with a molded top and bottom, each with flanges to receive polyethylene sidewalls. U.S. Pat. No. 5,417,540 issued to Cox et al. describes a collapsible shipping container featuring rigid corner posts hinged to the bottom which stand up for assembly. U.S. Pat. No. 5,185,193 issued to Phenicie et al. describes a collapsible shipping container with interlocking panels. The common feature of these containers and others from the known prior art is that either their skeletal frames, or their sidewalls are rigid in both the collapsed and un-collapsed states. Even though they are collapsible, the shapes of the rigid components define the collapsed volume.

[0006] Inflatable shipping aids have also been previously disclosed. For example, U.S. Pat. No. 6,341,475 issued to Weder describes inflatable surrounds that form against and around fragile items during shipping. U.S. Pat. App. Pub. No. 2008/0203090A1 filed by Dickinson discloses an expandable cushioning assembly. U.S. Pat. App. Pub. No. 2008/0314783 filed by Yoshifusa discloses an inflatable device that cushions and surrounds existing item packaging. However, all of the previously mentioned inventions are designed to work inside of a separate shipping container. Standing alone, they are not suitable for shipping or transport.

[0007] U.S. Pat. No. 4,815,153 issued to Bleser et al. describes an inflatable playpen in which the volume of the playpen is defined and bounded by inflatable structural members. However, the materials described for embodiment teach only ease of cleaning and weight-bearing capacity only sufficient for infants. The present invention requires and provides for drastically increased durability, abrasion resistance, and load bearing capabilities. The playpen also features an inflatable floor, which is neither desirable nor suitable for use in the current invention. Because the playpen as described is only useful in one orientation, optimal safety requires the use of water-filled stabilizers to maintain an upright position. In contrast, once loaded and as long as the contents are not orientation-sensitive, the present invention may be placed in any orientation to maximize use of available transportation space.

[0008] Therefore, it is an object of the present invention to provide a durable, reusable, inflatable, collapsible and foldable cargo container suitable for use in shipping and storage. It is another object of the present invention to provide the said container in a variety of shapes, strengths and interior volumes. It is also an object of the present invention that the inflated configuration edges act as built-in cushions thereby absorbing and mitigating dynamic shock and vibration. It is also an object of the present invention to minimize thermal shock because the inflated edges determining the structure are flexible and will easily shrink and expand due to temperature extremes (~40 Deg F) to ~140 Deg F) normally experienced in world-wide uncontrolled shipping and storage.

SUMMARY OF THE INVENTION

[0009] The present invention is an inflatable, reusable cargo-containing and protecting device suitable for use in shipping, which is inflatable by compressed air. A plurality of air chambers made of durable material forms the exterior frame of the container, while high strength webbing or fabric connects the air chambers and forms the walls of the container. The material for the air chambers, webbing and or web fabric may comprise neoprene, PVC, hypalon, or other similar material. Advantageously, the material is formable, pliable, foldable, and abrasion resistant. The material forming the air chambers is additionally air-tight. A high-strength, foldable, pliable material in a webbed or solid format forms the walls and is preferably disposed on the interior of the volume formed by the frame, as a lining, for example. The material may comprise non-rigid materials, such as ballistic nylon, PVC or other suitable material and may be stitched, epoxied, chemically welded, or otherwise attached to the air chambers. A user may store a large number of the devices in a deflated and folded state, requiring only minimal space. When required, the devices are inflated, packed and shipped. At the receiving end, the devices may be deflated and folded for storage or return, either way taking advantage of the low weight and small volume required.

[0010] For use from storage, the device is unfolded onto a flat surface such as a floor or pallet. The user may attach the material or inner liner before or after inflation depending on the physical dimensions of the inflated container. The user then introduces compressed air into the first air chamber through the air inlet. One-way check valves in each connected air chamber ensure that the compressed air introduced is distributed throughout all of the chambers that form the container. If not already done, the inner liner is affixed to attachment points located on the structure formed by the air chambers. Once loaded, the container may be moved manually or by machine with the sling loops affixed to the inner liner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The foregoing and other objects, features and advantages of the invention will be apparent from the follow-
ing more particular description of the embodiments of the invention, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

[0012] FIG. 1 shows a full view of the invention with possible placements of major components.

[0013] FIG. 2 shows detail of the D-rings and the airflow within a check valve.

DETAILED DESCRIPTION OF THE INVENTION


[0015] The present invention is a cargo-containing and protecting container inflatable by compressed air. The cargo container is preferably foldable and reusable. In a preferred embodiment, a plurality of communicating air chambers [1] form external frame members [2] of the container. The frame members [2] define and bound the interior volume of the container. The air chambers [1] may comprise neoprene, polyester, PVC, chlorosulfonated polyethylene, such as HYPOLON®, or other similar material. The material is preferably formable, pliable, foldable, puncture proof, abrasion resistant, and is capable of embodying airtight structures. The material is preferably at least 0.5 mm thick, preferably at least 0.9 mm, and at least about 1000 denier. The air chambers [1] must bear the static weight of the combined load, i.e., they must handle the weight of the device itself and the weight of the contents placed within it. The air chambers [1] must also be capable of bearing momentary shock and compression loads such as those generated by impact, inertia, and vibration. Preferably, the air chambers are capable of withstanding air pressures of 3 psi or more.

[0016] Each air chamber [1] is preferably in fluid communication with each other and can comprise one or more check valves [4], which facilitate one-way communication between adjacent air chambers [1] in a controlled manner. Upon a first air chamber [1] reaching a desired minimum pressure, the check valve opens to allow compressed air to flow into a second air chamber [1] but prevents air from the second air chamber [1] from flowing back into the first air chamber [1]. These check valves [4] serve two purposes. First, they allow inflation of the entire container from a single air inlet [5]; once a first air chamber [1] reaches the desired minimum pressure, the check valve [4] will allow additional compressed air to flow through to the second air chamber [1], and so on throughout the remaining chambers [1]. Once all air chambers [1] have reached the desired minimum pressure, any additional compressed air will be evenly distributed throughout all communicating air chambers [1] by the inherent action of the check valves [4]. The second purpose of the check valves [4] is to isolate the air chambers [1] in case of rupture or puncture. For example, consider three air chambers [1] in serial fluid communication through said check valves [4]. If the second (center) air chamber [1] catastrophically ruptures, it will no longer be at the desired minimum pressure. Therefore, the first air chamber [1] will force air through the check valve only if it is above, or only until it reaches, the desired minimum pressure. The third air chamber [1] is unaffected due to the one-way control of the check valve [1]. A preferred embodiment also comprises at least one air inlet [5] through which compressed air may be introduced into a first air chamber [1] and subsequently into any other air chambers [1] through their respective check valves [4] as previously described.

[0017] An embodiment may comprise one or more pressure relief valves [9] in one or more air chambers [1] to counter unexpected sudden pressure increases. An example of a sudden increase might be a crushing force against an air chamber [1] caused by shifting cargo, resulting in a sudden and dramatic increase in pressure within the affected chamber [1]. Said relief valves [9] may be released to counter harsh environmental conditions which heat the entire container, thereby causing the air in each chamber [1] to expand. Short of rupture, the check valves [4] and the relief valves [9] should only be operable when the air pressure within the controlled chamber [1] is above the desired minimum.

[0018] The device further comprises at least one air inlet valve [5] to inflate at least one air chamber. Each air chamber must be capable of being inflated. As such, each air chamber must be characterized by either an air inlet valve [5] and/or a check valve [4] which permits the introduction of air.

[0019] In a preferred embodiment, a plurality of air chambers [1] defines the edge surfaces of a cube solid or rectangular cuboid solid, thereby defining and bounding a container with a cube solid or rectangular cuboid volume. One or more air chambers [1] can be added to increase structural containment or support characteristics of the device. For example, an additional, vertical air chamber positioned at the approximate midpoint of a sidewall can further strengthen the container. Preferably, this is done in a manner that neither increases nor decreases the defined volume. In yet another embodiment, a plurality of air chambers [1] defines the top and bottom circumferences and the length of a cylinder, thereby defining and bounding a container with a cylindrical volume. Additional contemplated embodiments feature a plurality of air chambers [1] defining the edge surfaces of any polygonal solid or closed-curve solid not previously claimed. These embodiments would therefore define and bound a container with the corresponding polygonal solid or closed-curve solid volume.

[0020] In a preferred embodiment, attachment points [6] are affixed and variously located on the air chambers [1]. These attachment points serve two main purposes. First, they are the primary means of attachment for a flexible liner [3]. Second, they provide a means for tying down loose cargo within the container. The attachment points [6] may take several forms. A preferred embodiment features D-rings which can be used with straps, ropes, or shock cords, which are often found in shipping. D-rings are superior over regular loops because the point loads imposed on the D-ring is distributed over its long side as compared to a round loop which concentrates the load on a small area of its circumference. Buckles may also be used, as they distribute the point load similar to a D-ring and also work quickly and efficiently with straps.

[0021] In a preferred embodiment, a flexible liner [3] of webbed construction is attached to the air chambers [1] via the aforementioned attachment points [6]. The flexible liner [3] comprises a variety of materials, including but not limited to, ballistic nylon, PVC, polyester, chlorosulfonated polyethylene, or other suitable material that is high strength, foldable, and pliable. The liner [3] is suspended from the air chambers, and preferably within the volume defined and bounded by the air chambers [1], and when attached, forms one or more of the sides, bottom or top of the container. Alternatively, the flexible liner [3] may be permanently...
stitched, epoxied, chemically welded, Velcro’d, zipper or otherwise mechanically fastened directly to the air chambers [1]. For example, it may be desirable to stitch, epoxy or weld a liner to form the bottom of the container while the sides and/or top of the container are attached by D-rings. The bottom, or floor, of the container is not inflated and is not inflatable. In general, the sides or liners are not inflatable. It may also be desirable to separately attach the top, or cover, surface independently.

[0022] The container, when inflated, is preferably at least about 1 meter, more preferably between 3 and 10 meters, in length, width (or diameter) and/or height. The container preferably possesses the strength to hold and support multiple weight ranges of 2 Kg to over 400 Kg.

[0023] In a preferred embodiment, the flexible liner [3] also features sling loops [8], such as can be made of the same or different material as the flexible liner [3]. The sling loops [8] are disposed on the flexible liner so as to provide handles for manual carry or lift points for mechanical carry such as by forklift or crane.

[0024] The flexible liners can be made of a mesh or webbing. Alternatively, the flexible liner can be made of fabric or cloth, such as a woven material. In some embodiments, the flexible liner is made of the same material as the air chambers. The flexible liners can be made of materials which are permeable to fluids and/or air or impermeable to fluids and/or air. In one embodiment, the flexible liner is a single contiguous piece, such as a bag, that fits within or around the air chambers. Alternatively the flexible liner defining each sidewall, floor and top can be a separate piece. In yet another embodiment, the flexible liner can be a single contiguous piece defining the sidewalls.

[0025] Optional solid panels [7] made of rigid polyethylene or other similar materials that are rigidly bulk but still somewhat flexible may be used in conjunction with or in place of the flexible liner [3]. These panels can optionally use the same attachment points [6] on the air chambers [1] as the flexible liner [3]. In this configuration, the panels [7] form one or more of the top, bottom or sides of the container. For example, one or more solid panels [7] may be used to stiffen the floor of the container or may be added to help contain the cargo. The solid panels [7] may also provide slots, handles or sling loops [8] to provide the same carrying accommodations as described for the flexible liner. In some embodiments, it may be desirable to connect two or more solid panels by hinges to facilitate folding.

[0026] While there has been illustrated and described what is at present considered to be the preferred embodiment of the present invention, it will be understood by those skilled in the art that various changes and modifications may be made and equivalents may be substituted for elements thereof without departing from the true scope of the invention. Therefore, it is intended that this invention not be limited to the particular embodiment disclosed, but that the invention will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A foldable, reusable, cargo containing and protecting container inflatable by compressed air, said container comprising:
   a. a plurality of optionally communicating air chambers [1] that, upon inflation, form a plurality of vertical and horizontal external frame members thereby defining and bounding an interior volume; and
   b. at least one flexible liner [3] which, when attached to the external frame members [2] and suspended within the volume defined and bounded by the air chambers [1], forms one or more sidewalls, a bottom and/or a top of said container; and
   c. optionally, one or more check valves [4] which facilitate one-way communication between air chambers [1], such that the inflating air may flow through a first air chamber [1] and into a second air chamber [1] but air from the second air chamber [1] cannot flow into the first air chamber [1]; and
   d. optionally, one or more relief valves [9] which facilitate immediate air release due to over-pressurization of one or more air chambers [1]; and
   e. at least one air inlet valve [5] through which compressed air may be introduced into an air chamber [1]; and
   f. a plurality of attachment points [6] affixed and variously located on the air chambers [1] and which provide a means of securing the flexible liner [3]; and
   g. optionally, one or more solid panels [7] configured to form one or more of the top, bottom or sides of the container.

2. The container of claim 1, wherein the air chambers [1] comprise an airtight, pliable, abrasion resistant, puncture proof material, such as neoprene, PVC, or chlorosulfonated polyethylene or polyurethane.

3. The container of claim 1, wherein at least one of the flexible liners [3] comprises a pliable, abrasion resistant, puncture proof material, such as ballistic nylon, PVC, chlorosulfonated polyethylene or polyurethane.

4. The container of claim 1, wherein the attachment points [6] comprise D-rings.

5. The container of claim 1, wherein the flexible liner [3] defining at least one sidewall of the container is mechanically fastened to the air chambers [1] via a plurality of D-rings [10].

6. The container of claim 1, wherein the flexible liner [3] defining at least one sidewall of the container is stitched, epoxied or welded to the air chambers [1].

7. The container of claim 1, wherein the flexible liner [3] comprises solid materials [8].

8. The container of claim 1, wherein a plurality of air chambers [1] defines the edge surfaces of a cube solid or rectangular cuboid solid.

9. The container of claim 1, wherein a plurality of air chambers [1] defines a top and bottom circumference and the vertical length of a cylinder.

10. The container of claim 1 where the floor of the container is a solid rigid material attached to each adjacent air chamber defining a sidewall.

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