(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 157 751**
**A2**

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **85850116.6**

(22) Date of filing: **01.04.85**

(51) Int. Cl.⁴: **B 65 D 81/38**

(30) Priority: **02.04.84 SE 8401805**

(43) Date of publication of application: **09.10.85**
**Bulletin 85/41**

(84) Designated Contracting States: **AT BE CH DE FR GB IT LI LU NL SE**

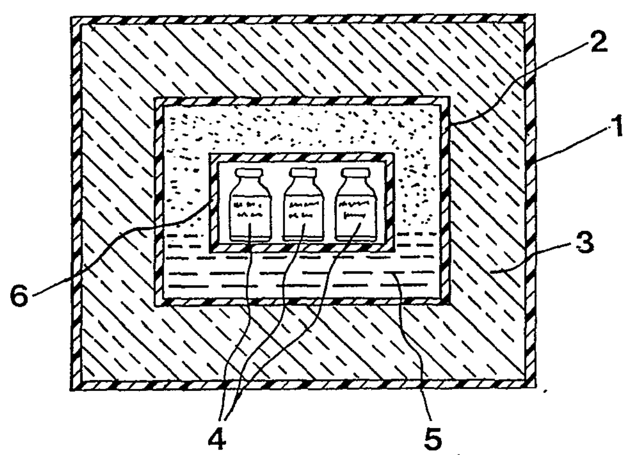
(71) Applicant: **Lejondahl, Lars-Erik, Harkulesgatan 15, S-641 34 Katrineholm (SE)**

(72) Inventor: **Karlsson, Björn G., Boställsgatan 54, D-583 31 Linköping (SE)**
Inventor: **Björk, Curt, Konsistoriegatan 21 B, S-582 34 Linköping (SE)**
Inventor: **Lejondahl, Lars-Erik, Herkulesgatan 15, S-641 34 Katrineholm (SE)**

(74) Representative: **Roth, Ernst Adolf Michael et al, GÖTEBORGS PATENTBYRA AB Box 5005, S-402 21 Göteborg (SE)**

(54) **Thermally insulated container.**

(57) The invention refers to a thermally insulated container, mainly intended for storing and/or transport of material which requires storing at a low temperature such as e.g. vaccine, biological matter or the like, including one storing room intended for a cooled object, which is surrounded by at least one insulating layer (3). This is achieved according to the invention thereby that the cooled object (4) is hermetically separated from the surrounding, that a phase transforming material (5) is arranged in connection to the cooled object (4) and that at at least one insulating layer (3) is arranged to surround the cooled object (4) on all sides.




EP 0 157 751 A2

0157751

# THERMALLY INSULATED CONTAINER

The present invention refers to a thermally insulated container, mainly intended for storing and/or transportation of material requiring storage at a constant temperature or within a temperature interval, such as for example vaccine, biological material or the like, including a storing space intended for an object to be cooled, and which is surrounded by at least one insulating layer.

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 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$^0$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 transportroute 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. British patent GB-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 German patent 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 an outer cylinder located in an insulated container. Between the inner and outer cylinder 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 an relief tube. The device is position sensitive, e.g. it must always be located in a certain way where the filling tube and the tube for evacuation of steam is directed upwards, in order to work. It is also only intended to maintain a certain temperature in its inner space during a short period of time.

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 impacts and blows. A further purpose is that the inner space of the container shall be kept at an mainly constant temperature or within a certain temperature interval during a long period of time. The container shall use a passive system, e.g. no energy shall be supplied from outside to maintain the determined temperature. By means of a container according to the invention it should be possible to neglect the time the transport will take, e.g. it should be possible to transport the container by boat instead of using airfreight which makes the transport cheaper. This is achieved according to the invention thereby, that that the container is designed with at least one outer and one inner casing which are hermetically sealed off, that a phase transforming material is arranged in the inner casing of the container in connection to the cooled object and that at least one insulating layer is arranged between the outer and inner casing of the container and intended to completely surround the cooled object.

## Short description of the drawings

The invention will hereinafter be further explained as an embodiment with reference to two enclosed drawings.

Figure 1 shows a cross section of a container according to the invention,
figure 2 shows another container according to the invention,
figure 3 shows a further alternative of a container intended for a higher temperature interval.

## 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 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 thereby 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 crosslinked polyethylene 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 pack 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 vaccin, 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 salt 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 $0^0$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. Partly is shown how 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. Another essential difference is the insulation which is arranged in the space between the outer and inner casing 1, 2 of the container. A number of layers of foil 8 have been used here instead of a porous insulating material. It is still important that the casing 1,2 is diffusion sealed and it is suitable that vaccum is used to reduce the heat leakage further. One advantage in using the film layer is that a better protection against i.a. among radiation is achieved.

The cooled object can also be located together with the phase transformation material in an inner cylindric metal container. Around this container are a number of , e.g. 20, insulating layers arranged . The insulating layers can e.g. consist of layers of glass fibres and 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.

As there in some cases is a need to protect the cooled object from freezing, to crystalize, the container according to the invention may be designed in a way shown in figure 3. Hereby the inner space of the container has been divided into two chambers 9, 10 by means of a partition wall 12, whereby the first chamber 9 contains the phase transforming material and the secondchamber 10 constitutes the storing space for the cooled object 4. The phase transforming material 5 may in this case consist of ice of distilled water and maintain a temperature of $0^{0}$C. Owing to the fact that the cooled object 4 is not enclosed by the phase transforming material 5 on all sides, but some of the wall surfaces in the storing space 10 are close to the insulating layers 3, the storing space 10 will achieve a somewhat higher temperature than the phase transforming material. This depends on the small amount of heat which finds its way through the outer insulating layer 3. The somewhat higher temperature at hand in the storing space

10 in this type of package is about some tenths of degrees over 0, which is enough to store vaccine at a temperature which does not damage, crystalize, the vaccine.

By designing the partition wall 12 with different insulation ability the temperature in the storing space 10 may be adjusted to desired level. The insulation ability of the partition wall 12 hereby determines the difference in temperature between the storing space 10 and the phase transforming material 5.

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 a metal film (see figure 3).

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.

0157751

## CLAIMS

1. Thermally insulated container, mainly intended for storing and/or transport of material requiring storage at a constant temperature or within a temperature interval, such as e.g. vaccine, biological material or the like, including a storing space, intended for a cooled object, which is surrounded by at least one insulating layer,

c h a r a c t e r i z e d t h e r e b y,

that the container is designed with at least one outer and one inner casing (1, 2) which are hermetically sealed off, that a phase transforming material (5) is arranged in the inner casing (2) of the container in connection to the cooled object (4) and that at least one insulating layer (3) is arranged between the outer and inner casing (1, 2) of the container and intended to completely surround the cooled object (4).

2. A thermally insulated container according to the claim 1,

c h a r a c t e r i z e d t h e r e b y,

that the insulating layer (3) consists of a porous material.

3. A thermally insulated container according to the claim 1,

c h a r a c t e r i z e d t h e r e b y,

that the insulating layer (3) consists of a porous material under vaccum.

4. A thermally insulated container according to claim 1,

c h a r a c t e r i z e d t h e r e b y,

that the insulating layer (3) consists of one or more layers of foil (8).

5. A thermally insulated container according to claim 1,

c h a r a c t e r i z e d t h e r e b y,

that the insulating layer (3) consists of a space which is under vacuum.

6. A thermally insulated container according to one or more of the above claims,

c h a r a c t e r i z e d   t h e r e b y,
that the phase transforming material (5) is ice of distilled water.

7. A thermally insulated container according to one or more of the preceeding claims,
c h a r a c t e r i z e d   t h e r e b y,
that the phase transforming material (5) is salt.

8. A thermally insulated container according to anyone of above claims,
c h a r a c t e r i z e d   t h e r e b y,
that the phase transforming material (5) is arranged to absorb mechanical strains such as impacts or blows.

9. A thermally insulated container according to anyone of above claims,
c h a r a c t e r i z e d   t h e r e b y,
that a partition wall (12) which has a certain insulating ability is arranged between the phase transforming material (5) and the cooled object (4) and that the cooled object (4) is surrounded only partly by the phase transforming material (5) for achieving a temperature difference between the cooled object (4) and the phase transforming material (5).

FIG 1

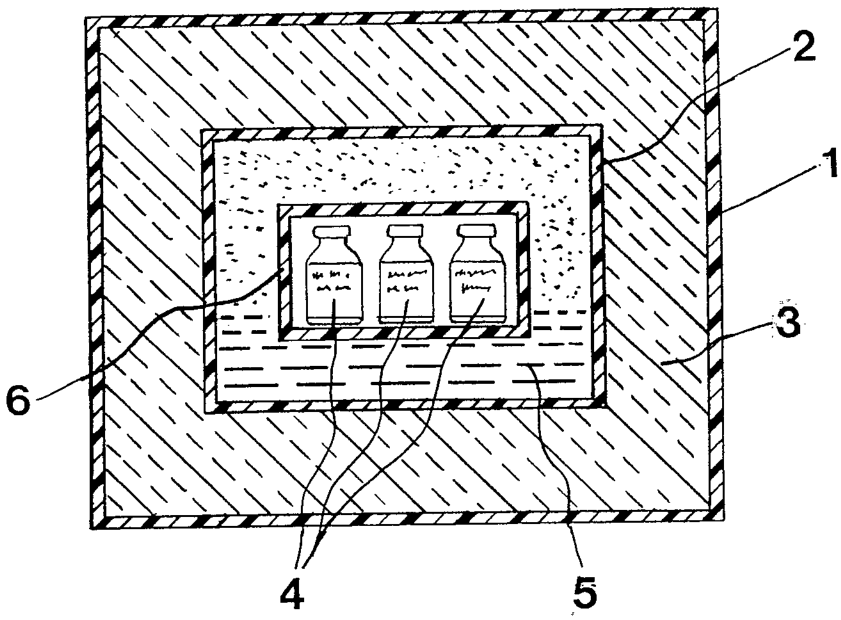



FIG 2

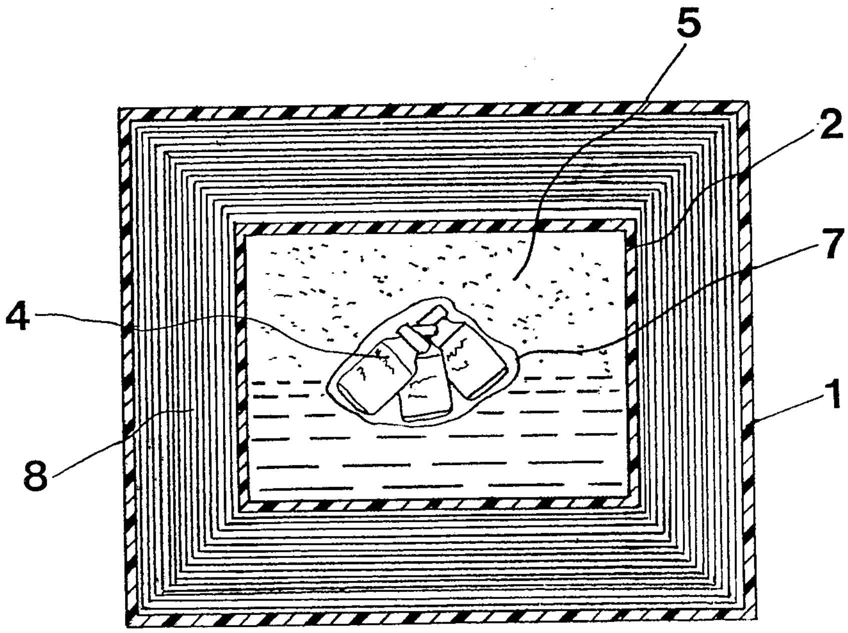


FIG 3