

MODULAR THERMALLY INSULATED TRANSPORTATION CONTAINER

The present invention relates to a modular thermally insulated transportation container for transporting temperature sensitive items; a modular system for constructing thermally insulated transportation containers; and a method for constructing a thermally insulated container.

Thermally insulated containers are used to transport items that are sensitive to temperature and must therefore be maintained within predetermined temperature ranges throughout the journey, such as +2°C to +8°C and +15°C to +25°C, or close to a particular temperature such as -20°C. Such items include goods such as vaccines and drugs, biological samples, tissue cultures, chilled and frozen foods and many other products, some of which have extremely high financial value and are very sensitive to temperature changes. It is essential that such products are maintained within the appropriate temperature ranges during transportation.

Such goods are normally transported in thermally insulated containers and gel bags containing Phase Change Materials (hereafter referred to as PCMs) that have been cooled or heated to a predetermined temperature to provide additional heating or cooling as required. Heat energy flows into or out of the container, according to the difference between the ambient temperature and the internal temperature of the container. The temporal ambient temperature profile that will be experienced by the container cannot be predicted a priori, since containers may be moved from relatively cold countries to relatively hot countries and may be left standing for a significant period of time.

If the container is exposed to excessively high or low temperatures for extended periods, the internal temperature may go outside the required range, causing damage to the contents. The requirement to open a container on its journey increases the risk of payload theft. In current containers, the number and type of PCM packs employed is calculated according to the anticipated delivery time and the ambient temperature ranges likely to be experienced during transportation. However, as delivery can take longer than anticipated and the ambient temperatures may be much higher or lower than expected, the payload temperature may go outside the required range. During transportation, shocks, collisions or vibrations can cause the goods to move within the container, particularly those located at the side walls; these

might then fall to a lower part of the container, increasing the risk of being heated/cooled to a temperature outside the predetermined safe range.

Thus it is desirable to provide a thermally insulated container that is arranged to maintain the temperature within the desired temperature range throughout the payload volume for the duration of the journey.

Thermally insulated containers are frequently transported by aircraft. Transportation aircraft can typically be classified into narrow bodied, wide bodied and freighter variations. Usually the container is mounted onto a Unit Load Device (ULD) such as a pallet, which is then loaded onto the aircraft. There are several different types of standard pallet available, for example for use on the main and/or lower decks on aircraft, which include, but are not limited to, PMC, PAG, PKC (IATA references) and LD3, LD7, LD11 (ISO references).

When manufacturing thermally insulated containers, it is typical for manufacturers to take into account the pallet size and the dimensions of the aircraft when determining the dimensions of the container, for a given internal capacity required. This can lead to a large number of different sized and shaped containers being made, with each container requiring different manufacturing techniques, sized components and/or tooling. This leads to increased manufacturing costs.

Therefore it is desirable to simplify the manufacturing processes and construction of the thermally insulated containers, while still providing some variety for the size and shape of the thermally insulated containers in order to fit different sized pallets and aircraft.

Accordingly the present invention seeks to provide a modular thermally insulated transportation container for transporting temperature sensitive items; a modular system for constructing thermally insulated transportation containers; and a method for constructing a thermally insulated container that mitigates at least one of the aforementioned disadvantages, or at least provides an alternative configuration to known containers, systems and methods.

According to a first aspect, there is provided a thermally insulated container for transporting temperature sensitive goods, said container having a modular construction that includes: a plurality of thermally insulated container sections; and a support frame for fixing the container sections together to provide at least part of the thermally insulated container

structure, wherein the support frame includes a plurality of longitudinal support elements, a plurality of transverse support elements, and a plurality of vertical support elements, and wherein at least one of the support elements includes a first part including a tubular outer part, and a second part including a first connector member that is arranged to move axially a limited amount within the tubular outer part, such that the length of the support element is telescopically adjustable.

According to a second aspect, there is provided a modular system for constructing thermally insulated transportation containers for transporting temperature sensitive goods, said modular system enabling a variety of different sized thermally insulated containers to be constructed, said modular system including: thermally insulated wall elements that are configurable into a plurality of container sections; and a support frame for fixing the container sections together to form at least part of a thermally insulated container structure, said support frame including a plurality of longitudinal support elements, a plurality of transverse support elements, and a plurality of vertical support elements, wherein the lengths of at least some of the support elements are adjustable, the arrangement being such that at least two of the height of the support frame, the width of the support frame and the length of the support frame are adjustable.

According to a third aspect, there is provided a method for constructing a modular thermally insulated transportation container that is arranged for transporting temperature sensitive goods, including: constructing a plurality of container sections from a set of thermally insulated wall elements; and fixing said container sections together to form at least part of a thermally insulated container structure with an external support frame having a plurality of longitudinal support elements, a plurality of transverse support elements, and a plurality of vertical support elements to form at least part of a thermally insulated container structure; and adjusting the lengths of at least some of the support elements such that at least two of the height of the support frame, the width of the support frame and the length of the support frame are adjusted.

Herein disclosed is a thermally insulated container for transporting temperature sensitive goods. The container has a modular construction that includes a plurality of thermally insulated container sections. The container further includes

means for fixing the container sections together to provide at least part of the thermally insulated container structure.

The invention enables a variety of different sized containers to be constructed from a relatively low number of components, for example by varying the number of sections included.

Advantageous features of preferred embodiments are disclosed in the dependent claims and statements of invention below.

Advantageously at least some, and preferably each, of the container sections includes first and second open ends, and the container sections are aligned in a substantially co-axial manner such that an open end of a first container section is positioned adjacent to an open end of a second container section.

At least one, and preferably each, of the container sections includes at least one side wall and is open at each end. In preferred embodiments, each container section includes four side walls. Typically each container section is similar.

At least some of the container sections can be tubular, and preferably each of the container sections is tubular. The tubular sections are aligned substantially co-axially end to end.

Adjusting the number of tubular sections in the container adjusts the size of the container in one dimension. Typically, adjusting the number of container sections adjusts the length of the container.

Advantageously at least some of the container sections can include a plurality of thermally insulated wall elements, and preferably each of the container sections includes a plurality of thermally insulated wall elements. Since each section is made from a plurality of components, it is possible to adjust the container size in at least one additional direction.

Advantageously at least some of the container sections can include a first substantially U-shaped thermally insulated wall element, and preferably each of the container sections includes a first substantially U-shaped thermally insulated wall element.

Advantageously at least some of the container sections can include a second substantially U-shaped thermally insulated wall element, and preferably each of the container sections includes a second substantially U-shaped thermally insulated wall element. In preferred embodiments the first and second substantially U-shaped sections are similar, but in other embodiments may be dissimilar. Advantageously the first and second substantially U-shaped thermally insulated wall elements can be connected together to form a substantially tubular container section. In some embodiments, each container section consists of first and second substantially U-shaped thermally insulated wall elements only.

Advantageously the thermally insulated wall elements can include at least one thermally insulated wall panel. Advantageously at least some of the container sections can include at least one thermally insulated wall panel, and preferably each of the container sections includes at least one thermally insulated wall panel. Typically, at least some, and preferably each, container section includes at least one pair of thermally insulated wall panels.

Advantageously at least some of the container sections can include at least one thermally insulated wall panel interposed between the first and second substantially U-shaped thermally insulated wall elements. For example, the first and second substantially U-shaped thermally insulated wall elements can be connected together by a pair of thermally insulated wall panels to provide a tubular container section of increased size. Additional thermally insulated wall panels can be included to increase the size of the tubular container section further. Typically adjusting the number of panels in each container section adjusts the height of the container.

Advantageously at least some, and preferably each, of the thermally insulated wall elements can include locating formations, such as a tongue and groove arrangement, for connecting the thermally insulated wall elements together.

Advantageously at least some, and preferably each, of the thermally insulated container sections can include locating formations, such as a tongue and groove arrangement, for connecting the thermally insulated container sections together.

Advantageously the structural support elements can be used to make several different container sizes, including Euro; Double (length) Euro; US; Double (length) US; Freighter; Double (length) Freighter. These six variations can be made in different heights to suit main deck loading on the aircraft, which give a further six container configurations.

As shown in the above aspects, the means for fixing the container sections together include the support frame.

Advantageously the support frame can be mounted externally of the container sections.

Advantageously the support frame can be arranged to apply a compressive load to at least some, and preferably each, of the container sections. Advantageously the support frame is arranged to apply a compressive load to the container sections in at least one of the following directions: a longitudinal direction, a transverse direction and a vertical direction.

As shown in the second aspect, the height of the support frame is adjustable. The support frame includes means for adjusting the height of the support frame. The means for adjusting the height of the support frame can be continuously adjustable.

As shown in the second aspect, the width of the support frame is adjustable. The support frame includes means for adjusting the width of the support frame. The means for adjusting the width of the support frame can be continuously adjustable.

As shown in the second aspect, the length of the support frame is adjustable. The support frame includes means for adjusting the length of the support frame. The means for adjusting the length of the support frame can be continuously adjustable.

In preferred embodiments the support frame is continuously adjustable in at least one direction.

In preferred embodiments the support frame comprises a substantially cuboid space frame arrangement.

As shown in the above aspects, the support frame includes a plurality of substantially longitudinal support elements, a plurality of substantially horizontal support elements and a plurality of substantially vertical support elements. Advantageously at least some of the support elements are elongate. At least some, and preferably each, of the support elements are tubular, or include a tubular part.

As shown in the above aspects, the length of at least one, and preferably each, of the longitudinal support elements is adjustable. As shown in the first aspect, the or each longitudinal support element is telescopically adjustable.

As shown in the above aspects, the length of at least one, and preferably each, of the transverse support elements is adjustable. As shown in the first aspect, the or each transverse support element is telescopically adjustable.

As shown in the above aspects, the length of at least one, and preferably each, of the vertical support elements is adjustable. As shown in the first aspect, the or each vertical support element is telescopically adjustable.

As shown in the first aspect, at least one, and preferably each, of the longitudinal support elements includes a first part, which includes a tubular outer part, and a second part that is arranged to move with respect to the first part, said second part including a first connector member that is arranged to move axially within the tubular outer part a limited amount. Advantageously at least one, and preferably each, of the longitudinal support elements can include a second connector element that is arranged to move axially within the tubular outer part a limited amount. The first connector element is located towards one end of the longitudinal support element and the second connector element is located towards the other end. Adjusting the position of the first and/or second connector elements with respect to the first part adjusts the overall length of the longitudinal support element. By shortening the length of the longitudinal support elements, a compressive load is applied to the container sections in a longitudinal direction, that is, a direction that pushes the container sections together along the axis of the container sections.

The container can include at least one first threaded element that is arranged to adjust the position of the second part with respect to the first part. Advantageously the first threaded element is arranged to adjust the position of the first and second connector elements with respect to the first part.

As shown in the first aspect, at least one, and preferably each, of the transverse support elements includes a first part, which includes a tubular outer part, and a second part that is arranged to move with respect to the first part, said second part including a first connector member that is arranged to move axially within the

tubular outer part a limited amount. Advantageously at

least one, and preferably each, of the transverse support elements can include a second connector element that is arranged to move axially within the tubular outer part a limited amount. The first connector element is located towards one end of the transverse support element and the second connector element is located towards the other end. Adjusting the position of the first and/or second connector elements with respect to the first part adjusts the overall length of the transverse support element. By shortening the length of the transverse support elements, a compressive load is applied to the container sections in a transverse direction.

The container can include at least one second threaded element that is arranged to adjust the position of the second part with respect to the first part. Advantageously a second threaded element is arranged to adjust the position of the first connector element with respect to the first part. Advantageously another second threaded element is arranged to adjust the position of the second connector element with respect to the first part.

As shown in the first aspect, at least one, and preferably each, of the vertical support elements includes a first part, which includes a tubular outer part, and a second part that is arranged to move with respect to the first part, said second part including a connector member that is arranged to move axially within the tubular outer part a limited amount. Advantageously at least one, and preferably each, of the vertical support elements can include a second connector element that is arranged to move axially within the tubular outer part a limited amount. The first connector element is located towards one end of the vertical support element and the second connector element is located towards the other end. Adjusting the position of the first and/or second connector elements with respect to the first part adjusts the overall length of the vertical support element. By shortening the length of the vertical support elements, a compressive load is applied to the container sections in a vertical direction. This acts to urge the structural wall elements within each section towards one another, thereby more tightly holding the individual sections together.

The container can include at least one third threaded element that is arranged to adjust the position of the second part with respect to the first part. Advantageously a third threaded element is arranged to adjust the position of the first connector element with respect to the

first part. Advantageously another third threaded element is arranged to adjust the position of the second connector element with respect to the first part.

Advantageously each longitudinal support element can be connected to at least one of a transverse support element and a vertical support element. Advantageously the longitudinal support elements are connected to their respective transverse and/or vertical support element via the connector elements.

Advantageously each longitudinal support element can be connected to two transverse support elements. Advantageously the longitudinal support elements are connected to their respective transverse support elements via the connector elements.

Advantageously each longitudinal support element can be connected to two vertical support elements. Advantageously the longitudinal support elements are connected to their respective vertical support elements via the connector elements.

Advantageously each transverse support element can be connected to two vertical support elements. Advantageously the transverse support elements are connected to their respective vertical support elements via the connector elements.

Advantageously the support frame is at least partly separable in order to recover the thermally insulated wall elements for use in a new container.

The container can include a first closure member that is openable to provide access to the interior of the container. Preferably the first closure member comprises a first door. The first door is pivotally attached to the support frame. Advantageously the first door can be arranged to pivot about the hinge through an angle that is greater than 180 degrees, typically up to around 250 degrees.

The container can include a second closure member that is openable to provide access to the interior of the container. Preferably the second closure member comprises a second door. The second door is pivotally attached to the support frame. Advantageously the second closure member is arranged substantially opposite to the first closure member. Advantageously the second door can be arranged to pivot about the hinge through an angle that is greater than 180 degrees, typically up to around 250 degrees.

In some embodiments the container includes at least one rollable element, such as a wheel or castor, to support at least part of the weight of the door. At least one rollable element is preferably mounted to an underside of the or each door.

In some embodiments the container includes at least one foot, and preferably a plurality of feet. The feet may be used, for example, to obviate the need for a pallet. The feet can be spaced to enable the container to be lifted by a forklift truck. Typically the feet are attached to the frame.

Advantageously at least one foot includes a recess for housing at least part of the rollable element when the door is in a closed position. This helps to protect the rollable element during transit. Advantageously, the foot is mounted to the container such that a leading edge protrudes beyond the container body. Preferably the arrangement is such that at least a part of the foot is located beneath the door, when the door is in the closed position. This enables the foot to support at least part of the weight of the door, when the door is in the closed position.

Advantageously at least one foot engages and supports the rollable element, when the door is in the closed position. For example, the rollable element can include a flange that engages with a surface, preferably an upper surface, of the foot. The foot at least partly supports the weight of the rollable element, and hence the door, when the door is in the closed position. Preferably the interaction between the foot and the flange moves the rollable element out of contact with the ground.

The container can include a set of PCM units for controlling the temperature within the container.

Advantageously some of the PCM units are mounted on each of the walls of the container. The PCM units are preferably mounted onto the walls via brackets. Advantageously substantially the entire inner surface of each wall is covered with PCM units to provide more even heating / cooling within the container.

Advantageously some of the PCM units are mounted on at least one of the first and second closure members. Advantageously substantially the entire inner surface of each closure member is covered with PCM units to provide more even heating / cooling within the container.

In preferred embodiments, at least one of the container walls and/or container closure members includes a plurality of layers of PCM units.

The set of PCM units can include a first PCM unit having a first PCM arranged to change phase at a first temperature and a second PCM unit having a second PCM arranged to change phase at a second temperature, wherein the first and second temperatures are different. For example, the first PCM can change phase at a temperature in the range -20°C to $+5^{\circ}\text{C}$, and preferably at a temperature of around 0°C , and the second PCM changes phase at a temperature in the range $+5^{\circ}\text{C}$ to $+20^{\circ}\text{C}$ and preferably at a temperature of around $+5^{\circ}\text{C}$. The first PCM can mostly comprise of water and the second PCM can mostly comprise of a wax.

Advantageously the PCM can change from a solid state to a liquid state at a temperature in one of the following ranges: $+2^{\circ}\text{C}$ to $+8^{\circ}\text{C}$; -25°C to -15°C ; $+15^{\circ}\text{C}$ to $+25^{\circ}\text{C}$.

The container can include an external temperature sensor for measuring the ambient temperature outside of the container.

The container can include an internal temperature sensor for measuring the temperature in the payload volume.

The container can include a recording device for recording the temperature in the payload volume and / or the ambient temperature.

Advantageously the container is made from recyclable materials.

Herein disclosed is a modular system for constructing thermally insulated transportation containers for transporting temperature sensitive goods, said modular system enabling a variety of different sized thermally insulated containers to be constructed, (wherein each thermally insulated container constructed is sized and shaped for loading onto an aircraft Unit Load Device), said modular system including thermally insulated wall elements that are configurable into a plurality of container sections, and means for fixing the container sections together to form at least part of a thermally insulated container structure. The modular system enables transportation containers of any configuration described herein to be constructed.

Advantageously at least some of the container sections can be tubular, and preferably each of the container sections is tubular.

Advantageously the set of thermally insulated wall elements includes a substantially U-shaped element and a wall panel. Typically each container section includes first and second substantially U-shaped elements which are similar, and optionally can include at least one pair of wall panels interposed between the first and second substantially U-shaped elements.

Advantageously at least some of the thermally insulated wall sections include locating formations, such as a tongue and groove arrangement, for connecting the thermally insulated wall sections together.

Advantageously the means for fixing the container sections together includes a support frame. The support frame can be arranged according to any configuration described herein.

Herein disclosed is a method for constructing a modular thermally insulated transportation container that is arranged for transporting temperature sensitive goods, including: constructing a plurality of container sections from a set of thermally insulated wall elements, and fixing said container sections together to form at least part of a thermally insulated container structure.

Herein disclosed is a method wherein each container section is tubular.

Advantageously the method can include constructing a thermally insulated container according to any configuration described herein.

Embodiments of the invention will now be described by way of example only with reference to the accompanying drawings, in which:

Figs. 1a to 1f are views of a thermally insulated container according to a first embodiment of the invention;

Fig. 2a is an isometric view of structural elements that define the thermally insulated walls of the container in Figures 1a to 1f;

Fig. 2b is an exploded view of the structural elements of Fig. 2a;

Fig. 3a is an isometric view of an outer frame used to hold the structural elements of Fig. 2a together, in a non-loaded condition;

Fig. 3b is an enlarged detail view, with partial cutaway section, of a frame corner joint highlighted in Figure 3a, in the non-loaded condition;

Fig. 3c is a plan view from above of Fig. 3b showing part of a longitudinal support element, a transverse support element and some hidden details of their respective adjustment mechanisms;

Fig. 3d is a side view of Fig. 3b showing part of a longitudinal support element, a vertical support element and some hidden details of their respective adjustment mechanisms;

Fig. 3e is a side view of Fig. 3b showing part of a longitudinal support element, a transverse support element a vertical support element and some hidden details of their respective adjustment mechanisms;

Fig. 4a is an isometric view of the outer frame used to hold the structural elements of Fig. 2a together, in loading (reduced size) condition;

Fig. 4b is an enlarged detail view, with partial cutaway section, of a frame corner joint highlighted in Figure 4a, in the loaded (reduced size) condition;

Fig. 4c is a plan view from above of Fig. 4b showing part of a longitudinal support element, a transverse support element and some hidden details of their respective adjustment mechanisms;

Fig. 4d is a side view of Fig. 4b showing part of a longitudinal support element, a vertical support element and some hidden details of their respective adjustment mechanisms;

Fig. 4e is a side view of Fig. 4b showing part of a longitudinal support element, a transverse support element a vertical support element and some hidden details of their respective adjustment mechanisms;

Figs. 5a to 5c are isometric views of the structural elements of the container in different configurations, which enable different sized containers to be constructed from that shown in Figures 1a to 1f;

Figures 6a to 6f are views of a thermally insulated container according to a second embodiment of the invention;

Figures 7a to 7f are views of a thermally insulated container according to a third embodiment of the invention;

Figure 8a is a view of an alternative frame arrangement that can be used in conjunction with the first, second and third embodiments, wherein the length and the height of the frame is adjustable, but the width is not, said frame being in a fully contracted position;

Figure 8b is a view of the frame of Figure 8a in an expanded condition;

Figure 8c is an enlarged view of a portion of the frame of Figure 8a;

Figure 8d is an exploded view of Figure 8c;

Figure 8e is an enlarged view of a part of the Frame of Figure 8c to a larger scale than that shown in Figure 8c, with cut away sections to show hidden detail;

Figure 8f is an enlarged view of a part of the Frame of Figure 8d to a larger scale than that shown in Figure 8d;

Figure 9a shows a fourth embodiment of the invention, including feet and a wheel to support the weight of the door; and

Figure 9b is an enlarged view of part of the fourth embodiment with some features removed to show details of the feet and the way in which they are attached to a frame.

Thermally insulated containers according to the invention have a modular construction. The containers include a plurality of container sections, which are typically tubular, that are joined together in order to provide at least part of the thermally insulated container structure. A frame holds the tubular sections together. Furthermore each tubular section itself has a modular construction. Each tubular section includes at least upper and lower substantially U-shaped members (typically having a base/top member that is substantially orthogonal to its side walls) and, optionally at least one side wall panel. The container also includes at least one

door for accessing the interior of the container, and preferably two doors arranged opposite to one another.

It will be appreciated from the following description that a number of different sized thermally insulated containers can be constructed from a relatively low number of basic components in order to enable the containers to be mounted onto particular aircraft pallets and aircraft, such as $\frac{1}{4}$ PMC, $\frac{1}{2}$ LD11, $\frac{1}{2}$ PAG, and $\frac{1}{2}$ PMC pallets.

A thermally insulated container 1 according to a first embodiment of the invention is shown in Figs. 1a to 4d. The container 1 includes five tubular sections 3 that are arranged substantially co-axially to form part of the structure of the container 1. The tubular sections 3 each have a rectangular cross-section and therefore, when they are axially aligned, they form an upper wall 11, a base 12 and two side walls 13,15 of the container 1, and provide front and rear openings. Though of course, it will be appreciated by the skilled person that the tubular sections 3 can be aligned in a different orientation, for example vertically to provide four side walls, and upper and lower openings.

Each tubular section 3 is similar. Each tubular section 3 includes an upper U-shaped element 5, a lower U-shaped element 7 and four side panels 9. The side panels 9 are located between the upper and lower U-shaped elements 3,5 and provide the container with extended side walls.

The upper U-shaped elements 5,7 and the side panels 9 each include an outer shell made from a plastics material, to provide a substantially rigid outer shell. They are each manufactured by a roto-moulding process and are each filled with foam, and preferably high density foam, such as polyurethane foam, and are therefore thermally insulated.

The upper U-shaped element 5 includes an upper wall 5a and first and second sides 5b,5c. The first side 5b is located towards one end of the upper wall 5a and is arranged substantially perpendicular thereto. The second side 5c is located towards the other end of the upper wall 5a and is arranged substantially perpendicular thereto. The first and second sides 5b,5c are arranged substantially parallel to one another. The upper wall 5a defines a part of an upper wall 11 of the container. The first and second sides 5b,5c define part of side walls 13,15 of the container.

The first side 5b includes a first tongue and groove arrangement 17, which includes a central tongue 19 located at one end of the first side 5a. The second side 5c includes a second tongue and groove arrangement 21, which includes first and second lateral tongues 23,25, and a central cavity 27. The first tongue and groove arrangement 17 is complementary to the second tongue and groove arrangement 21.

The upper U-shaped element 5 includes front and rear lips 29,31 for supporting transverse members 33 in an external support frame 35. The front lip 29 on a first tubular section 3 forms a transverse recess with the rear lip 31 on an adjacent second tubular section 3.

The upper U-shaped element 5 includes corner recesses 37 for receiving longitudinal members 59 in the frame 35.

The upper U-shaped element 5 includes a central ridge 41, which provides a mounting for receiving central brackets 43,44 which are used to locate and support PCM units 42 in the interior of the container. The ridge 41 is arranged centrally on the internal face 45 and is arranged substantially parallel with the first and second sides 5b,5c. The upper U-shaped element 5 further includes lateral ridges 47,49, which provide mountings for receiving lateral brackets 51,53, which are used to locate and support PCM units in the interior of the container. Further brackets 48 are mounted on internal ridges 50 located on an inner face of the side panels 9.

The lower U-shaped element 7 is similarly arranged to the upper U-shaped element 5. The wall 7a defines part of the container base 12.

Each side panel 9 is substantially rectangular in plan. Each side panel 9 includes a first tongue and groove arrangement 55, which is located towards one end of the panel. The first tongue and groove arrangement 55 is arranged similarly to the first tongue and groove arrangement 17 on the upper U-shaped element 5. Each side panel 9 includes a second tongue and groove arrangement 57, which is located at an opposite end to the first tongue and groove arrangement 55. The second tongue and groove arrangement 57 is similarly arranged to the second tongue and groove arrangement 21 on the upper U-shaped element 5.

The side panels 9 are interposed between the upper and lower U-shaped elements 5,7 in order to adjust the height of the tubular sections 3.

In Figures 1a-1f, the each tubular section 3 includes four side panels 9, with the upper U-shaped element 5 being spaced from the lower U-shaped element 7 by two panels 9 on each side. Each pair of panels 9 is connected by the complementary first and second tongue and groove arrangements 55,57. Each panel 9 in the pair is connected to one of the upper and lower U-shaped elements 5,7 via the complementary first and second groove arrangements 17,57;21,55. When the side panels 9 are connected to the upper and lower U-shaped elements 5,7, a tubular container wall section 3 is constructed, which is thermally insulated. However, it will be appreciated by the skilled person that while two panels 9 are provided on each side in Figures 1a-1d, that more or fewer panels 9 can be included in order to adjust the shape of the tubular section 3. It will be further appreciated that the side panels 9 are entirely optional and that the upper and lower U-shaped elements 5,7 can be connected together via the first and second tongue and groove arrangements 17,21 in order to construct a tubular section 3.

The container 1 includes a plurality of tubular sections 3. In Figures 1a-1f, the container 1 includes five tubular sections 3. Optionally, the tubular sections 3 can include one or more alignment pin and recess pairs (not shown) for aligning the sections 3 with respect to one another.

The tubular sections 3 are fixed together by the external frame 35. The size of the external frame 35 is adjustable to apply a compressive load to the tubular sections 3, thereby fixing their positions relative to each other.

The frame 35 includes four horizontal longitudinal frame elements 59, four horizontal transverse frame elements 61, and four vertical frame elements 63. The frame elements 59,61,63 are arranged in a substantially cuboid space frame fashion (see Figures 3a and 4a). The frame 35 is fitted about the tubular sections such that the longitudinal support elements 59 sit in the corner recesses 37 of the tubular sections 3.

The frame 35 is arranged to apply a compressive load to the tubular sections 3, and as such includes mechanisms for adjusting the size of the frame in each of the longitudinal, transverse and vertical directions. Reducing the size of the frame applies a compressive load to the tubular sections 3. Increasing the size of the frame reduces / removes the compressive load, for example when it is desired to disassemble the container 1. Details of the way in which the

frame elements 59, 61 and 63 are connected together and the mechanisms for tightening/releasing the frame are illustrated in Figures 3b to 4e.

Each of the frame elements 59,61,63 includes an outer section 59a,61a,63a of tubing, which is elongate and has a rectangular cross section. Preferably the tubing is made from aluminium, however other materials such as steel and / or plastics can be used.

Each transverse frame element 61 includes a first connector 65 located towards each end of the outer section 61a. Each first connector 65 includes a block of material (such as aluminium or a thermoplastics material) that is located within the outer section 61a. The position of each first connector 65 with respect to the outer section 61a is adjustable. Each first connector 65 is associated with a first threaded anchor 67 and a first bolt 69. The threaded anchor 67 includes an internal thread that is arranged to receive the bolt 69. The position of the first anchor 67 is fixed with respect to the outer section 61a. Tightening/loosening the first bolt 69 adjusts the position of the first connector 65 relative to the outer section 61a, as can be seen by comparing Figures 3c and 4c. By adjusting the first bolt 69, the width of the frame 35 is adjusted. When the width of the frame is reduced, a compressive load is applied to the container sections 3 in a transverse direction.

Each longitudinal frame element 59 includes a second connector 71 located towards each end of the outer section 59a. Each second connector 71 includes a block of material (such as aluminium or a thermoplastics material) located within the outer section 59a. The position of each second connector 71 with respect to the outer section 59a is adjustable. The first bolt 69 passes through the outer section 59a and the second connector 71 and is arranged to move within first slots 73 formed in the outer section 59. A threaded element 75 passes through the second connector 71 at a first end and runs the entire length of the outer section 59a passing through the second connector 71 at the opposite end of the outer section 59a. A nut 77 is located towards each end of the threaded element 75. Rotating the nut 77 adjusts the axial position of the second connector 71 with respect to the outer section 59a. Rotating the nut 77 clockwise effectively shortens the overall length of the longitudinal frame element 59, and hence the length of the frame 35, and rotating the nut 77 anti-clockwise effectively extends the overall length of the longitudinal frame element 59. When the length of the frame is reduced, a compressive load is applied to the container sections 3 in a longitudinal direction.

The longitudinal frame element 59 includes second slots 79. A bolt 81 extends through the second slots 79 and the second connectors 71 into a third connector 83 which is located within the outer section 63a of the vertical frame element 63. Each third connector 83 comprises a block material (such as aluminium or a thermoplastics material) that is arranged for limited axial movement with respect to the outer section 63a. Third and fourth bolts 85,89 pass through the first connector 65 into the third connector 83. The third and fourth bolts 85,89 extend through the third connector 83 and engage with second and third threaded anchors 91,93 respectively. By rotating the third and fourth bolts 85,89 the position of the third connector 83 with respect to the outer section 63a can be adjusted by a small amount, thereby effectively adjusting the height of the frame 35 by a small amount. When the height of the frame 35 is reduced, a compressive load is applied to the container sections 3 in a vertical direction. Thus the thermally insulated wall elements 5,7,9 in each individual section 3 are urged together, thereby ensuring that each individual section 3 retains its shape.

The second bolt 81 passes through the third connector 83. The third bolt 83 is arranged to move within the second slot 79 when the second connector 71 moves relative to the frame element 59. Thus each longitudinal frame element 59 is connected to its respective transverse frame elements 61 and vertical frame elements 63 by an adjustable arrangement, wherein the height, width and length of the frame are each adjustable by a small amount.

The overall effect of applying the external frame 35 to the tubular sections 3 is to provide a part of the container structure, which defines four walls of the container (upper, base, and two side walls).

Optionally, the transverse cross members 33 can be applied within the recesses formed by the front and rear lips 29,31 in order to further strengthen the container.

It will be appreciated from Figures 3a and 4a that at two corners of the frame the longitudinal frame elements 59 extend a little beyond the adjacent vertical frame elements 63. A hinge 95, in the form of a cylindrical rod, is provided between pairs of adjacent frame elements 59. A thermally insulated door 97 is mounted at each open end of the container via one of the hinges 95. Each door 97 includes a roto-moulded outer shell that is filled with an insulating material, such as foam, and preferably a high density foam. Having doors 97 at each end of the

container provides better access to the payload volume within the container and also enables PCM units 42 to be loaded into the container more easily.

The insulated container 1 is designed specifically for use in transporting goods that must be maintained at a temperature of between +2°C and +8°C such as, for example, vaccines, temperature sensitive therapies and medicines. Insulated containers for different temperatures will be generally similar in construction, but may be modified as described in more detail below to maintain the required temperatures. For example, for some applications the internal temperature must be maintained in the range +15°C to +25°C whereas for other applications, the internal temperature must be maintained in the range -25°C to -15°C.

It can be seen from Figure 1e that the PCM units 42 are loaded into the container in a regular fashion via the receiving brackets 43,44,51,53 and further brackets. The PCM units 42 are sized such that substantially the whole area of the interior face of the container walls and doors are lined with PCM units 42 to provide maximum cooling duration. Furthermore, since the arrangement of the PCM units is highly regular this provides good thermal equilibration within the container 1.

Each PCM unit 42 comprises a hollow container made from a polymer such as polyethylene and is filled with a PCM. The PCM used is dependent on the temperature characteristics that the payload requires. Some units 42 may have a different PCM from other units 42, in order to provide the required cooling required. For example, in order to maintain the goods being transported at a temperature of between +2°C and +8°C: some units 42 may include a PCM that changes phase at around 0°C and other units 42 may include a PCM that changes phase at around +5°C. A PCM that changes phase at around 0°C can comprise filtered water, and may include two acticides: DB20, which is fast acting, and MBS, which is slower acting. A PCM that changes phase at around +5°C can comprise a paraffin wax (mostly n-tetradecane).

An advantage of the invention is that for each of the temperature ranges +2°C to +8°C; -25°C to -15°C; +15°C to +25°C it is only necessary to have one set of PCM panels (one different set for each temperature range) for any destination, that is regardless as to whether the container is being sent to a relatively hot country or a relatively cold country. This is because of the thermal stability achieved by the invention.

In use, prior to loading the insulated container 1, each of the PCM units is conditioned by cooling (or heating) to predetermined temperatures. For example, any units 42 including a PCM that changes phase at 0°C are typically cooled to a temperature of around -20°C and units 42 containing a PCM that changes phase at +5°C are cooled to a temperature of around +6 °C. The units 42 are then loaded into the insulated container 1 to provide a substantially cuboid payload volume. At this stage the goods are loaded into the payload volume and can be surrounded by a packing material such as bubble wrap to ensure that the goods do not move during transit. If used, it is preferable that the packing material has also been conditioned to reduce its temperature prior to use.

It will be appreciated that when the container construction is completed, that it can be mounted on an appropriate aircraft pallet (see for example Figures 1a, 1b, 1c, 1e and 1f). The inventors have found that the width W of the container should be around 1550mm to enable the modular construction to be used on the following pallets: ¼ BMC, ½ LD11, ½ PAG and ½ PMC. This corresponds to the length of the top/bottom walls 5a,7a of the upper and lower U-shaped elements.

The insulated container 1 has a modular construction that has a relatively small number of structural elements that can be constructed together to form the walls 3,5,7,9 of the container 1; and a frame 11, which is arranged to hold the structural elements together. The structural elements can be fitted together in different configurations, as can be seen in the Figures in order to produce differently sized containers 1,101,201, with the frame 135,135,235 being sized according to the size of the container (as will be apparent from the description below and from a comparison of Figs. 1a to 1f with Figs. 5a to 7f).

It will be appreciated from Figures 5a to 5c that different configurations of the tubular sections 3; 103; 303 are achievable by providing a greater or lesser number of side wall panels 9; 109.

For example, Figures 6a to 6f show a second embodiment of the invention which provides a container 101, which is made up of three tubular sections 103, a frame 135 and two doors 197. Each tubular section 103 includes upper and lower U-shaped elements 105,107 and one pair of wall panels 109 interposed therebetween. It will be apparent from the drawings that the second embodiment is constructed from the same basic elements as the first embodiment. It

will also be appreciated that the size of the support frame 135 is smaller than in the first embodiment.

A third embodiment is shown in Figures 7a to 7e. This embodiment provides a container 203, which includes two tubular sections 203, a frame 235 and two doors 297. Each tubular section 203 includes upper and lower U-shaped elements 205,207 but does not include any wall panels. It will be apparent from the drawings that the third embodiment is constructed from the same basic elements as the first embodiment. It will also be appreciated that the size of the support frame 235 is smaller than in the first embodiment.

Various modifications of the invention are possible that fall within the scope of the current invention, some examples of which are discussed below.

While the support frame is shown in the Figures as having adjustability at each corner, it is envisaged that in some embodiments at least some of the corner joints will be non-adjustable, for example can be welded together. Adjustability at each corner is desirable because the manufacturing tolerances for roto-moulded products are relatively high. However, if the thermally insulated wall elements are manufactured by a different process, or the tolerances of the roto-moulding process improves, a simplified frame structure can be used. For example, it may only be necessary to apply a compressive load in any subset of the following directions: longitudinal, transverse and vertical, for example in just one of those directions (e.g. longitudinal only), or just two of those directions (e.g. longitudinal and vertical), and therefore the required adjustability at the corners can be set accordingly.

Figures 8a to 8f show an alternative frame arrangement 335 that can be used in conjunction with the first, second and third embodiments, wherein the length and the height of the frame 335 is adjustable, but the width is not. In this frame 335, there are four longitudinal elements 359; four transverse elements 361; and four vertical elements 363. The longitudinal elements 359 are fixed to the vertical elements 363, and the vertical elements 363 are fixed to the transverse elements 361. The length of each transverse element 361 is fixed. The length of each longitudinal element 359 is adjustable. The length of each vertical element 363 is adjustable.

Each longitudinal element 359 includes an outer tubular member 359a and first and second inner parts 359b,359c, each of which are arranged for limited telescopic movement with

respect to the outer tubular member 359a. The first inner part 359b is arranged with respect to the outer tubular member 359a such that a first portion is located within the tubular member 359a and a second portion protrudes out of a first end 359d of the tubular member. The second inner part 359c is arranged with respect to the outer tubular member 359a such that a first portion is located within the tubular member 359a and a second portion protrudes out of a second end of the tubular member. A door mount portion 359d is releasably attached to one end of the second inner part 359c. The length of the longitudinal element 359 is adjustable by adjusting the position telescopically of at least one of the first and second inner parts 359b,359c with respect to the tubular outer member 359a.

The positions of the first and second inner parts 359b,359c with respect to the outer member 359 are fixable by tightening screw elements 360. The screw elements 360 are inserted into holes 370 in the tubular member 359a. The screw elements 360 pass through slots 380 formed in the first and second inner parts 359b,359c. The slots 380 enable limited relative movement between the inner and outer parts, while the screw elements are loosened.

The first inner part 359b abuts a respective vertical element 363 and a respective transverse element 361 to form a corner 365 of the frame 335. The second inner part 359c abuts a respective vertical element 363 and a respective transverse element 361 to form another corner 365 of the frame 335.

Each vertical element 363 includes first and second outer tubular members 363a,363b and at least one inner part 363c. The inner part 363c is arranged for limited telescopic movement with respect to at least one of, and preferably each of, the first and second outer tubular members 363a,363b. The inner part 363c is arranged with respect to the first outer tubular member 363a such that a first portion is located within the first tubular member 363a. The inner part 363c is arranged with respect to the second outer tubular member 363b such that a second portion is located within the second tubular member 363b. The length of the vertical element 363 is adjustable by adjusting the position telescopically of the inner part 363c with respect to at least one of the first and second outer members 363a,363b.

The telescopic position of the inner part 363c with respect to at least one of the first and second outer members 363a,363b is fixable by tightening screw elements 362. The screw elements 362 are inserted into holes 390 in the tubular member 362a,362b. The screw

elements 362 pass through slots 392 formed in the inner part 362c. The slots 392 enable limited relative movement between the inner and outer parts, while the screw elements are loosened.

The first outer member 363a abuts a respective transverse element 361 and a respective longitudinal element 359 to form another corner 365 of the frame 335. The second outer member 363b abuts a respective transverse element 361 and a respective longitudinal element 359 to form another corner 365 of the frame 335.

Optionally the frame 335 may include strengthening members. For example, triangular shaped strengthening members 367 can be provided to strengthen the joint between each vertical element 363 and its respective transverse element 361 (see Figures 8c and 8d). Similar strength members can be used between other elements. Each of the outer tubular members 363a, 363b in each vertical element 363 can include a substantially L-shaped bracket 369 attached to an outer surface thereof. Each vertical element inner part 363c can include a flange 371 that can be bolted to respective L-shaped bracket to strengthen the vertical elements 363, using bolts 364. The flange 371 is arranged substantially perpendicular to an outer surface of the inner part 363c. Slots 373 are provided towards each end of the flange. The slots 373 enable the inner part 363c to slide into the first and second outer members 363a, 363b, and enable the flange 371 to be located outside of the first and second outer members 363a, 363b. Thus each slot 373 receives a wall 375 of the first and second outer members 363a, 363b respectively as the inner part is pushed into the outer part. Strengthening the vertical elements in this manner is advantageous since the doors are mounted to the vertical elements.

Thus the adjustability in this frame has moved away from the corners.

Figures 9a and 9b show a container 401 according to a fourth embodiment of the invention. The fourth embodiment is similar to the preceding embodiments, except that it includes feet 403, and a castor or wheel 405 to support the weight of a door 497.

The feet 403 are attached to a frame 435 and are arranged to protrude beyond the frame 435. Each foot includes a recess 407. The recess is arranged to receive and house the castor or wheel 405 when the door 497 is closed. Typically, each door 497 only includes one castor or

wheel 405 and it is arranged on the door substantially aligned with one of the feet, and is arranged to interact with that foot when the door is in the closed position.

The castor or wheel 405 includes a flange 409 that is arranged to engage the respective foot 403 when the door is closed, typically on an upper surface of the foot. This enables the foot 403 to support at least part of the weight of the door 497 via the castor or wheel 405, when the door 497 is in the closed position. Preferably the interaction between the foot and flange is such that the castor or wheel 405 is lifted off the ground when the door is closed.

The feet 403 can be used in addition, or as an alternative to, a transport pallet.

It will be appreciated that modifications can be made to the above embodiments that still fall within the scope of the invention, for example, different types of PCM may be used to meet required temperature ranges. The invention is not to be considered as limited to just the ranges mentioned in the examples.

Optionally, the container can include at least one of an external temperature sensor mounted on the outside of the casing container, and an internal temperature sensor mounted inside the payload volume. These are connected to a single or multi-channel data logger that is provided to maintain a record of the payload temperature during the entire transit time. The temperature log may be kept in visual or electronic form, and in the latter case facilities may be provided for downloading the information to a computer. The data logger can also be arranged to record events such as the insulated container being opened or tampered with. The data logger can be connected to a sensor which monitors open and/or closing events, and is arranged to record data relating to those events. This enables an operator to establish if the container has been accessed during transportation.

The transverse elements 361 can be arranged to be adjusted in a similar fashion to the vertical elements 363 and / or longitudinal elements 359.

CLAIMS

1. A thermally insulated container for transporting temperature sensitive goods, said container having a modular construction that includes: a plurality of thermally insulated container sections; and a support frame for fixing the container sections together to provide at least part of the thermally insulated container structure, wherein the support frame includes a plurality of longitudinal support elements, a plurality of transverse support elements, and a plurality of vertical support elements, and wherein at least one of the support elements includes a first part including a tubular outer part, and a second part including a first connector member that is arranged to move axially a limited amount within the tubular outer part, such that the length of the support element is telescopically adjustable.
2. A container according to claim 1, wherein at least some of the container sections includes first and second open ends, and the container sections are aligned in a substantially co-axial manner such that an open end of a first container section is positioned adjacent to an open end of a second container section.
3. A container according to claim 1 or 2, wherein at least one of the container sections is tubular.
4. A container according to any one of the preceding claims, wherein at least one of the container sections includes a plurality of thermally insulated wall elements.
5. A container according to claim 4, wherein at least one of the container sections includes a first substantially U-shaped thermally insulated wall element.
6. A container according to claim 4 or 5, wherein at least one of the container sections includes a second substantially U-shaped thermally insulated wall element.
7. A container according to claim 5 and 6, wherein at least one of the container sections includes at least one thermally insulated wall panel interposed between the first and second substantially U-shaped wall elements.
8. A container according to claim 7, wherein at least one of the container sections includes a pair of thermally insulated wall panels interposed between the first and second substantially U-shaped thermally insulated wall elements to provide a tubular container section.

9. A container according to any one of claims 4 to 8, wherein at least one of the thermally insulated wall elements includes locating formations, such as a tongue and groove arrangement, for connecting the thermally insulated wall elements together.
10. A container according to any one of the preceding claims, wherein the support frame is mounted externally of the container sections.
11. A container according to claim any one of the preceding claims, wherein the support frame is arranged to apply a compressive load to at least some of the container sections.
12. A container according to any one of the preceding claims, including means for adjusting at least two of the height, width and length of the support frame.
13. A container according to any one of the preceding claims, including means for adjusting each of the height, width and length of the support frame.
14. A container according to any one of the preceding claims, wherein the support frame is continuously adjustable in at least one of the longitudinal, transverse and vertical directions.
15. A container according to any one of the preceding claims, including at least one threaded element that is arranged to adjust the position of the second part with respect to the first part.
16. A container according to any one of the preceding claims, including means for fixing the position of the first part with respect to the second part.
17. A container according to any one of the preceding claims, wherein each of the longitudinal support elements is telescopically adjustable.
18. A container according to claim 17, including, for each longitudinal support element, at least one first threaded element that is arranged to adjust the position of the second part with respect to the first part.
19. A container according to any one of claims 17 to 19, including means for fixing the position of the first part with respect to the second part.
20. A container according to any one of the preceding claims, wherein each of the transverse support elements is telescopically adjustable.

21. A container according to claim 20, including, for each transverse support element, at least one second threaded element that is arranged to adjust the position of the second part with respect to the first part.
22. A container according to any one of claims 20 or 21, including means for fixing the position of the first part with respect to the second part.
23. A container according to any one of the preceding claims, wherein each of the vertical support elements is telescopically adjustable.
24. A container according to claim 23, including, for each vertical support element, at least one third threaded element that is arranged to adjust the position of the second part with respect to the first part.
25. A container according to claim 23 or 24, including means for fixing the position of the first part with respect to the second part.
26. A container according to any one of the preceding claims, wherein each longitudinal support element is connected to at least one of a transverse support element and a vertical support element.
27. A container according to any one of the preceding claims, wherein each longitudinal support element is connected to two transverse support elements.
28. A container according to any one of the preceding claims, wherein each longitudinal support element is connected to two vertical support elements.
29. A container according to any one of the preceding claims, wherein each transverse support element is connected to two vertical support elements.
30. A container according to any one of the preceding claims, including a first closure member that is openable to provide access to the interior of the container.
31. A container according to any one of the preceding claims, including a second closure member that is openable to provide access to the interior of the container.

32. A container according to claim 30 or 31, wherein at least one of the first and second closure elements is a door, and the container further includes at least one rollable element, such as a wheel or castor, to support at least part of the weight of the door.
33. A container according to any one of the preceding claims, including at least one foot.
34. A container according to claim 33 when dependent on claim 33, wherein at least one foot includes a recess for housing at least part of the rollable element when the door is in a closed position.
35. A container according to claim 33 or 34 when dependent on claim 33, wherein at least one foot engages and supports the rollable element, when the door is in the closed position.
36. A container according to any one of the preceding claims, including a set of PCM units for controlling the temperature within the container.
37. A container according to claim 36, wherein PCM units are mounted on each of the walls of the container.
38. A container according to claim 36 or 37, when dependent on claims 30 or 31, wherein PCM units are mounted on at least one of the first and second closure members.
39. A container according to claim 37 or 38, wherein at least one of the container walls and/or container closure members includes a plurality of layers of PCM units.
40. A container according to any one of claims 36 to 39, wherein the set of PCM units includes a first PCM unit having a first PCM arranged to change phase at a first temperature and a second PCM unit having a second PCM arranged to change phase at a second temperature, wherein the first and second temperatures are different.
41. A container according to claim 40, wherein the first PCM changes phase at a temperature in the range -20°C to $+5^{\circ}\text{C}$, and preferably at a temperature of around 0°C , and the second PCM changes phase at a temperature in the range $+5^{\circ}\text{C}$ to $+20^{\circ}\text{C}$ and preferably at a temperature of around $+5^{\circ}\text{C}$.
42. A container according to claim 40 or 41, wherein the first PCM mostly comprises of water and the second PCM mostly comprises of a wax.

43. A container according to any one of claims 36 to 42, wherein the PCM changes from a solid state to a liquid state at a temperature in one of the following ranges: +2°C to +8°C; -25°C to -15°C; +15°C to +25°C.
44. A container according to any one of the preceding claims, wherein the support frame is at least partly separable in order to recover the thermally insulated wall elements for use in a new container.
45. A container according to any one of the preceding claims, including an external temperature sensor for measuring the ambient temperature outside of the container.
46. A container according to any one of the preceding claims, including an internal temperature sensor for measuring the temperature in the payload volume.
47. A container according to any one of the preceding claims, including a recording device for recording the temperature in the payload volume and / or the ambient temperature.
48. A modular system for constructing thermally insulated transportation containers for transporting temperature sensitive goods, said modular system enabling a variety of different sized thermally insulated containers to be constructed, said modular system including: thermally insulated wall elements that are configurable into a plurality of container sections; and a support frame for fixing the container sections together to form at least part of a thermally insulated container structure, said support frame including a plurality of longitudinal support elements, a plurality of transverse support elements, and a plurality of vertical support elements, wherein the lengths of at least some of the support elements are adjustable, the arrangement being such that at least two of the height of the support frame, the width of the support frame and the length of the support frame are adjustable.
49. A container according to claim 48, wherein at least one of the container sections is tubular.
50. A container according to claim 48 or 49, wherein the set of thermally insulated wall elements includes a substantially U-shaped element and a wall panel.

51. A container according to any one of claims 48 to 50, wherein at least one of the thermally insulated wall sections includes locating formations, such as a tongue and groove arrangement, for connecting the thermally insulated wall sections together.
52. A modular system according to any one of claims 48 to 51, wherein the arrangement of the support frame is such that each of the height of the support frame, the width of the support frame and the length of the support frame is adjustable.
53. A modular system according to any one of claims 48 to 52, wherein at least one of the support elements includes a first part including a tubular outer part, and a second part including a first connector member that is arranged to move axially a limited amount within the tubular outer part, such that the length of the support element is telescopically adjustable.
54. A method for constructing a modular thermally insulated transportation container that is arranged for transporting temperature sensitive goods, including: constructing a plurality of container sections from a set of thermally insulated wall elements; and fixing said container sections together to form at least part of a thermally insulated container structure with an external support frame having a plurality of longitudinal support elements, a plurality of transverse support elements, and a plurality of vertical support elements to form at least part of a thermally insulated container structure; and adjusting the lengths of at least some of the support elements such that at least two of the height of the support frame, the width of the support frame and the length of the support frame are adjusted.
55. A method according to claim 54, including reducing the size of the support frame to apply a compressive load to the container sections.
56. A method according to claim 54 or 55, wherein each container section is tubular.
57. A method according to any one of claims 54 or 56, wherein the container constructed is arranged according to any one of claims 1 to 51.