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(54) **Container for the transport of temperature sensitive products**

(57) A container (1) for the transport of temperature sensitive products comprises a base (10), one or more side walls (11), and a lid (12), which are made from an insulating foam and which together define a container inner space in the assembled state. Thermal insulation means are arranged in the base (10), in the one or more side walls (11), and in the lid (12). The base (10) and the one or more side walls (11) together are a single integrally formed piece (10,11). Both the said single piece (10,11)

as well as the lid (12) are produced through expansion molding. The insulation means comprise vacuum insulation panels (2) arranged in the respective walls of the single piece (10,11) and of the lid such, that they face the inner space of the container. The preconditioned temperature storage units (3) are arranged within the container inner space to define a product containment space (4) where the products can be placed for storage or transport.

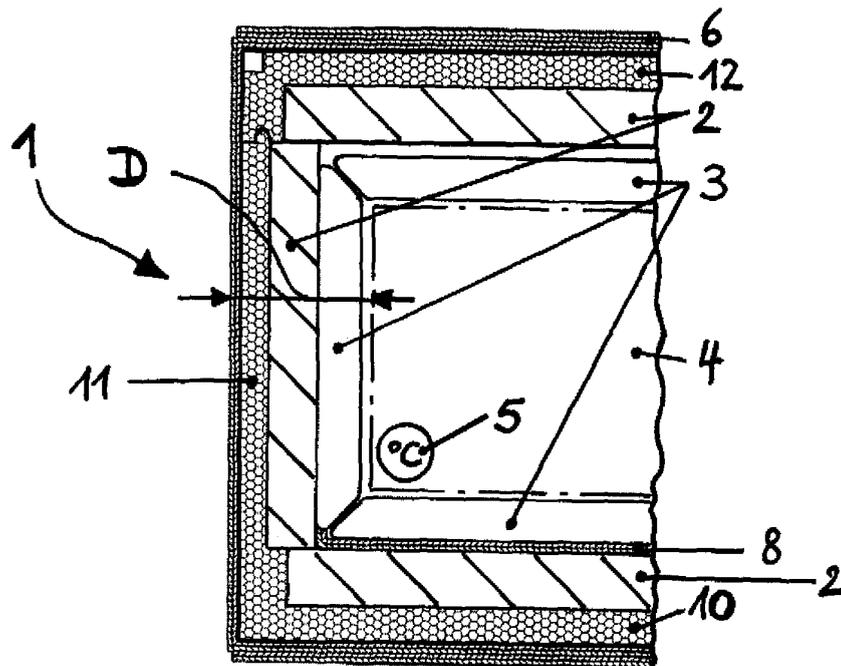


Fig. 1

Description

[0001] The present invention deals with a container for the transport of temperature sensitive products.

[0002] In various fields of application the transport of temperature sensitive products is not rarely prescribed by the competent authorities and must be strictly observed. This holds in particular for a number of products (e.g. biotechnologically produced products containing proteins) produced by the pharmaceutical industry which are to be distributed to hospitals, pharmacies, etc.. For such products, it is oftenly a requirement that a continuous (uninterrupted) cold chain must be maintained from production until delivery of the product. A typical prescribed temperature range is 2°C to 8°C.

[0003] The products are usually transported in large containers which are themselves surrounded by cardboard or the like, and are stacked on pallets. The temperature in the containers used for the transport of the products is measured during transport, that is to say a measuring device is arranged in the product containment space of the respective containers together with the products to be transported. The measuring device records the temperature during transport of the products, so that upon receipt of the container, the recipient may easily check whether or not the cold chain has been interrupted.

[0004] However, while the above-described transportation of large containers on pallets may be an efficient way for the distribution of large amounts of products, it is not an efficient way for the distribution of smaller amounts of products via courier, as this may be desirable for products for clinical studies, for example. One reason is, that a temperature measuring device must be present in each container, which represents substantial expense. Another reason is, that the usual containers are voluminous and are not suitable for delivery of small amounts of products via courier because of their inconvenient handling.

[0005] Containers for the transport or storage of blood or temperature sensitive medical products are known, for example, from EP-A-1 302 410. Such containers allow the transport of small amounts of products. The container comprises a number of pieces - at least three - that need to be assembled with the aid of groove-and-tongue joints. In the inner space of the container defined after assembly of the pieces, a temperature measuring device such as a thermometer or a suitable temperature recording device is provided which can be checked by the recipient upon receipt of the container in order to verify that the cold chain has not been interrupted. The walls of the container elements are double-walls, and the space between the double-walls is filled with a paraffin-based latent heat storage medium which has a phase transition in the desired temperature range to be maintained.

[0006] In many instances, it is desirable or even required to have preconditioned temperature storage units (e.g. cooling elements) arranged in the inner space of the container, in addition to the latent heat storage me-

dium acting as an insulation means to keep the temperature in the product containment space within a predetermined desired temperature range. However, when using conventionally structured containers, for a container having a product containment space having a volume of e.g. about twenty-four litres this leads to a container which is too large and too heavy for it to be handled by one person as a single item that can be distributed or shipped by courier, as this may be desirable for products for clinical studies, for example.

[0007] It is an object of the invention to suggest a container which is suitable for the transport of comparatively small amounts of temperature sensitive products which can be handled by one person as a single item. At the same time, the container should be easy to manufacture and should have a size and weight which is such that the container can be handled as a single item for distribution or shipping by one person.

[0008] This object is achieved through the container as it is defined by the features of independent claim 1. Advantageous embodiments are the subject of the respective dependent claims.

[0009] In particular, the container for the transport of temperature sensitive products in accordance with the present invention comprises a base, one or more side walls, and a lid, which are made from an insulating foam and which together define a container inner space in the assembled state. Thermal insulation means are arranged in the base, in the one or more side walls, and in the lid, respectively. The base and the one or more side walls together are a single integrally formed piece. Both the said single piece as well as the lid are produced through expansion molding. The insulation means comprise vacuum insulation panels arranged in the respective walls of the single piece and of the lid such, that they face the inner space of the container. Preconditioned temperature storage units are arranged within the thus defined container inner space to define a product containment space where the products can be placed for the transport. It is thus possible to provide a container having a reduced wall thickness when compared to conventional containers, so that the container according to the invention has a size and weight which is such that it can be carried and handled as a single item by one person.

[0010] Expansion molding is a well-established technique for the manufacturing of moldings having a desired shape and is described in the literature. Therefore, the following description only shortly summarizes essential steps of this technique. First, the mold is filled with a foaming material, for example in the form of pre-expanded beads of the foaming material. Once filling of the mold with the pre-expanded beads has been completed, the mold is closed and steam or another suitable propellant gas causes melting and substantial expansion of the beads. Thus, a molding having the desired shape defined by the mold is produced which is made from an expanded insulating foam. After cooling of the mold (if necessary), the mold can be opened and the molding can be demold-

ed, i.e. it can be taken out from the mold.

[0011] In the instant invention, the base and the at least one side wall are a single integrally formed piece. Since it may be possible to manufacture any desired shapes of containers as long as deforming of the respective moldings is possible, it may also be possible that the single integrally formed piece has a base and only one side wall (e.g. circular outer shape of the side wall). In the case of an essentially rectangular shape of the container, there are four side walls (front and rear side wall, left and right side wall).

[0012] Once the single piece and the lid of the container have been molded, the vacuum insulation panels can be mounted to or attached to the lid of the container or to the base and side walls of the single piece, respectively. For example, a vacuum insulation panel can be attached to the lid in a suitable recess provided in the lid by gluing the vacuum insulation panel to the lid. The same is generally possible with respect to the vacuum insulation panels which are to be mounted to or attached to the base and the side walls, respectively.

[0013] The preconditioned temperature storage units can be arranged directly adjacent to the vacuum insulation panels so as to define the product containment space for the products to be stored or transported. This results in a very compact size of the overall container, since the wall thickness of the side walls made from the expanded insulating foam may only be in the range of about 20 mm to 25 mm. Given a typical thickness of a preconditioned temperature storage unit of about 30 mm it is thus possible to have an overall thickness of the side wall from the very outer point of the container (including a cardboard wrapped about the container) to the product containment space of somewhere about 100 mm. For a product containment space of e.g. twenty-four litres having a rectangular cross-section this allows to produce a container with excellent insulation properties which is at the same time reliable to manufacture and which still can be carried and handled by one person as a single item.

[0014] This is particularly advantageous with respect to the transport of small amounts of products in small containers which, for example, may have a volume of the product containment space of about 12 liters or 24 liters (and which may carry loads of about 10 kg), and which at the same time have excellent thermal insulation properties. It is thus possible to deliver smaller amounts of products by courier since the dimension of the container are such that it can be conveniently handled as a single item by one person. In addition, given that the delivery will be performed within three days from closing the container no temperature measuring device is required in the inner space of the container since the temperature is maintained stable there (i.e. the temperature is kept within the specified range) for at least this period of time, so that upon receipt of the container the recipient need not check the temperature within the container but simply has to check the date of filling, closing and shipping the container.

[0015] The container according to the invention is, however, in no way limited to the sizes mentioned above. In particular, also large container sizes can be produced which can be stacked and shipped on pallets as usual. However, if the transport within the container may potentially take more than three days (as this may be the case during intercontinental transport, where considerable delays may occur caused by the customs, for example), a thermometer or other temperature recording device should be arranged in the inner space of the container so that the upon receipt of the container the recipient may check whether the cold chain has not been interrupted during transport. Therefore, in one embodiment of the container according to the invention, the container further comprises a temperature measuring element arranged in the product containment space.

[0016] In a further preferred embodiment of the container according to the invention, the insulating foam is expanded polystyrene, or expanded polypropylene, or expanded polyurethane. These materials are well-known as being suitable for the expansion molding technique to form containers having the desired shape and size. For example, suitable pre-expanded polystyrene beads for expansion molding to form the expanded polystyrene are available under the trademarks Styropor® by BASF, Ludwigshafen, Germany. An example of pre-expanded polypropylene beads suitable for expansion molding to form the expanded polypropylene are beads offered by BASF, Ludwigshafen, Germany, under the trademark Neopolen®. Also, expansion molding of polyurethane to obtain an expanded polyurethane insulating foam is well-known in the art.

[0017] Further advantageous aspects can be gathered from the following description of a preferred embodiment with the aid of the drawings in which

Fig. 1 shows a detail of a container according to the invention in a cross-sectional view, and

Fig. 2 shows a perspective view of a pallet with a number of containers according to the invention being stacked on the pallet for shipping.

[0018] In Fig. 1 a detail of an embodiment of a container 1 according to the invention is shown in cross-sectional view. Container 1 comprises a base 10, side walls 11 (only the left side wall is shown in Fig. 1 while the remaining side walls, namely front and rear wall as well as right side wall, are not shown in Fig. 1), and a lid 12. Vacuum insulated panels 2 are arranged in base 10, side walls 11 and in lid 12. For example, vacuum insulated panels 2 may be glued to lid 12 and to side walls 11 and base 10, respectively. On their inner surface facing the inner space of container 1, vacuum insulated panels 2 may be provided with a self-adhesive foam layer for protection of the respective vacuum insulated panel. Base 10 and side walls 11 together form a single integrally formed piece (the lower part of container 1). Both the integrally

formed piece comprising base 10 and side walls 11 as well as the lid 12 are made from an insulating foam produced through expansion molding. Suitable materials for the expanded insulating foam are those already mentioned above, for example, expanded polystyrene.

[0019] In the inner space of container 1 directly adjacent to the vacuum insulated panels 2 there are arranged a number of preconditioned temperature storage units 3, which define a product containment space 4 (the boundaries of which are indicated by a dash-and-dot line in Fig. 1), into which the products can be inserted. Temperature storage units 3 can be conventional, for example, they may contain a medium making a phase transition in the desired temperature range, which may be in the range of 2°C to 8°C. For example, the medium contained in temperature storage units may be a paraffin-based medium.

[0020] A temperature measuring element 5 such as a thermometer or a temperature recording device may be arranged in product containment space 4, which can be checked upon receipt of the container in order to verify that the cold chain has not been interrupted during transport. However, for short time (up to three days) transport, e.g. for courier delivery of products such as biotechnologically produced products containing proteins or other temperature sensitive products, temperature measuring element 5 is optional and can also be omitted. Container 1 is surrounded by a corrugated cardboard box 6 for transportation, which has a double layer on its top and bottom (as shown in Fig. 1). An additional cardboard insert 8 is provided on base 10 which assist in positioning of preconditioned temperature storage unit 3 arranged on cardboard insert 8. The remaining temperature storage units 3 also have a shape so as to define product containing space 4 between them.

[0021] For a thicknesses of the cardboard 6 of 7 mm, of side wall 11 made from the polystyrene foam of 20 mm, of vacuum insulated panel 2 of 35 mm, and of preconditioned temperature storage unit 3 of about 30 mm, and for a clearance of 8 mm between product containment space 4 and preconditioned temperature storage unit 3, the overall distance D from the very outer point of the container to the product containment space 4 is in the range somewhere about 100 mm, which makes the container very compact. The overall height of the container may be somewhere about 450 mm, the width may be somewhere about 500 mm and the length may be somewhere about 600 mm, so that the container can be conveniently handled as a single item by one person. The width and the length, that is to say the "footprint" of the container of 500 mm x 600 mm allows an optimal arrangement of four containers on a ISO pallet having a "footprint" of 1200 mm x 1000 mm. However, it is evident that larger sizes of containers are also possible.

[0022] Container 1 can be delivered by courier as a single item or, in the alternative, a number of containers 1 can be stacked on a standard pallet for shipping. Such a pallet 7 with a number of containers 1 stacked upon

one another and/or adjacent to one another is shown in Fig. 2. Transport of containers 1 on pallets 7 is particularly advantageous for the transport of empty containers 1 from their manufacturing point to the filling, closing and shipping point. Another advantageous field of transportation of containers 1 on pallets 7 is the transport of containers 1 on pallets to a courier collecting point, where the single containers 1 are removed from the pallets 7 in order to get distributed to their respective destinations.

Claims

1. Container (1) for the transport of temperature sensitive products, comprising a base (10), one or more side walls (11), and a lid (12), which are made from an insulating foam and which together define a container inner space in the assembled state, with thermal insulation means being arranged in the base (10), in the one or more side walls (11), and in the lid (12), respectively, **characterized in that** the base (10) and the one or more side walls (11) together are a single integrally formed piece (10,11), wherein both the said single piece (10,11) as well as the lid (12) are produced through expansion molding, and wherein the insulation means comprise vacuum insulation panels (2) arranged in the respective walls of the single piece (10,11) and of the lid such, that they face the inner space of the container, and **in that** preconditioned temperature storage units (3) are arranged within the thus defined container inner space to define a product containment space (4) where the products can be placed for storage or transport.
2. Container (1) according to claim 1, further comprising a temperature measuring element (5) arranged in the product containment space (4).
3. Container (1) according to any one of the preceding claims, wherein the insulating foam is expanded polystyrene, or expanded polypropylene, or expanded polyurethane.

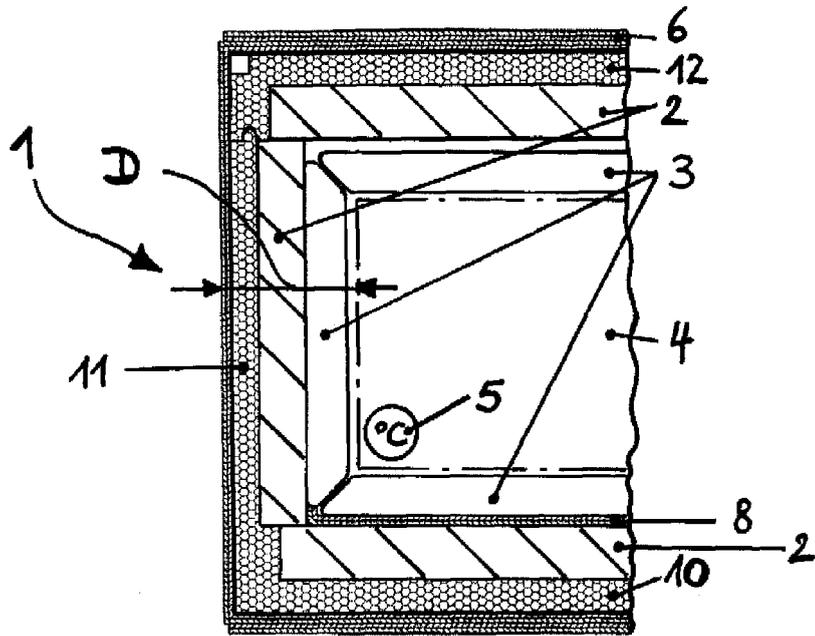


Fig. 1

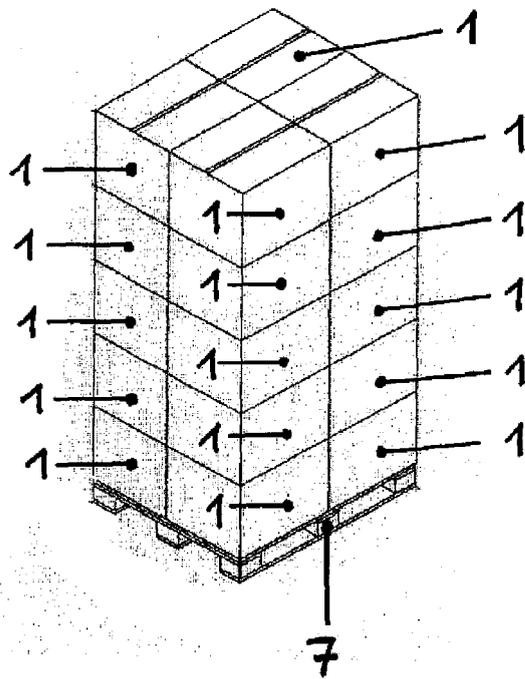


Fig. 2



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Place of search The Hague		Date of completion of the search 16 January 2008	Examiner Leijten, René
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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