Title: SHIPPING CONTAINER ROOF STRUCTURE

Abstract: A shipping container roof structure including a unitary roof shell with at least one flange portion depending therefrom to at least a portion of a shipping container to position the roof shell thereon.
SHIPPING CONTAINER ROOF STRUCTURE

TECHNICAL FIELD

[0001] The present invention relates to shipping containers for purposes other than transport and particularly to a roofing structure for a shipping container.

BACKGROUND ART

[0002] A "shipping container" in the context of the present invention is a large reusable metal box generally used for intermodal shipments. In this context, "container" or "shipping container" is virtually synonymous with "(standard) intermodal freight container" (a container designed to be moved from one mode of transport to another without unloading and reloading).

[0003] An intermodal container (also container, freight container, ISO container, shipping container, hi-cube container, box, conex box and sea can) is a standardized reusable metal box used for the safe, efficient and secure storage and movement of materials and products within a global containerized intermodal freight transport system.

[0004] Containers have been used for other purposes at the end of their voyaging lives. Permanent or semi-permanent placement for storage is common. A container has 8,000 lb (3,629 kg) of steel which takes 8,000 kWh (28,800 MJ) of energy to melt down. Repurposing used shipping containers is increasingly a real solution to both social and ecological problems.

[0005] The provision of roofing structures for shipping containers is not unknown conventionally. However, the conventional practice when providing a roofing structure or shelter structure in relation to one or more shipping containers is to provide a rafter or support frame with one or more roof members or sheets attached thereto.

[0006] For example, one prior art shelter structure for shipping containers is formed from a number of curved frame members supported at one end on a first shipping container and at a second end on a second shipping container with a tensile membrane stretched thereover.

[0007] Another prior art roofing structure provided for shipping containers is adapted to be supported between a pair of shipping containers and includes a number of substantially A-frame rafter assemblies which are each attached to one shipping container on one side and a second shipping container on another side with a plurality of metal sheets attached on the rafter assemblies to form a roof structure.
It is further known to provide a shipping container with external walls and a box-shaped upper structure located overlying the top of a shipping container in order to contain soil to plant grass on a roofing structure of a shipping container.

Each of these conventionally available roofing structures has their own particular problems varying from complexity of manufacture and assembly, weight issues and portability issues.

It will be clearly understood that, if a prior art publication is referred to herein, this reference does not constitute an admission that the publication forms part of the common general knowledge in the art in Australia or in any other country.

SUMMARY OF INVENTION

The present invention is directed to a shipping container roof structure, which may at least partially overcome at least one of the abovementioned disadvantages or provide the consumer with a useful or commercial choice.

With the foregoing in view, the present invention in one form, resides broadly in a shipping container roof structure including a unitary roof shell with at least one flange portion depending therefrom to at least abut a portion of a shipping container to position the roof shell thereon.

In an alternative form, the present invention resides in a shipping container with roof structure, the roof structure including a unitary roof shell with at least one flange portion depending therefrom to at least abut a portion of a shipping container to position the roof shell thereon.

The shipping container will normally be as discussed above. Lengths of containers vary from 8 feet (2.438 m) to 56 feet (17.07 m) and heights from 8 feet (2.438 m) to 9 feet 6 inches (2.9 m).

A typical container has doors fitted at one end, and is constructed of corrugated weathering steel. Containers were originally 8 feet (2.44 m) wide by 8 feet (2.44 m) high, and either a nominal 20 feet (6.1 m) or 40 feet (12.19 m) long. They can be stacked up to seven units high.

At each of the eight corners of a standard shipping container are corner castings with openings for fasteners.
Taller units have been introduced, including 'hi-cube' or 'high-cube' units at 9 feet 6 inches (2.9 m) and 10 feet 6 inches (3.2 m) high. The United States and Canada often use longer units at 48 ft (14.63 m) and 53 ft (16.15 m).

"Pallet wide" containers are about 2 inches (5 cm) wider than standard containers to accommodate for Euro-pallets common in Europe. These containers feature an internal width of 2440 mm for easy loading of two 1200 mm long pallets side by side - many sea shipping providers in Europe allow these as overhangs on standard containers are sufficient and they fit in the usual interlock spaces (with the same floor panel the side ribs of pallet-wide containers are embossed to the outside instead of being moulded to the inside). Australian RACE containers are also slightly wider to accommodate Australia Standard Pallets. The 45 ft pallet-wide high-cube shortsea container has gained wider acceptance as these containers can replace the 13.6 m swap bodies that are common for truck transport in Europe - the EU has started a standardization for pallet wide containerization in the EILU (European Intermodal Loading Unit) initiative.

The unitary roof shell of the preferred embodiment of the present invention can be formed in any manner will typically be moulded. The moulding process preferably allows the roof shell to be formed in a single piece, and typically including one or more abutment blocks to allow attachment of the roof shell to the shipping container, as well as the inclusion of the at least one flange portion.

The roof shell of the present invention will typically be manufactured in one or more standard sizes which correspond to the standard sizes of shipping containers. Alternatively, a bespoke size and/or shape roof shell may be formed upon request.

A variety of materials can be used to form the unitary roof shell including fibreglass, plastic or any other product that lends itself to the moulding process. More than one material may be used in the formation of the roof shell to form a composite material or construction of the roof shell.

It is further preferred that the material(s) used to form the unitary roof shell are waterproof or at least water resistant in order that rain or condensation is prevented from penetrating through the roof shell and resting on the top of the shipping container.

Still further, it is preferred that the material(s) used to form the unitary roof shell may provide some insulation to the upper portion of the shipping container. In practice, if the roof shell is shaped and extends above the surface of the roof container, a void will be defined between the roof shell and the upper surface of the shipping container which will provide space
for air, and the air in combination with the roof shell itself will normally insulate the upper surface of the shipping container.

[0024] The roof shell of the present invention may be provided in any shape. For example, typical roof shapes or styles include skillion, or slanted, open or box gable, salt box, pyramid or hip, M-shaped, Dormer, Butterfly, Mansard, Alpine, flat, jerkin head, gambrell, hip and valley, Dutch or any combination of these types. Further, the roof shape can be or include a partially spherical shape such as hemispherical or torispherical.

[0025] Further, there are also other shapes provided in foreign countries or cultures, such as the shape of rooves provided in Asian countries, which may be desirable in some situations or by some customers. The roof shell of the present invention may be or include any of these roof shapes.

[0026] The roof structure applied to the shipping container may also support a further roof structure which is not supported directly by a shipping container or only supported partially by shipping container. For example, a pair of shipping containers may be provided spaced from one another with a roof structure applied to each of them, and with a further roof structure provided spanning the distance between the shipping containers and supported either partially by one or both of the shipping containers and/or by one or more of the roof structures provided on the shipping containers.

[0027] Similarly, a single shipping container may be provided with an adjacent awning-style roof structure which may be partially supported by either the shipping container and/or by the roof structure of the shipping container and also by one or more awning support legs.

[0028] The roof structure of the present invention also includes at least one flange portion depending from the unitary roof shell. Typically, a perimeter flange will be provided extending substantially about the perimeter of the roof shell. Alternatively, a partial perimeter flange which may extend over one or more sides of the roof shell may be provided. In a particularly preferred embodiment, a pair of side flanges extending substantially continuously along the length of each lateral side of the roof shell, are provided. In this way, the side flanges are spaced such that the shipping container can be received between the side flanges and the ends of the roof shell leaving the ends of the shipping container preferably unobstructed so that the doors of the shipping container which are normally provided on the ends of the shipping container can be opened and closed easily.

[0029] At least one flange portion is provided on the sides of the roof structure and at least
one lower profile flange may be provided at the ends of the roof shell so as not to obstruct the door of the container.

[0030] The flange portion can extend any distance vertically down the side of the container but normally only a small distance is required in order to properly locate the flange relative to the shipping container.

[0031] The flange will typically be of sufficient width or thickness such that the flange does not deform when the roof structure is being placed on the shipping container. The thickness of the flange will also minimise or prevent any lateral movement of the roof structure relative to the shipping container, even under wind load.

[0032] Typically, although the roof structure will be relatively light in weight, the weight of the roof structure is sufficient to at least temporarily hold the roof structure on the shipping container. Normally, the roof structure will be attached to the shipping container, and preferably to the corner castings provided on many standard shipping containers. One or more internal rafters or other supports may be provided. Typically, if provided, these will be moulded with the remainder of the roof shell.

[0033] Preferably, one or more abutment blocks are provided on or in association with the roof shell. Typically, the abutment blocks are provided in locations which will correspond to the location of the corner castings of the shipping container to which the roof structure is to be applied. The standardisation in size of the shipping containers assists with this.

[0034] Typically, each of the abutment blocks is provided in a corner of the roof shell although the roof shell may extend further laterally in any one or more directions than the periphery of the shipping container.

[0035] Each of the abutment blocks is typically a substantially solid block capable of supporting the weight of the roof structure relative to the shipping container and allowing portions of attachment mechanisms to be embedded at least partially therein during the preferred moulding process.

[0036] Each abutment block will also typically mount a portion of an attachment mechanism to attach the roof structure to the shipping container. A particularly preferred form of attachment mechanism is a twistlock, similar or the same as that already used to attach shipping containers to road transport or cranes or the like.
[0037] It is also preferred that each abutment block will be provided with a second attachment device allowing the attachment of a lifting device to the roof structure. Typically, the second attachment device may be a ring or similar allowing the attachment of ropes or cables from a crane as an example to lift the roof structure onto and from the shipping container.

[0038] A twistlock and corner casting together form a standardised rotating connector for securing shipping containers and form the preferred mechanism for attaching the roof structure of the present invention to a shipping container.

[0039] A female part of the attachment mechanism is a 7x7*4+1/2 in (180x180x1 10 mm) corner casting fitted to the shipping container itself, and which has no moving parts, but a generally oval engagement hole in the upper or lower surface. The hole is typically a 4.9 in (124.5 mm) diameter circle with two flat sides 2.5 in (63.5 mm) apart.

[0040] The male component preferably provided on each abutment block of the roof shell of the present invention is a twistlock. The twistlock preferably has two portions, namely a short neck that extends, typically perpendicularly, from the surface of the abutment block, and a rotating head portion. The head portion is typically the same or similar external dimension as the neck portion which is normally rectangular having a longer and a shorter dimension and may be pointed or tapered to make insertion into the corner casting easier. The head portion is rotatable such that in a first aligned condition, the head and neck can pass the generally oval engagement hole in the corner casting and a second engagement condition in which the head portion extends further laterally than the dimensions of the neck and typically engages the corner casting. The head portion is typically biased into either the aligned or engaged condition and tactile and/or audible feedback is normally provided when the head portion is moved into or out of either or both of these conditions.

[0041] The head portion is typically inserted through the engagement hole (it is roughly 4.1 in/104.1 mm long and 2.2 in/55.9 mm wide) in the corner casting of the shipping container, and then the head portion is rotated 90° so that it cannot be withdrawn. The maximum size and position of the holes in the connector of standard shipping containers is defined in international standard ISO 1161:1984 and the twistlock provided will therefore preferably comply with this standard.

[0042] The roof structure of the present invention may be provided with air vents allowing circulation of air through the roof shell if the roof shell is provided in the preferred hollow embodiment to define a void between the roof shell and the shipping container. The roof shell
may be provided with an insulation material such that the roof shell is hollow at least partially filled with the insulation material. A solid roof shell in which the shape of the shell is filled three-dimensionally is less preferred due to the increased weight and therefore decreased portability and increased problems with moving the roof shell.

[0043] The roof structure may be provided with external guttering or attachment points for external guttering in order to enable rainwater to be collected, either for use or for conveying away from the shipping container.

[0044] Preferably, the attachment between the roof structure of the present invention and the shipping container may be such that the shipping container can be transported with the roof structure attached thereto or alternatively, the roof structure can be removed for transport.

[0045] The advantages of the roof structure of the present invention include minimal construction time and therefore, minimised labour cost and reduced cost of materials. Further, because the roof structure is of a unitary roof shell form, there are no joins or mechanical fasteners which may be susceptible to failure. The roof structure of the present invention is reusable, light in weight, simple to locate relative to a shipping container and low in cost.

[0046] Any of the features described herein can be combined in any combination with any one or more of the other features described herein within the scope of the invention.

[0047] The reference to any prior art in this specification is not, and should not be taken as an acknowledgement or any form of suggestion that the prior art forms part of the common general knowledge.

BRIEF DESCRIPTION OF DRAWINGS

[0048] Various embodiments of the invention will be described with reference to the following drawings, in which:

[0049] Figures 1A to 1P are schematic illustrations of various roof design types which may find use in the roof structure of the present invention.

[0050] Figures 2A to 21 are illustrations of buildings with various roof design types which may find use in the roof structure of the present invention.

[0051] Figure 3A is a schematic illustration of a pair of shipping containers each with a roof structure and supporting a third roof structure therebetween according to a preferred
embodiment.

[0052] Figure 3B is a schematic illustration of a single shipping container with a roof structure and supporting an awning type roof structure beside according to a preferred embodiment.

[0053] Figure 4 is a schematic illustration of a preferred location of abutment blocks in a roof shell of a preferred embodiment of the present invention.

[0054] Figure 5 is a schematic illustration of a pair of shipping containers each with a roof structure and supporting a third roof structure therebetween according to a preferred embodiment.

[0055] Figure 6 is a schematic illustration of a box gable roof structure according to a particularly preferred embodiment of the present invention.

[0056] Figure 7A is an isometric from the side and above of a corner casting of a shipping container.

[0057] Figure 7B is an isometric from the side and below of a corner casting of a shipping container (removed from the shipping container) showing the engagement hole.

[0058] Figure 8A is an isometric view of a twistlock in a first, aligned condition.

[0059] Figure 8B is an isometric view of a twistlock in a second, engagement condition.

DESCRIPTION OF EMBODIMENTS

[0060] According to a particularly preferred embodiment of the present invention, a shipping container roof structure is provided.

[0061] The shipping container roof structure 10 of the preferred embodiment as illustrated particularly in Figure 6 includes a unitary roof shell with a pair of side flange portions 11 depending therefrom to receive an upper portion of a shipping container to position the roof shell thereon. The embodiment illustrated in Figure 6 is a closed gable shape with the pitch of each of the roof surfaces indicated on the Figure.

[0062] This unitary roof shell is moulded in a single piece, including four abutment blocks 12 to allow attachment of the roof shell to the shipping container as well as the side flange portions. The location of the abutment blocks is illustrated in Figure 4.
A variety of materials can be used to form the unitary roof shell including grass, plastic or any other product that lends itself to the moulding process. More than one material may be used in the formation of the roof shell to form a composite material.

The unitary roof shell is shaped and extends above the surface of the roof container, to define a void between the roof shell and the upper surface of the shipping container.

The roof shell of the present invention may be provided in any shape. Typical roof shapes which may be used are illustrated in Figures 1A to 1P and include skillion, or slanted, open or box gable, salt box, pyramid or hip, M-shaped, Dormer, Butterfly, Mansard, Alpine, flat, jerkin head, gambrell, hip and valley, Dutch or any combination of these types.

Further, there are also other shapes provided in foreign cultures such as the shape of roof is provided in Asian countries which may be desirable in some situations or by some customers. A selection of these roof shapes are illustrated in Figures 2A to 21.

The roof structure applied to a particular shipping container may also support a further roof structure which is not supported directly by a shipping container or only supported partially by shipping container. Three example configurations are illustrated in Figures 3A, 3B and 5. For example, as illustrated in Figure 3A, a pair of shipping containers 13 is provided is spaced from one another with a roof structure 10 applied to each of them with a secondary roof structure 21 (which may be of the same type as the roof structure 10 or different) provided spanning the distance between the shipping containers 13 and supported either partially by one or both of the shipping containers and/or by the roof structures provided on the shipping containers 13. A double span secondary roof structure is illustrated in Figure 5.

Similarly, as illustrated in Figure 3B, a single shipping container 13 may be provided with an adjacent awning structure 14 (which may be of the same type as the roof structure 10 or different) which may be partially supported by either the shipping container 13 and/or by the roof structure of the shipping container and also by one or more awning support legs 15.

In the preferred embodiment illustrated in Figure 6, a pair of side flanges 11 extending continuously over the length of each side of the roof shell, are provided. The side flanges 11 are spaced from one another such that the shipping container 13 can be received between the side flanges 11 and the ends of the roof shell are shaped such that the doors of the shipping container 13 which are normally provided on the ends of the shipping container are unobstructed.
According to the preferred embodiment, the roof structure 10 is anacnea to the shipping container 13 to the corner castings provided on many standard shipping containers as are illustrated in Figures 7A and 7B.

A number of abutment blocks 12 are provided in association with the roof shell as illustrated in Figure 4 in locations to correspond to the location of the corner castings of the shipping container to which the roof structure is to be applied. The standardisation in size of the shipping containers assists with this.

Each of the abutment blocks 12 is typically a substantially solid block capable of supporting the weight of the roof structure relative to the shipping container.

Each abutment block of the preferred embodiment also mounts a portion of an attachment mechanism to attach the roof structure to the shipping container. A particularly preferred form of attachment mechanism is a twistlock, similar or the same as that already used to attach shipping containers to road transport or cranes or the like and one form of which is illustrated in Figures 8A and 8B.

It is also preferred that each abutment block will be provided with a second attachment device allowing the attachment of a lifting device to the roof structure. Typically, the second attachment device may be a ring or similar allowing the attachment of ropes or cables from a crane as an example.

A twistlock 17 (Figures 8A and 8B) and corner casting 18 (Figures 7A and 7B) together form the preferred mechanism for attaching the roof structure of the present invention to the shipping containers.

A female part of the attachment mechanism is the 7x7x4+1/2 in (180x180x110 mm) corner casting as illustrated in Figures 7A and 7B fitted to the shipping container itself, and which has no moving parts, but a generally oval engagement hole 16 in the upper or lower surface. The engagement hole 16 is typically a 4.9 in (124.5 mm) diameter circle with two flat sides approximately 2.5 in (63.5 mm) apart.

The illustrated and preferred twistlock has two portions, namely a short neck 19 that extends perpendicularly from the surface of the abutment block and a rotating head portion 20. The head portion 20 is normally of similar external dimension to the neck portion 19 which is preferably rectangular having a longer and a shorter dimension and is pointed or tapered to make insertion into the engagement hole 16 easier. The head portion 20 is rotatable such that in a first
aligned condition, illustrated in Figure 8A, the head 20 and a portion of the neck 19 can pass through the generally oval engagement hole 16 in the corner casting 18 and a second engaged condition, illustrated in Figure 8B, in which the head portion 20 extends further laterally than the dimensions of the neck 19 and engages the corner casting 18.

[0078] The head portion 20 is typically inserted through the engagement hole (it is roughly 4.1 in/104.1 mm long and 2.2 in/55.9 mm wide) in the corner casting of the shipping container, and then the head portion is rotated 90° so that it cannot be withdrawn. The maximum size and position of the holes in the connector of standard shipping containers is defined in international standard ISO 1161:1984 and the twistlock provided will therefore preferably comply with this standard.

[0079] In the present specification and claims (if any), the word 'comprising' and its derivatives including 'comprises' and 'comprise' include each of the stated integers but does not exclude the inclusion of one or more further integers.

[0080] Reference throughout this specification to 'one embodiment' or 'an embodiment' means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, the appearance of the phrases 'in one embodiment' or 'in an embodiment' in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more combinations.

[0081] In compliance with the statute, the invention has been described in language more or less specific to structural or methodical features. It is to be understood that the invention is not limited to specific features shown or described since the means herein described comprises preferred forms of putting the invention into effect. The invention is, therefore, claimed in any of its forms or modifications within the proper scope of the appended claims (if any) appropriately interpreted by those skilled in the art.
CLAIMS

1. A shipping container roof structure including a unitary roof shell with at least one flange portion depending therefrom to at least abut a portion of a shipping container to position the roof shell thereon.

2. A shipping container roof structure as claimed in Claim 1 further including one or more abutment blocks provided on or in association with the roof shell to correspond to the location of corner castings of the shipping container to which the roof structure is to be applied.

3. A shipping container roof structure as claimed in claim 1 or Claim 2, wherein a portion of an attachment mechanism to attach the roof structure to the shipping container is provided at each corner of the shipping container roof structure.

4. A shipping container roof structure as claimed in any one of claims 1 to 3, further including an attachment device allowing the attachment of a lifting device to the roof structure.

5. A shipping container with roof structure, the roof structure including a unitary roof shell with at least one flange portion depending therefrom to at least abut a portion of a shipping container to position the roof shell thereon.
CLAIMS

1. A shipping container roof structure for a shipping container with an existing, substantially horizontal roof wall, the shipping container roof structure including a unitary roof shell with at least one flange portion depending therefrom to at least abut a portion of the shipping container to position the roof shell relative to the shipping container above the existing roof wall of the shipping container, each roof shell spanning a single shipping container.

2. A shipping container roof structure as claimed in Claim 1 further including one or more abutment blocks provided on or in association with the roof shell to correspond to the location of corner castings of the shipping container to which the roof structure is to be applied.

3. A shipping container roof structure as claimed in claim 1 or Claim 2, wherein a portion of an attachment mechanism to attach the roof structure to the shipping container is provided at each corner of the shipping container roof structure.

4. A shipping container roof structure as claimed in any one of claims 1 to 3, further including an attachment device allowing the attachment of a lifting device to the roof structure.

5. A shipping container with roof structure, the roof structure including a unitary roof shell with at least one flange portion depending therefrom to at least abut a portion of a shipping container to position the roof shell relative to the shipping container above the existing roof wall of the shipping container, each roof shell spanning a single shipping container.
INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2013/001349

A. CLASSIFICATION OF SUBJECT MATTER
E04B 7/00 (2005.01)  B65D 90/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
TXTAU1, TXTCA1, TXTEP1, TXTGB1, TXTSG1, TXTUS1, TXTUS5, TXTUS, EPODOC: IPC B65D88, B65D90, B65D43, E04H, E04B and keywords ship+, freight+, container^ intermodal+, box+, ISO contain+, connex+, roof+, lid+, shelter, cover+, over_head+, ceiling?, flange+, rim+, collar+, corner+, mating+, lock+, attach+, fix+, abut+, sing+, uniar+, pre_form+, pre_fabricat+, etc., Espace and Google Patent searches with keywords shipping*, freight*, container*, roof*, ISO, skirt*, cargo, house*, building*, convert*, recycl*, modular, fit*, shelter*, etc..

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C  [X] See patent family annex

* Special categories of cited documents:
  "X" document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search  3 April 2014
Date of mailing of the international search report  24 February 2014

Name and mailing address of the ISA/AU

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FormPCT/ISA/210 (fifth sheet) (July 2009)
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<td>WO 2006/024396 A2 (LEANbox GMBH) 09 March 2006 Abstract, Figure 7, pages 12-14</td>
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<td>X</td>
<td>GB 2399337 A (TIMBERbox LIMITED) 15 September 2004 Abstract, Figures, page 7, lines 1-12</td>
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<td>A</td>
<td>GB 2476102 A (KEY HOUSING LIMITED) 15 June 2011 Abstract, Figures</td>
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This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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