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(54) **Cooling box and method for transporting heat-sensitive products in a transport vehicle and/or for distributing products to final customers**

(57) The present invention relates to a cooling box (1) and a method for safely transporting heat-sensitive products (2) in a transport vehicle (3) and/or for distributing heat-sensitive products (2) to final customers. The cooling box (1) according to the invention comprises a thermally insulating cuboid housing (7) with a commissioning opening (8) on an upper side (11), a first (9) and a second (10) storage chamber, a cover (12) to open and close the commissioning opening (8) of the housing (7), the cover (12) containing a cool pack (13) with eutectic material (14) and having at least one coupling (15) for coupling a supply line (16) for a cooling fluid (17), preferably liquid nitrogen (LIN), and having heat exchange surfaces (19) to cool the cool pack (13) down by the cooling fluid (17), a profiled outer bottom plate (20) to cooperate in a form locking manner with a certain underlying raster (5; 29), and a profiled outer cover plate (21) to carry other transport containers (30). The method according to the invention for transporting heat-sensitive products (2) together with other transport containers (31)

from a supply center (32) to final customers, comprises commissioning at least one such cooling box (1) with cooled heat-sensitive products (2) in the supply center (32), cooling down the cool pack (13) in the cover (12) during commissioning by supplying a cooling fluid (17), closing the cover (12), placing the cooling box (1) in a transport vehicle (3) together with other beverage boxes (29) and/or transport containers (31), transporting and distributing the cooled products (2) to final customers, returning the cooling box (1) to the supply center (32), and cleaning the storage chambers (9, 10) and starting the process as described again. The invention allows a safe and economic transport of different goods, including fresh food and deep frozen food to final customers. Especially the handling of heat-sensitive food is improved and the risks during transport and possible handling of cooling boxes by final customers are minimized.

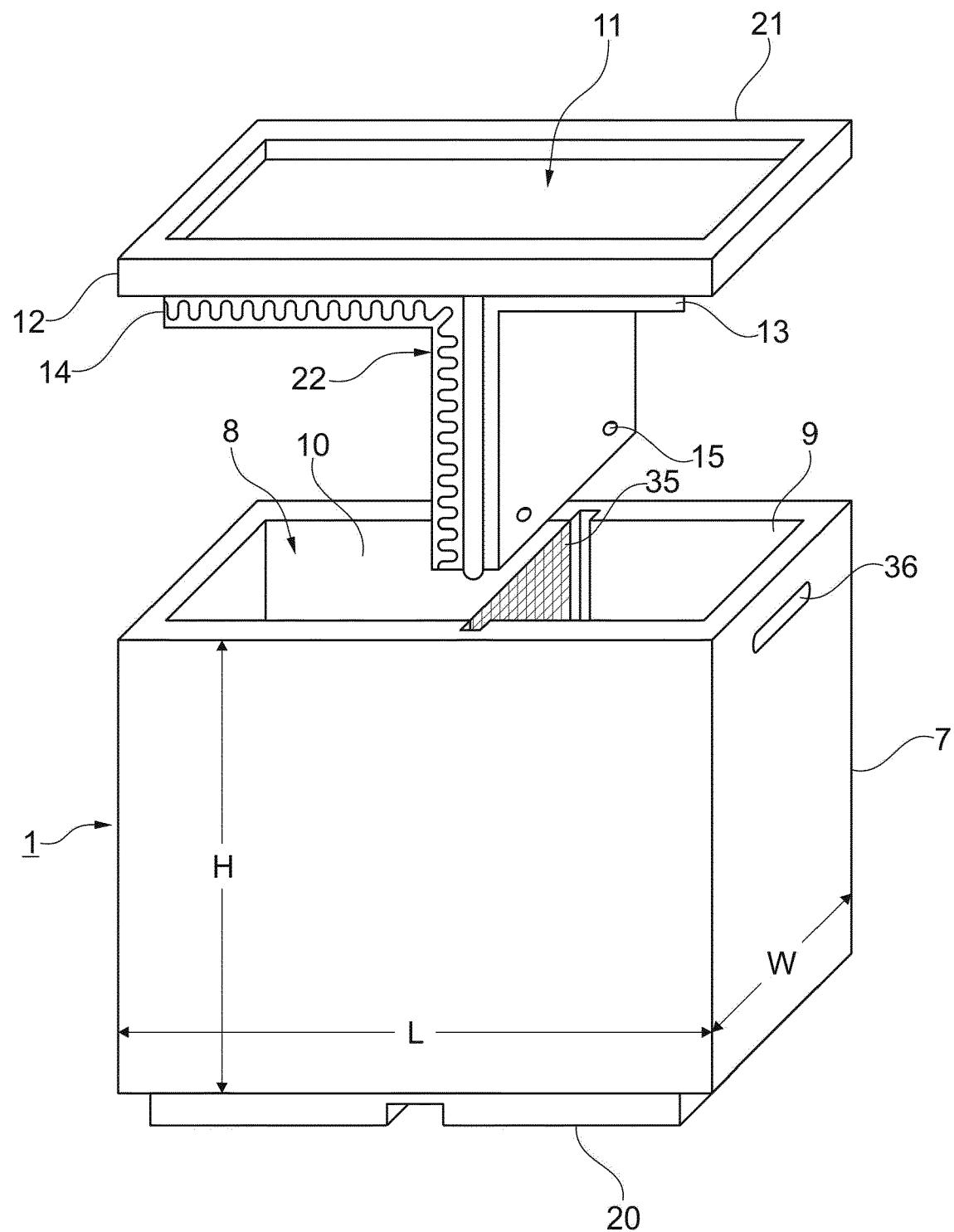


Fig. 1

Description

[0001] The present invention relates to a cooling box for transporting cooled products in a transport vehicle and/or for distributing cooled heat-sensitive products to final customers. The invention also relates to a method for transporting heat-sensitive products together with other transport containers from a supply center to final customers.

[0002] Nowadays, it has become more and more common to transport and distribute goods, including food, in particular heat-sensitive products, from a distribution center to final customers. Groceries receive orders from customers, for example online via internet platforms, and organize the transport of food and other products of the daily life to the customers. So far the most difficult part of such a business model is the transport of deep-frozen food and/or fresh food, which both require different temperatures, mostly below the environment temperature. The transport system has to make sure that the required temperature ranges are not exceeded during the whole transport duration. Moreover, to organize an economic system, it is necessary to jointly transport many different goods for many customers in a transport vehicle to deliver at the same time for example beverages, cooled products and other food and/or products for the daily life.

[0003] Of course, many kinds of cooling boxes are known in the prior art and many kinds of transport containers for different purposes are already used in supply chains.

[0004] Usual cooling boxes use exchangeable cool packs for keeping goods cool in the box for a certain period of time. It is also known to use carbon dioxide snow instead of cool packs. An example for such a system is described in WO 2011/086265 A1. The device for transporting and distributing heat-sensitive products as described in this document allows commissioning of the box with heat-sensitive products through an upper commissioning opening, and the temperature in the box is maintained by a bag filled with a required amount of carbon dioxide snow.

[0005] It is an object of the present invention to create a cooling box, which is designed to be transported together with other cooling boxes and/or together with other kinds of containers in a transport vehicle. Another object of the present invention is to provide a cooling box in which different kinds of heat-sensitive products requiring different transport temperature ranges can be transported, in particular deep frozen food and fresh food like salad or fruits. An additional object of the present invention is to create a method in the sense of a complete supply system for transporting and distributing heat sensitive products from a distribution center to final customers via transport vehicles.

[0006] A cooling box as solution for the above object is defined in independent claim 1. The corresponding method for transporting and distributing heat-sensitive products is defined in independent claim 11. Advanta-

geous features according to the invention, which can be separately or jointly applied as technically feasible are described in the respective dependent claims.

[0007] A cooling box for transporting heat-sensitive products in a transport vehicle and/or for distributing heat-sensitive products to final customers according to the present invention comprises:

- a thermally insulating cuboid housing with a commissioning opening on an upper side,
- a first and a second storage chamber both together surrounded on five sides by the housing and open on the upper side,
- a cover to open and close the commissioning opening of the housing, the cover containing a cool pack with eutectic material and having at least one coupling for coupling a supply line for a cooling fluid and having heat exchange surfaces to cool the cool pack down by the cooling fluid,
- a profiled outer bottom plate to cooperate in a form locking manner with a certain underlying raster,
- a profiled outer cover plate to carry other transport containers.

[0008] Concerning the outer shape of the cooling box the special situation in a transport vehicle was taken into account. Usual orders of customers require transporting boxes of beverages, cooling boxes and other transport containers in the same vehicle. To do this in a safe and handy manner, it is necessary to place the heavy loads on the ground and to form stacks with the light weight containers on top. The most appropriate way is to place beverage boxes on the ground of the cargo compartment of the transport vehicle and to place cooling boxes on top of them completing the stack by other transport containers on top of the cooling boxes. This means that cooling boxes according to the present invention need a profiled outer bottom plate to cooperate in a form locking manner with a certain underlying raster, in particular the upper side of beverage boxes. A profiled outer cover plate enables the cooling box to safely carry other transport containers. It is not absolutely necessary that the outer bottom plate and the outer cover plate of cooling boxes can cooperate with each other, but to form higher stacks of several beverage and cooling boxes and other transport containers it is advantageous to use profiles, which can cooperate with each kind of transported boxes or containers. The ground of the cargo compartment in the transport vehicle can also be profiled to allow cooperation with any kind of boxes and containers and it is also possible to add frames having a similar profile in the cargo compartment to allow a flexible loading with different amounts and kinds of containers even if one layer is not completely filled.

[0009] A second aspect of the present invention relates to the interior of a cooling box. As most known cooling boxes also the box according to the present invention has a thermally insulating cuboid housing with a com-

missioning opening on an upper side. However, according to the present invention the housing contains a first and a second storage chamber, which can be designed for one or two different temperatures, both together surrounded on five sides by the housing and open on the upper side. A cover is used to open and close the commissioning opening of the housing, wherein the cover contains a cool pack with eutectic material and has at least one coupling for coupling a supply line for a cooling fluid, which allows cooling down the cool pack via heat exchange surfaces. These heat exchange surfaces can preferably be in the interior of the cool pack, but also outer heat exchange surfaces may be used.

[0010] As will be described in detail below, the cool pack is integrated into the cover and can be cooled by allowing a cooling fluid to flow along heat exchange surfaces. This differs from most other concepts with exchangeable cool packs or a vaporizing cooling medium like dry ice.

[0011] According to a preferred embodiment of the invention the cool pack has such a shape that it forms at least a part of a separating wall between the first and the second storage chamber. This feature allows to establish the two storage chambers in the cooling box by inserting the cover with the cool pack and to cool down both storage chambers for a certain period of transport time.

[0012] In another preferred embodiment a first outer surface of the cool pack is in contact with the first storage chamber and a second outer surface of the cool pack is in contact with the second storage chamber, wherein the first and the second outer surfaces have different areas and/or profiles and/or thermal surface insulations. This feature allows keeping the first and the second storage chamber at different temperatures during the transport. As the heat transfer from the environment into the cooling box depends on the temperature difference between the environment and the interior of the storage chambers and on the size of the walls of the storage chamber, the parameters area, profile, and/or thermal insulation of the cool pack allow adapting the heat transfer from the cool pack into both storage chambers to most desired requirements. Depending on the eutectic material used for filling the cool pack and on the working temperature range of this material the above parameters can be adapted.

[0013] A cooling box according to the invention can be either unpacked with the customer and directly be returned by the transport vehicle or they can be left with the customer until it is returned by the customer to a supply center. For both purposes it is important that the cool pack is integrated in the cover and cannot be removed or manipulated and cannot jeopardize any person handling the cooling box. This is for example not always the case with containers cooled by carbon dioxide snow or by exchangeable cool packs. However, the integration of the cool pack into the cover makes it desirable that the cool pack can be cooled down in a short period of time, in particular 1 to 15 minutes, preferable 5 to 10 minutes, in a supply center. Thus, it is not required to bring a high

number of covers with cooling packs into a cooling chamber to cool them down for hours, but cooling can be done within a few minutes while the other part of the cooling box is separated from the cover, cleaned and commissioned with new heat-sensitive products.

[0014] For this reason the heat exchange surfaces of the cool pack are preferably designed and dimensioned to cool the cool pack by vaporizing liquid nitrogen into the cool pack through the coupling. Although other cooling mediums like liquid carbon dioxide can be used, liquid nitrogen seems to be the most appropriate means for cooling down the cool packs in an economic way and without complicated couplings and exhaust systems.

[0015] To make sure that the eutectic material in the cool pack cannot spoil the transported goods or jeopardize customers even in case of a leakage, a material should be used which is solid after cooling down and remains a gel when warmed up. Of course, a non-poisonous material should be used. Such materials are already available and used in exchangeable cool packs.

[0016] To form a safe enclosure and/or to improve the heat exchange the eutectic material is according to another embodiment of the invention contained in a metallic housing and/or has metallic heat exchange surfaces, preferably the metallic housing forms at least a part of the heat exchange surfaces. This embodiment can be realized for example by heat exchange pipes in the interior of the eutectic material for guiding a cooling fluid or by metallic plates, preferably rippled or otherwise profiled, along which the cooling fluid flows. Internal heat exchange surfaces in the cool pack compared to outer heat exchange surfaces have the advantage that they cannot be damaged during handling and better distribute the cold in the eutectic material.

[0017] It should be noted that the described concept makes it necessary that the cooling box according to the invention can be transported by a single person like for example beverage boxes. This restricts the outer dimensions to similar dimensions or even equal dimensions as those of beverage boxes. Under certain conditions a size up to twice the size of beverage boxes may be possible. This means that the outer dimensions length, width and height of the cooling box are 500 x 300 x 55 mm +/- 20 % for each dimension separately, preferably 10 %.

[0018] In another embodiment of the invention the cool pack has a T-shaped cross section forming an inner part of the cover and perpendicular to this inner part a separating wall between the first and the second storage chamber. In this case the heat exchange surfaces between the cool pack and the storage chambers can be made larger and the lower part of the cooling box needs not to contain a structural wall. However, to avoid that during commissioning products are placed in the area of the separating wall nets on both sides may be provided to allow after commissioning to introduce the separating wall between the nets.

[0019] As mentioned above the cooling box according to the invention is designed to be handled by a single

person, having preferably a weight of less than 10 kg when empty and being designed to carry up to 15 kg as transportable load. Handholds or the like should be located at outer side walls of the cooling box in such a way that they do not disturb the loading side by side.

[0020] In any case the shape and dimensions of the cooling box are adapted to the shape of other transport containers, in particular usual beverage boxes, to be transported together with the cooling box in a transport vehicle.

[0021] The present invention also relates to a method for transporting cooled heat-sensitive products together with other transport containers from a supply center to final customers according to claim 11. This method comprises:

- commissioning at least one cooling box as described above with cooled heat-sensitive products in the supply center,
- cooling down the cool pack of the cooling box before or during commissioning by connecting its coupling to a supply line supplying cooling fluid for a predetermined time interval,
- disconnecting the coupling and closing the cover of the cooling box,
- placing the cooling box in a transport vehicle having a bottom with a raster corresponding to the profiled bottom plate of the cooling box or already containing other transport containers or frames having an upper surface with a raster corresponding to the profiled bottom plate of the cooling box,
- placing other containers or frames having a shape corresponding to the profiled outer cover plate of the cooling box on top of the cooling box or several similar cooling boxes,
- transporting and distributing the cooled products to final customers,
- returning the cooling box to the supply center, and
- cleaning the storage chambers of the cooling box and starting the process as described again.

[0022] The method according to the invention allows a high throughput in a supply center as the cooling down of the cool pack, which is integrated in the cover of the cooling box can be done separately to the cleaning of the two storage chambers and the commissioning of the cooling box. As cleaning and commissioning may take a few minutes only the cool pack is designed to be cooled down also in a few minutes. For this purpose it is coupled to a supply line supplying a cooling fluid for a predetermined time interval. The time interval may depend on the required amount of cooling fluid and can be controlled by usual control means. If the control means show that cooling down is completed, the coupling is disconnected and the cover can be used to close an already commissioned cooling box.

[0023] The outer shape of the cooling box allows a safe transport in a transport vehicle similar to the known trans-

port of beverage boxes and the like, which can form stacks, when placed on top of each other. The shape of the cooling box makes it also possible to transport several of them or a mixture of beverage boxes, cooling boxes and other transport containers on a handcar or the like for distributing them to final customers. The empty cooling box is then returned to the supply center either with the transport vehicle or later by the customer, where it can be cleaned to start the whole process again.

5 **[0024]** In a preferred embodiment the cooling fluid is liquid nitrogen, which is widely and economically available and can be released into the environment or into a nitrogen network after use for cooling down the cooling packs.

10 **[0025]** The safest way to transport different goods in a transport vehicle is to place the heavier pieces in a lower level and to form stacks with the light weight containers on top. In relation to the present invention this means that (standard) beverage boxes form a lower layer, cool-

15 ing boxes are used for one or more intermediate layers and other transport containers are placed on top of them.

[0026] An example and details of the present invention are explained in connection with the drawing. However, the present invention is not restricted to the details of the drawing and all shown features can be used separately or in combination with each other.

20 Fig. 1: shows a schematic perspective view of a cooling box according to the invention with a somewhat lifted up cover,

25 Fig. 2: shows a longitudinal section through a cooling box according to fig. 1, and

30 Fig. 3: shows in a schematic view an overview over a transport cycle according to the invention.

35 **[0027]** Fig. 1 and 2 show a schematic perspective view on a cooling box 1 according to the invention with a somewhat lifted cover 12 and a longitudinal section through such a cooling box, respectively. The cooling box 1 has a thermally insulating housing 7 of cuboid shape and with similar dimensions as a usual beverage box. This means in particular that the length L and the width W allow placing the cooling box 1 with a profiled outer bottom plate

40 20 on one or two usual beverage boxes. The height H of the cooling box 1 including the cover 12 is about 500 mm +/- 20 %. The cover 12 has a profiled outer cover plate 21 to safely carry further transport containers (not shown in fig. 1). The cover 12 comprises a cool pack 13 containing a eutectic material 14 to keep the interior of the cooling box 1 cool. In the shown embodiment the cool pack 13 has a T-shape forming an inner part 27 of the cover 12 and perpendicular to this a separating wall 22 between a first 9 and a second 10 storage chamber. In

45 50 55 the interior of the eutectic material 14 or at least in contact with it a heat exchange surface 19 is provided, in the present case formed by at least one metallic pipe for guiding a cooling fluid 17 through the interior of the whole

cool pack 13. The cooling fluid 17, preferably liquid nitrogen LIN, enters the cool pack 13 through a coupling 15 to which a not shown supply line can be connected. The cooling fluid 17 leaves the cool pack through an outlet 38 either also coupled to an exhaust line or simply open to the environment 6. The size, shape and profile of the heat exchange surface 19 is designed to cool down the cool pack within 1 to 15 minutes by supplying liquid nitrogen LIN, which is released as gaseous nitrogen at the outlet 38. The cool pack 13 has at least partly a metallic housing 26. When the cover 12 is closed, the cool pack 13 has a first outer surface 23 forming two sides of the first storage chamber 9 and a second outer surface 24 forming two sides of the second storage chamber 10. To maintain different temperatures in the first 9 and the second 10 storage chambers the first outer surface 24 is at least partly covered by a surface insulation 25, while the second outer surface 24 is the metallic housing 26 itself. This results in a lower temperature in the second storage chamber 10, which can be used for example for transporting deep frozen food.

[0028] To keep an empty space for the separating wall 22 while commissioning the cooling box 1 with products 2 two nets 35 can be provided. To hold the separating wall 22 in a stable position a holder 39 for receiving an end of the separating wall 22 is mounted on the ground of the cooling box 1. Handholds 36 allow a single person to transport the whole cooling box 1 and a profiled outer cover plate 21 allows to safely place further transport containers (not shown) on top of at least one cooling box 1.

[0029] Fig. 3 gives an overview over the whole transport cycle when using transport boxes 1 according to the present invention. In a supply center 32 the first 9 and the second 10 storage chamber of a cooling box 1 are cleaned before the commissioning with products ordered by a final customer takes place. During commissioning fresh food in placed in the first storage chamber 9 while deep frozen food can be placed in the second storage chamber 10. During cleaning and commissioning of the cooling box 1 its cover 12 is cooled down by connecting the coupling 15 to a supply line 16, which supplies liquid nitrogen LIN as cooling fluid 17 from a tank 18 to flow through eutectic material 14 in the cool pack 13 before it is released as gaseous nitrogen through an outlet 38 into the environment 6 or an exhaust line 37. The supply is maintained for a predetermined filling time T or until a certain temperature of the cool pack 13 is reached. The filling may be controlled by a control circuit (not shown). After commissioning and releasing the cover 12 from the supply line 16 the cover 12 is used to close the cooling box 1 and to establish a separating wall 22 between the first 9 and the second 10 storage chamber. The closed cooling box 1 together with other such boxes is loaded into a transport vehicle 3, which receives for example a lower layer 28 of (standard) beverage boxes 29, on which the cooling boxes 1 are packed. Finally, transport containers 31 for light weight goods may be packed on top

of the cooling boxes 1. The bottom 4 of the transport vehicle 3 should have a raster 5 with a profile to safely transport in a form locking manner beverage boxes 29 or cooling boxes 1. Optionally, the compartment of the transport vehicle 3 contains at least one frame 33, which can safely carry on an upper surface 34 cooling boxes 1, even if a lower layer 28 is not completely filled with beverage boxes 29. The transport vehicle 3 can now deliver beverages, food and/or other articles as ordered to final customers. At the end empty cooling boxes 1 are returned (as well as empty beverage boxes 29 and transport containers 31) to the supply center 32, where the whole cycle can be started again.

[0030] The present invention allows a safe and economic transport of different goods, including fresh food and deep frozen food to final customers. Especially the handling of heat-sensitive food is improved and the risks during transport and possible handling of cooling boxes by final customers are minimized. The cooling boxes can either be used to unload them directly with the customer or to leave them with the customer for keeping the transported food cool for another few hours and to let the customer return the cooling box. In any case the transport cycle does not require large cooling chambers for exchangeable cool packs nor takes a long time to clean, refill and cool down the returned cooling boxes.

Reference List

30 [0031]

1	Cooling box
2	Product
3	Transport vehicle
35	4 Bottom of the vehicle
5	5 Raster of the bottom of the vehicle
6	Environment
7	7 Thermally insulating housing
8	8 Commissioning opening
40	9 First storage chamber
10	10 Second storage chamber
11	11 Upper side
12	12 Cover
13	13 Cool pack
45	14 Eutectic material
15	15 Coupling
16	16 Supply line
17	17 Cooling fluid
18	18 Tank
50	19 Heat exchange surface
20	20 Profiled outer bottom plate
21	21 Profiled outer cover plate
22	22 Separating wall
23	23 First outer surface
55	24 Second outer surface
25	25 Surface insulation
26	26 Metallic housing
27	27 Inner part of the cover

28	Lower layer	
29	Beverage box	
30	Raster formed by the upper sides of beverage boxes	
31	Transport container	5
32	Supply center	
33	Frame	
34	Upper surface of the frame	
35	Net	
36	Handhold	
37	Exhaust line	
38	Outlet	
39	Holder	

L	Length	
W	Width	
H	Height	
T	Filling time interval	

Claims

1. Cooling box (1) for transporting heat-sensitive products (2) in a transport vehicle (3) and/or for distributing heat-sensitive products (2) to final customers, the cooling box (1) comprising:

- a thermally insulating cuboid housing (7) with a commissioning opening (8) on an upper side (11),
 - a first (9) and a second (10) storage chamber both together surrounded on five sides by the housing (7) and open on the upper side (11),
 - a cover (12) to open and close the commissioning opening (8) of the housing (7), the cover (12) containing a cool pack (13) with eutectic material (14) and having at least one coupling (15) for coupling a supply line (16) for a cooling fluid (17) and having heat exchange surfaces (19) to cool the cool pack (13) down by the cooling fluid (17),
 - a profiled outer bottom plate (20) to cooperate in a form locking manner with a certain underlying raster (5; 29),
 - a profiled outer cover plate (21) to carry other transport containers (30).

2. Cooling box (1) according to claim 1, wherein the shape of the cool pack (13) is such that it forms at least a part of a separating wall (22) between the first (9) and the second (10) storage chamber.

3. Cooling box (1) according to claim 1 or 2, wherein a first outer surface (23) of the cool pack (13) being in contact with the first storage chamber (9) and a second outer surface (24) of the cool pack (13) being in contact with the second storage chamber (10) have a different area and/or profile and/or thermal surface

insulation (25).

4. Cooling box (1) according to one of the preceding claims, wherein the heat exchange surfaces (19) of the cool pack (13) are designed and dimensioned to cool the cool pack (13) by vaporizing liquid nitrogen (LIN) entering the cool pack (13) through the coupling (15).

10 5. Cooling box (1) according to one of the preceding claims, wherein the eutectic material (14) in the cool pack (13) is a solid when cooled down and is a gel at usual environmental (6) temperatures.

15 6. Cooling box (1) according to one of the preceding claims, wherein the eutectic material (14) is contained in a metallic housing (26) and/or has metallic heat exchange surfaces (19), preferably the metallic housing (26) forming at least a part of the heat exchange surfaces (19).

20 7. Cooling box (1) according to one of the preceding claims, wherein the outer dimensions length (L), width (W), and height (H) of the cooling box (1) are 500 x 300 x 500 mm [Millimeters] plus/minus 20% for each separately, preferably 10%.

25 8. Cooling box (1) according to one of the preceding claims, wherein the cool pack has a T-shaped cross section forming an inner part (27) of the cover (12) and perpendicular to this inner part (27) a separating wall (22) between the first (9) and the second (10) storage chamber.

30 35 9. Cooling box (1) according to one of the preceding claims, whereby the cooling box (1) is designed to be handled by a single person, having preferably a weight of less than 10 kg [Kilograms] and being designed to carry up to 15 kg as transportable load.

40 45 10. Cooling box (1) according to one of the preceding claims, whereby the shape and dimensions of the cooling box (1) are adapted to the shape of other transport containers (31), in particular usual beverage boxes (29), to be transported together with the cooling box (1).

50 11. Method for transporting heat-sensitive products (2) together with other transport containers (31) from a supply center (32) to final customers, the method comprising:

- commissioning at least one cooling box (1) according to one of claims 1 to 10 with cooled heat-sensitive products (2) in the supply center (32),
 - cooling down the cool pack (13) of the cooling box (1) before or during commissioning by connecting its coupling (15) to a supply line (16)

supplying cooling fluid (17) for a predetermined time interval (T),
 - disconnecting the coupling (15) and closing the cover (12) of the cooling box (1),
 - placing the cooling box (1) in a transport vehicle (3) having a bottom (4) with a raster (5) corresponding to the profiled bottom plate (20) of the cooling box (1) or already containing other transport containers (31) or frames (33) having an upper surface (34) with a raster corresponding to the profiled bottom plate (20) of the cooling box (1),
 - placing other containers (31) or frames (33) having a shape corresponding to the profiled outer cover plate (21) of the cooling box (1) on top of the cooling box (1) or several similar cooling boxes (1),
 - transporting and distributing the cooled products (2) to final customers,
 - returning the cooling box (1) to the supply center (32), and
 - cleaning the storage chambers (9, 10) of the housing (7) of the cooling box (1) and starting the process as described again.

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12. Method according to claim 11, wherein liquid nitrogen (LIN) or liquid carbon dioxide is used as cooling fluid (17).

13. Method according to claims 11 or 12, wherein the transport vehicle (3) is provided with at least one lower layer (28) of beverage boxes (29), having an upper side forming a raster (29) corresponding to the profiled outer bottom plate (20) of the cooling box (1) before loading cooling boxes (1), and wherein other transport containers (31), preferably of lighter weight than the cooling boxes (1), are loaded on top of the cooling boxes (1).

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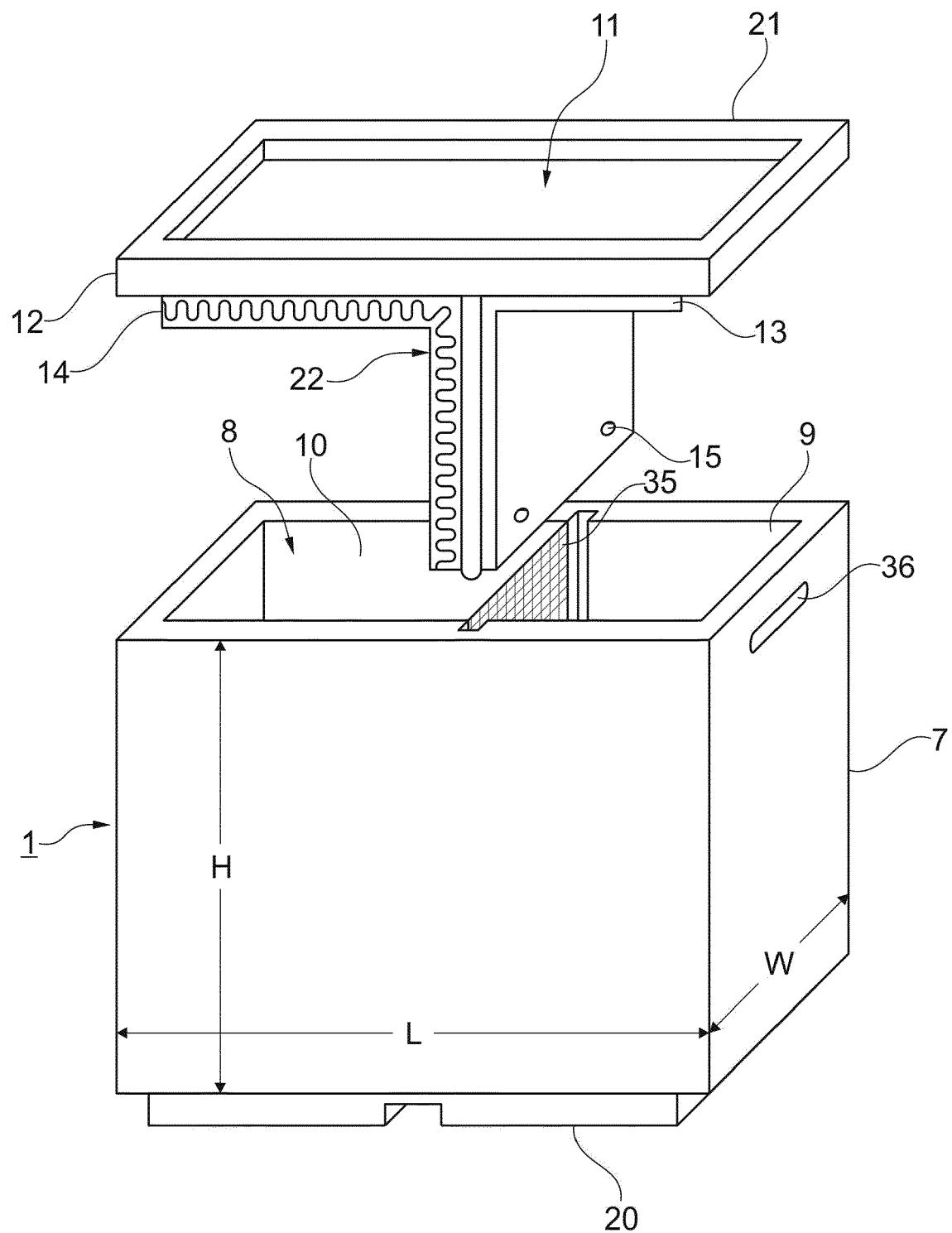


Fig. 1

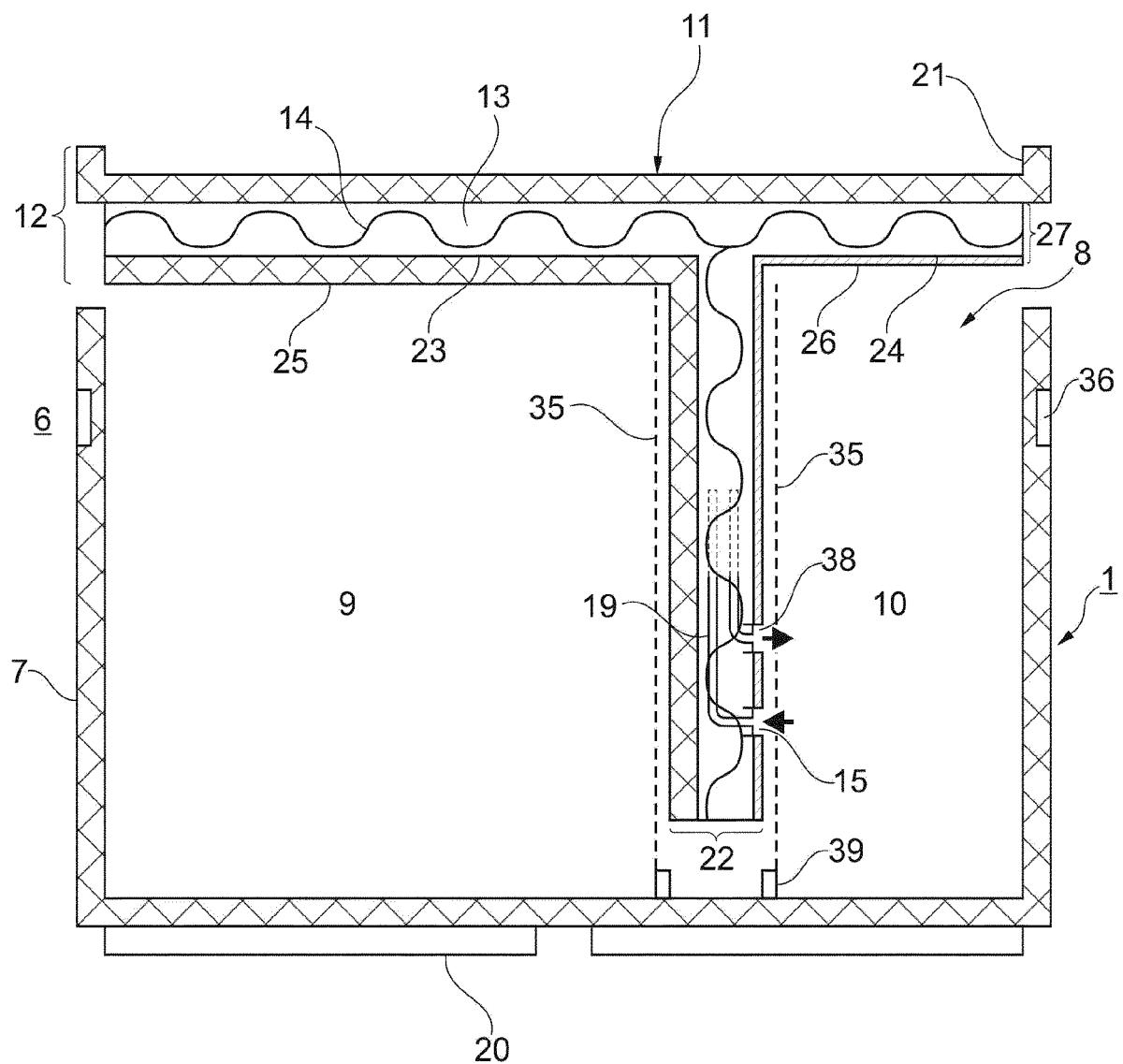


Fig. 2

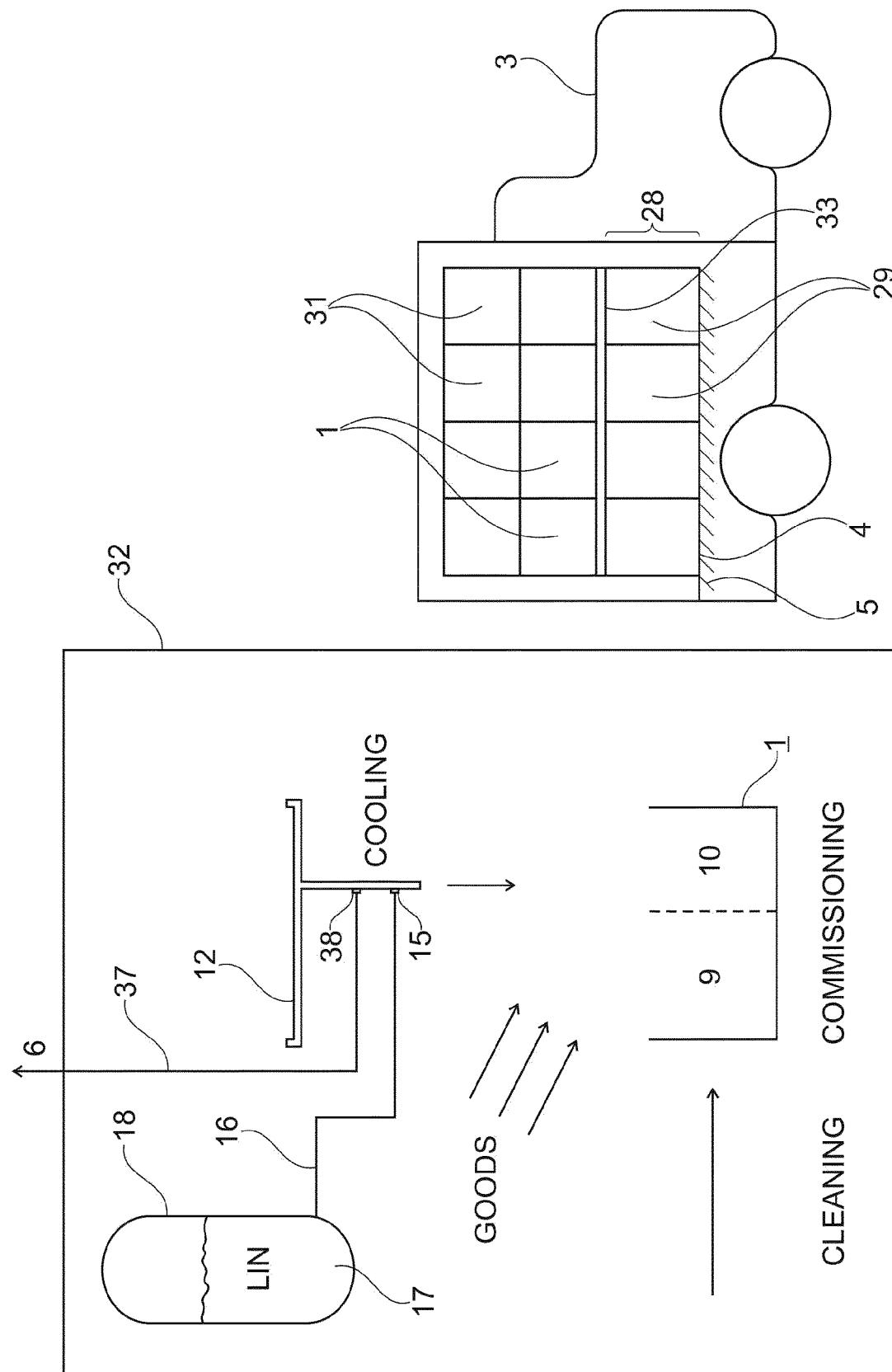


Fig. 3



EUROPEAN SEARCH REPORT

Application Number

EP 15 15 3079

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
10 A	US 2007/175236 A1 (DRYZUN NATHAN [AU]) 2 August 2007 (2007-08-02) * paragraphs [0027], [0066] - [0068]; figures 1-2, 4-5 *	1-13	INV. F25D3/10
15 A	JP 2012 057921 A (NIPPON EKITAN CORP) 22 March 2012 (2012-03-22) * abstract; figures 1-2 *	1-13	
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CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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