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Description

The present invention refers to a thermally insulated container, mainly intended for storing and transporting material such as vaccine, biological material and the like, requiring a substantial constant temperature during a time of several months.

At storing and/or transportation of biological and chemical material one has to consider that these material will change with time, if they are not stored at a certain, often low, temperature. This is mainly a problem in the developing countries, where the transport of vaccines, serum, blood plasma and some enzyme compounds is carried out in an environment, of rather high temperatures. In addition the transport routes are often long and in bad condition, which means that the transport will last long. In the developing countries it is also unusual that vaccines and the like are manufactured in the country, but the demand is almost always covered by import from different industrialized countries. This means that the transport routes will become still longer.

More than 90% of all vaccines require storing at temperatures between +2 and +8°C and are destroyed rather fast at higher temperatures and also by freezing. As vaccines and the like are very sensitive and as the transport route are long and hard, it is estimated that about 50% of all vaccines are destroyed along the transport route before they reach the final user in the developing country. Today the vaccines are transported between different stations, of which at least the bigger ones are equipped with cooling and freezing plants. These cooling and freezing plants are powered with electric power or alternatively by means of liquid petroleum gas or photogene and they are rather sensitive to disturbance. Due to the defective electricity supply network in the developing countries it is for example not unusual with long power failures. With the cooling plants which exist today it is therefore important that the transport is carried out as fast as possible. This means that vaccines are flown as far as possible into the developing countries and a net of intermediate storing stations is built up. This of course is expensive and requires a well organized chain of cooling plants.

State of the art

A number of different inventions are known within the field of storing or transport containers intended to be kept at a low constant temperature. GB-A-1,006,746 for instance thus discloses a container for transport of material which requires cooling by means of a gas in liquid state. The container comprises an insulating external container in which a porous container body is located and in the interior of which the material, which should be cooled can be introduced. The container body is prepared with slowly boiling liquid gas which slowly evaporates whereby cold is emitted. This invention is primarily intended for biological material which should be kept at a very low temperature, well below the freezing point, and which therefore requires a liquid gas for its cooling. The device is furthermore designed to allow the gas generated during the boiling to escape through evacuation canals. If the gas cannot be evacuated, the boiling will stop and the cooling will cease. Owing to the fact that only a limited quantity of liquid gas can be contained in the container this container is only intended to keep the biological material cooled during a short time before new liquid gas must be supplied. An important drawback at this invention is that during long transports trained operators must be at hand and regularly refuel liquid gas which has to be carried along.

Another refrigerated container is described in the DE-A-2825111 and refers to a container which is used to cool a metering device during a limited time in a surrounding with high temperature. The cooling device is primarily intended to be used during measurement inside tunnel owens and the like, and it comprises mainly an inner and outer cylinder located in an insulated container. Between the inner and outer cylinder there is arranged a heat-storing material which communicates with the surroundings via a steam exhaust tube and a filling tube. The inner device is again located in an insulated container filled with insulating material. This invention is thus intended for very high surrounding temperatures, which occur e.g. in owens. There is furthermore provided a heat storing material which when exposed to heat evaporates to steam which escapes through a relief tube. The device is position sensitive, e.g. it must always be located in a certain way there the filling tube and the tube for evacuation of steam is directed upwards, in order to work. It is only intended to maintain a certain temperature in its inner space during a short period of time.

The DE-A-2.411.960 discloses a casing for frozen products. The casing consists of double walls with a cold accumulating material therebetween, the state of aggregate of which is changed close to the storing temperature of the product. This casing is intended only for short time storing, e.g. one or a few days at most.

The US-A-3.810.367 refers to a cooling and storing container comprising an inner compartment holding the material to be cooled and an outer compartment holding heat absorbing material (ice and water). The two compartments are surrounded by walls and lids of heat insulating material. This container is also only adapted for short-time cooling and storing (several hours is mentioned).

Purpose and most important features of the invention

The purpose of the present invention is to provide a thermally insulated container which can be used as a disposable container and which is cheap to manufacture. Another purpose of the invention is that the container should be robust and protect its contents against damages caused

by external influence in the form of impact and blows. A further purpose is that the material to be stored and transported shall be kept at a substantially constant temperature during a time of several months. The container should use a passive system, e.g. no external energy should be supplied to maintain the determined temperature. By means of a container according to the invention it should be possible to neglect the transport time, e.g. it should be possible to transport the container by boat instead of using airfreight which makes the transport cheaper. This is achieved by a container comprising an outer and an inner casing each of which is hermetically sealed, the material is arranged inside the inner casing; a solid-to-liquid phase transforming refrigerant material, e.g. ice or brine is arranged in said inner casing surrounding said material; an insulation is filling the space between said inner and outer casing and comprises a porous material under vacuum, which encloses said inner casing on all sides; the space between said inner and outer casing is free from structural connections extending between said inner and outer casings.

Short description of the drawings

The invention will hereinafter be further explained as a pair of embodiments with reference to the enclosed drawing.

Figure 1 shows a cross section of a container according to the invention.

Figure 2 shows another container according to the invention.

Description of embodiments

In figure 1 is shown a thermally insulated container according to the invention. It consists of an outer casing 1 made e.g. of plastic material and it is designed as a square box in order to facilitate stacking and storing. The size of the outer casing can of course be varied within wide margins but can e.g. be about 50x50x50 cm. A container of this dimension has a transport weight of about 15-20 kg. In the space inside the outer casing there is located an inner casing 2 at a certain distance from the outer casing 1. Also this inner casing 2 may consist of plastic or similar material. The outer and inner casing 1, 2 are designed to be diffusion proof in order to reduce the pressure increase and to maintain a low heat conductivity. Between the outer and the inner casing 1, 2 there is formed a space, an insulating layer 3, which space preferably can be filled with an insulating, porous material, e,g. perlite. To increase the insulating ability of the insulating material this space has been put under vacuum by evacuation. This may e.g. be achieved thereby, that cross-linked polythylene is used. In order to obtain this it is required, that the outer and the inner casing are sealed e.g. by a plastic weld after packing of the material, the cooling object 4, which should be transported or stored.

The material, the cooled object, which shall be stored and/or transported at a constant temperature, is located in the intermediate space of the inner box shaped casing 1. The material, which can consist of a daily ration of vaccine, e.g. about 1-2 kg can be enclosed in a further box of plastic or similar material or it may simply be enclosed in shrink film 7 (see fig. 2). The space between the package 6, 7 of the cooled object and the inside of the inner casing 2 is filled with a phase transforming material 5, which e.g. can be brine or ice of distilled water. If ice is used as phase transforming material, vaccine of the above mentioned quantity, can be kept cooled during a very long time. Calculations and practical tests have shown that the cooled object can be kept at a temperature just above 0°C during 180 days. When the phase transforming material has been completely transformed to its other, warm, phase, the temperature in the container however will increase rapidly.

In the insulated container according to the invention there is no need of evacuating gas or the like because the phase transforming material will not transform to gases. This means the essential advantage that there is no need of arranging any thermal bridges in form of tubes or the like through which heat can be transported to the inner space of the container from the surroundings. As the cooled object is enclosed in a phase transforming material such as ice water or salt impacts and blows are effectively absorbed whereby the cooled object is well protected during the transport.

In figure 2 is shown an alternative embodiment according to the invention. The cooled object 4 has been packed by means of shrink film 7 only and put into the inner space 5 of the inner casing 2. The cooled object is located together with the phase transforming material in the inner casing. Around this inner casing a number of e.g. 20, insulating layers are arranged. The insulating layers can e.g. consist of layers of porous glass fibres and heat-reflecting aluminium foil. It is important at the application that the insulating layers fit tightly around the inner container and that no thermal bridges are formed in possible joints. The metal container and insulation layers are thereafter located in an outer, e.g. cylindric container, which could be provided with a reinforcement at the inside, and the outer container is vacuum evacuated.

Both the inner and outer container may consist of a container of the type of tin can, which makes the transport container cheap to manufacture as earlier already known technology may be used.

If the container is exposed to direct sunlight or other heat radiation it is appropriate to provide the outer surface of the container with a reflecting layer 11, e.g. in the form of metal film.

The invention is of course not limited to the above disclosed embodiments, but a number of alternative embodiments is possible within the scope of the claims.

Claims

1. A thermally insulated container for storing

and transporting material (4) such as vaccine, biological material and the like requiring a substantial constant temperature during a time of several months, characterized by the combination of the following features:

an outer and an inner casing (1, 2) each of which is hermetically sealed; the material (4) is arranged inside the inner casing (2);

a solid-to-liquid phase transforming refrigerant material (5), e.g. ice or brine is arranged in said inner casing (2) surrounding said material (4);

an insulation (3; 8) is filling the space between said inner (2) and outer (1) casing and comprises a porous material under vacuum, which encloses said inner casing (2) on all sides;

the space between said inner (2) and outer (1) casing is free from structural connections extending between said inner and outer casings.

2. A thermally insulated container according to claim 1, characterized in, that said outer and inner casing (1, 2) each consists of a metal vessel, e.g. a tin can.

3. A thermally insulated container according to claim 1 or 2, characterized in, that said insulation (8) is a multi-layer insulation comprising layers of said porous material under vacuum alternating with layers of heat-reflecting material.

Patentansprüche

1. Thermisch isolierter Behälter zum Speichern und Transportieren von Material (4) wie Impfstoffe, biologisches Material oder dergleichen, das während einer Zeitspanne mehrerer Monate eine im wesentlichen konstante Temperatur verlangt, gekennzeichnet durch die Kombination der folgenden Merkmale:

ein äußeres und ein inneres Gehäuse (1, 2), das jedes hermetisch abgedichtet ist; das Material (4) ist innerhalb des inneren Gehäuses (2) angeordnet; ein Kältemittel (5), das von der festen zur flüssigen Phase übergeht, zum Beispiel Eis oder Sole, wird in dem inneren Gehäuse (2), das das genannte Material (4) umgibt, eingebracht;

eine Isolierung (3; 8) dient zum Ausfüllen des Zwischenraumes zwischen dem inneren (2) und dem äußeren (1) Gehäuse und enthält ein poröses Material unter Vakuum, das das innere Gehäuse (2) allseitig umgibt;

der Zwischenraum zwischen dem inneren (2) und dem äußeren (1) Gehäuse ist frei von baulichen, sich zwischen dem inneren und dem äußeren Gehäuse erstreckenden Verbindungen.

2. Thermisch isolierter Behälter nach Anspruch 1, dadurch gekennzeichnet, daß das äußere und innere Gehäuse (1, 2) jeweils aus einem Metallgefäß bestehen, beispielsweise aus einer Weißblechdose.

3. Thermisch isolierter Behälter nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die genannte Isolierung (8) eine Mehrlagenisolierung ist, umfassend Lagen aus dem genannten porösen, unter Vakuum stehenden Material, abwechselnd mit Lagen aus wärmereflektierenden Material.

Revendications

1. Conteneur à isolation thermique permettant de stocker et de transporter un produit (4), tel que des vaccins, des produits biologiques et des produits analogues, exigeant une température sensiblement constante pendant une période de temps de plusieurs mois, caractérisé par la combinaison des particularités suivantes:

une boîte extérieure (1) et une boîte intérieure (2) dont chacune est fermée de manière étanche,

le produit (4) est disposé à l'intérieur de la boîte intérieure (2),

un matériau réfrigérant à transformation de phase solideliquide (5), par exemple de la glace ou une eau salée, est disposé dans cette boîte intérieure (2) en entourant le produit (4),

une isolation (3, 8) remplit l'espace se trouvant entre les boîtes intérieure (2) et extérieure (1) et est constituée d'un matériau poreux sous vide qui enferme la boîte intérieure (2) sur tous les côtés,

l'espace se trouvant entre les boîtes intérieure (2) et extérieure (1) est exempt de liaisons structurelles s'étendant entre ces boîtes intérieure et extérieure.

2. Conteneur à isolation thermique suivant la revendication 1, caractérisé en ce que la boîte intérieure (1) et la boîte extérieure (2) sont constituées chacune d'une enceinte métallique, par exemple une boîte de conserves.

3. Conteneur à isolation thermique suivant la revendication 1 ou 2, caractérisé en ce que l'isolation (8) est une isolation multicouches comprenant des couches dudit matériau poreux sous vide, alternant avec des couches de matière réfléchissant la chaleur.

FIG 1

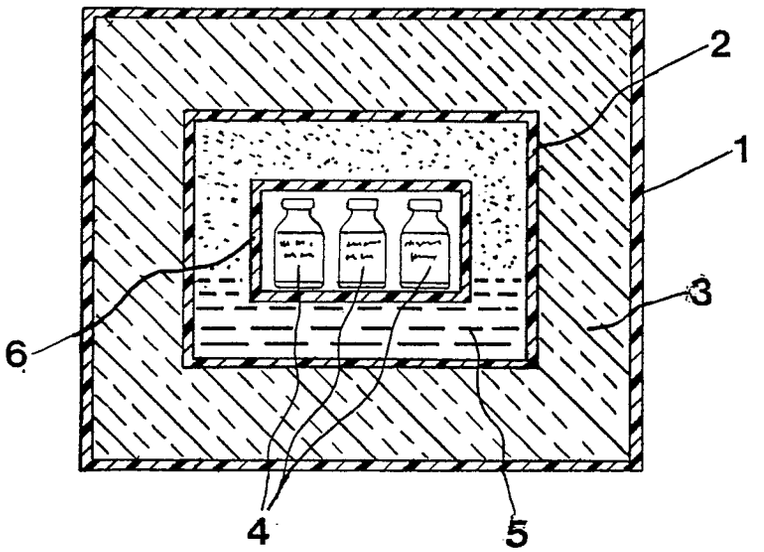

FIG 2