(12) UK Patent (19) GB (11) 2569577 (13) B

(45) Date of B Publication 09.11.2022

(54) Title of the Invention: An insulating cover or liner for use in the transportation of goods

(51) INT CL: ***B65D 81/38*** (2006.01)

(21) Application No: **1721434.7**

(22) Date of Filing: **20.12.2017**

(43) Date of A Publication **26.06.2019**

(56) Documents Cited:
GB 2420097 A
DE 003803238 C1
JP 2001180767 A
Chill Buddy brochure
CN 205291773 U
FR 002861365 A1

(58) Field of Search:
As for published application 2569577 A viz:
INT CL **B65D**
Other: **WPI, EPODOC**
updated as appropriate

Additional Fields
INT CL **B32B, B65D**
Other: **WPI, EPODOC**

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14 02 19

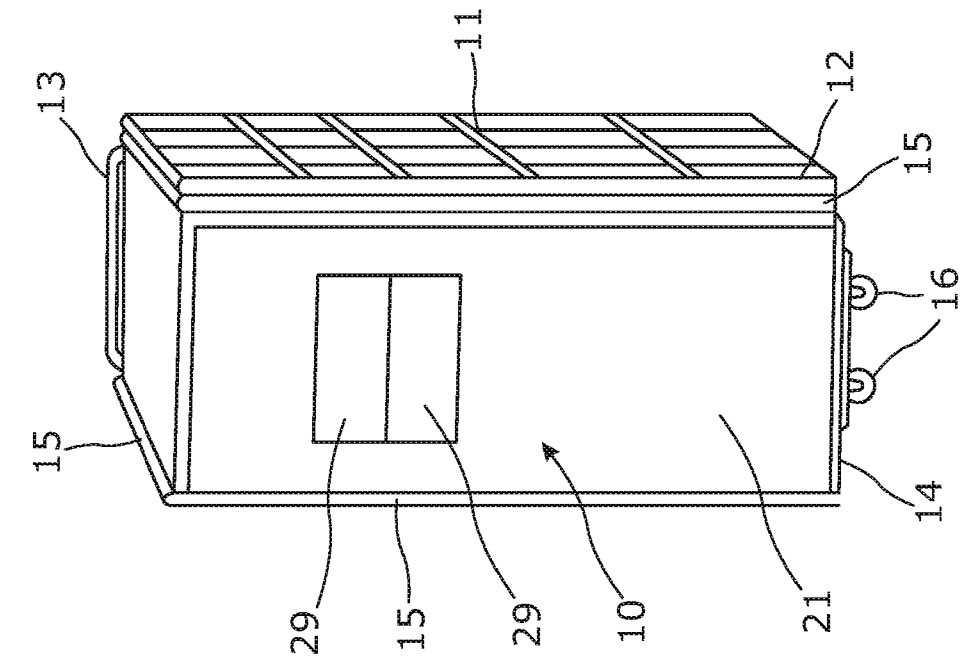

Fig. 2

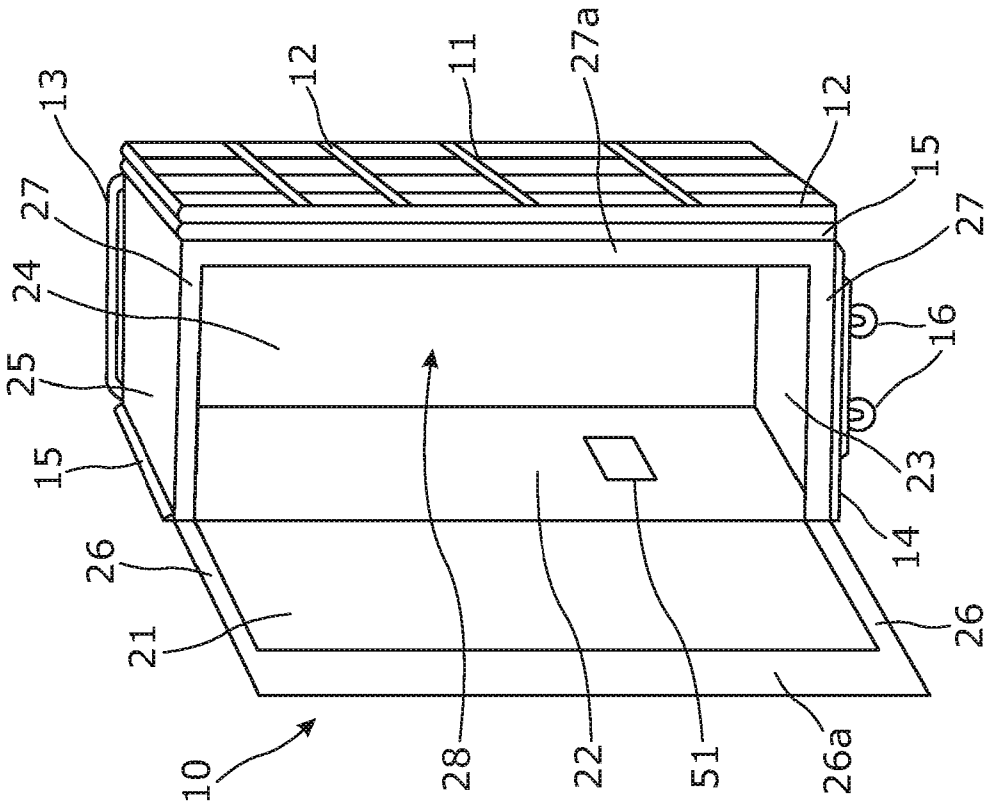

Fig. 1

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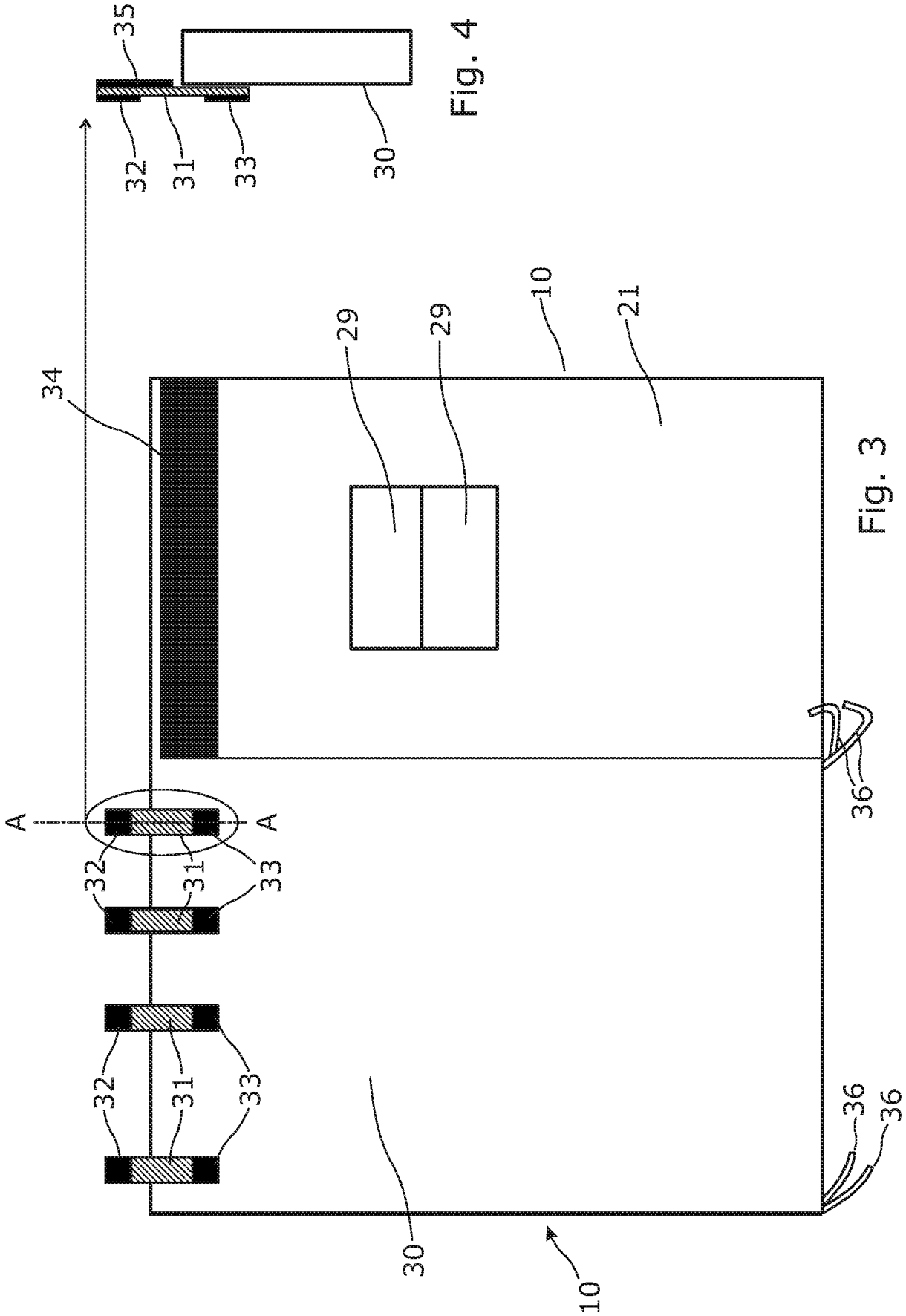

Fig. 4

Fig. 3

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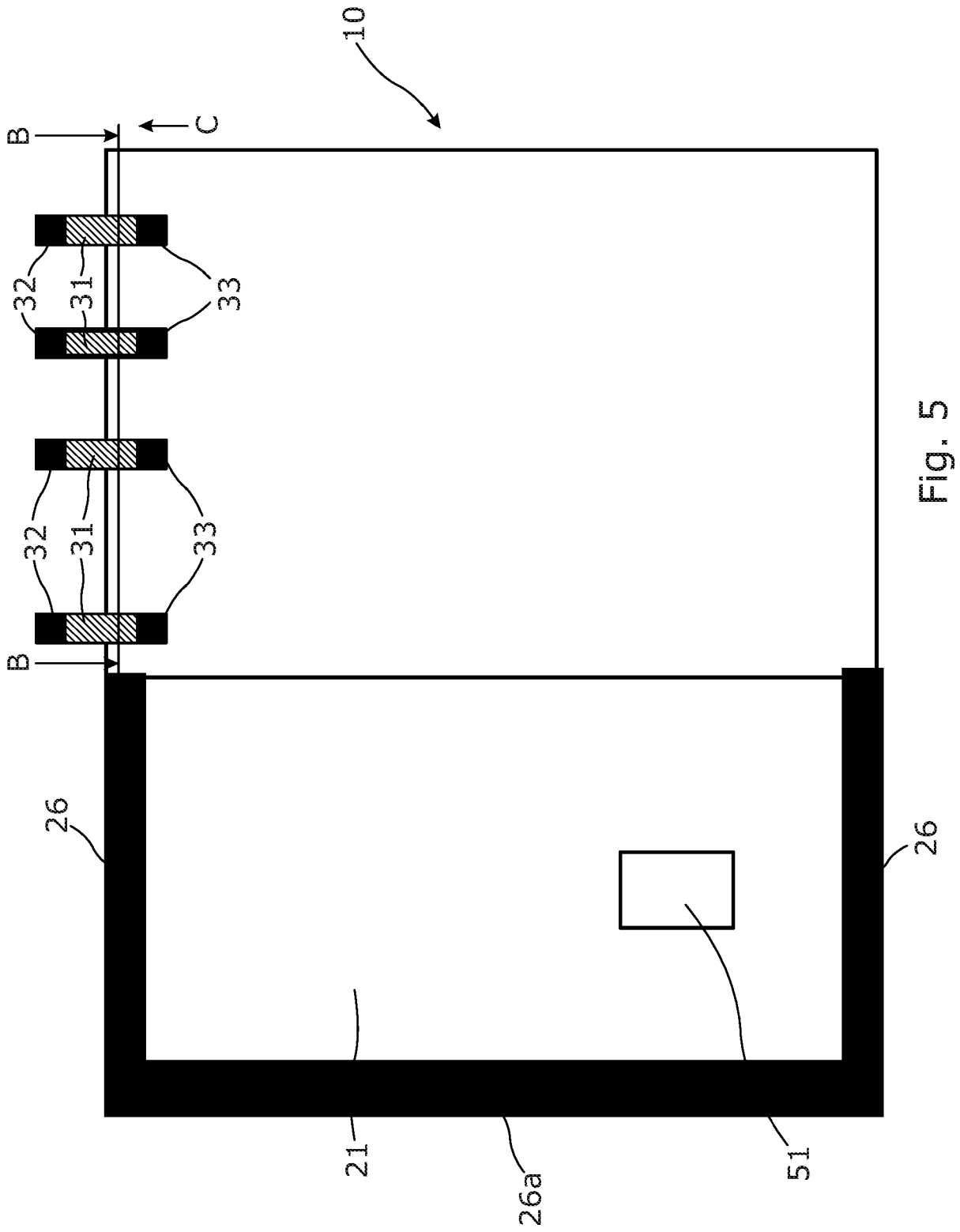

Fig. 5

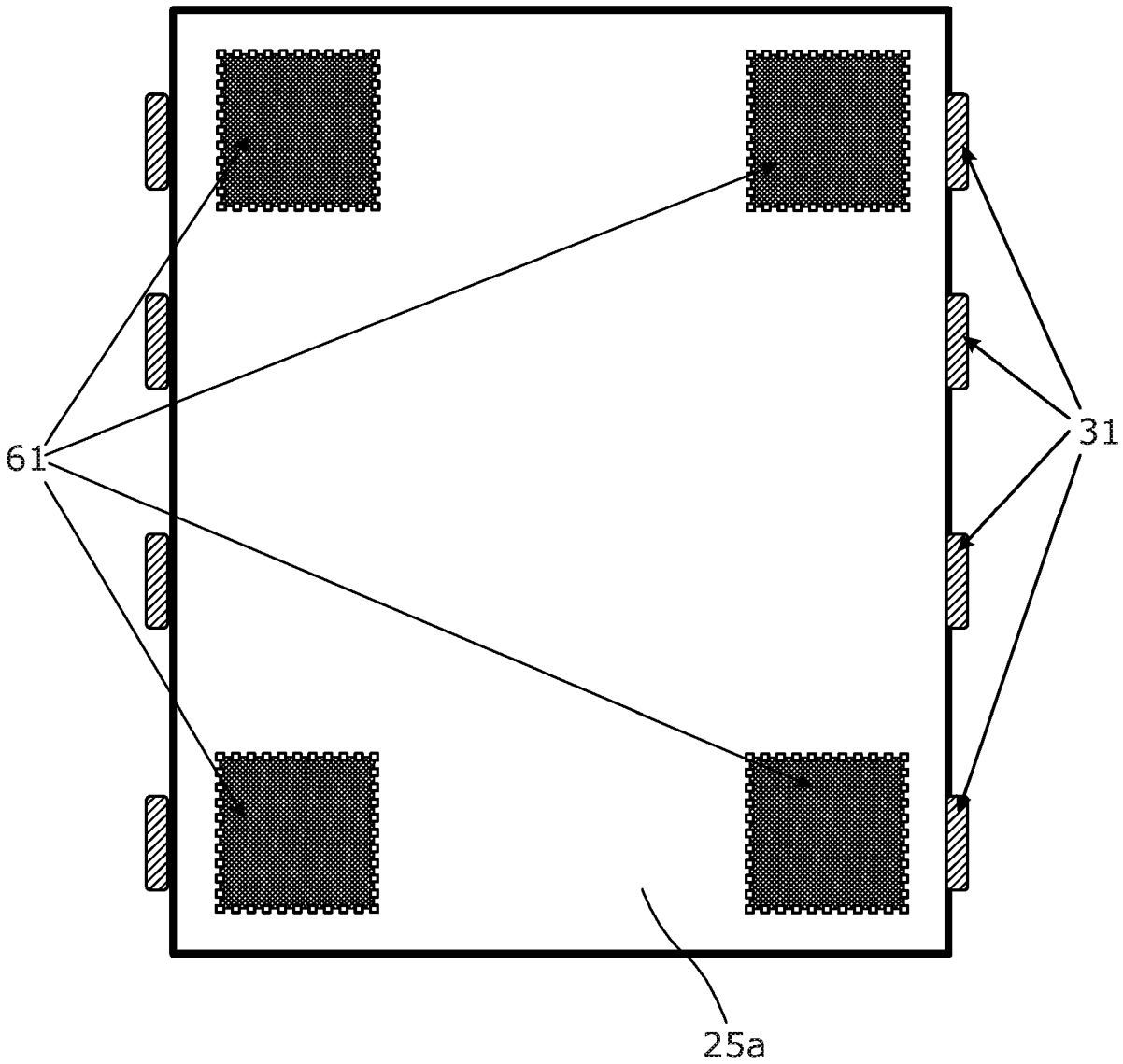

Fig. 6

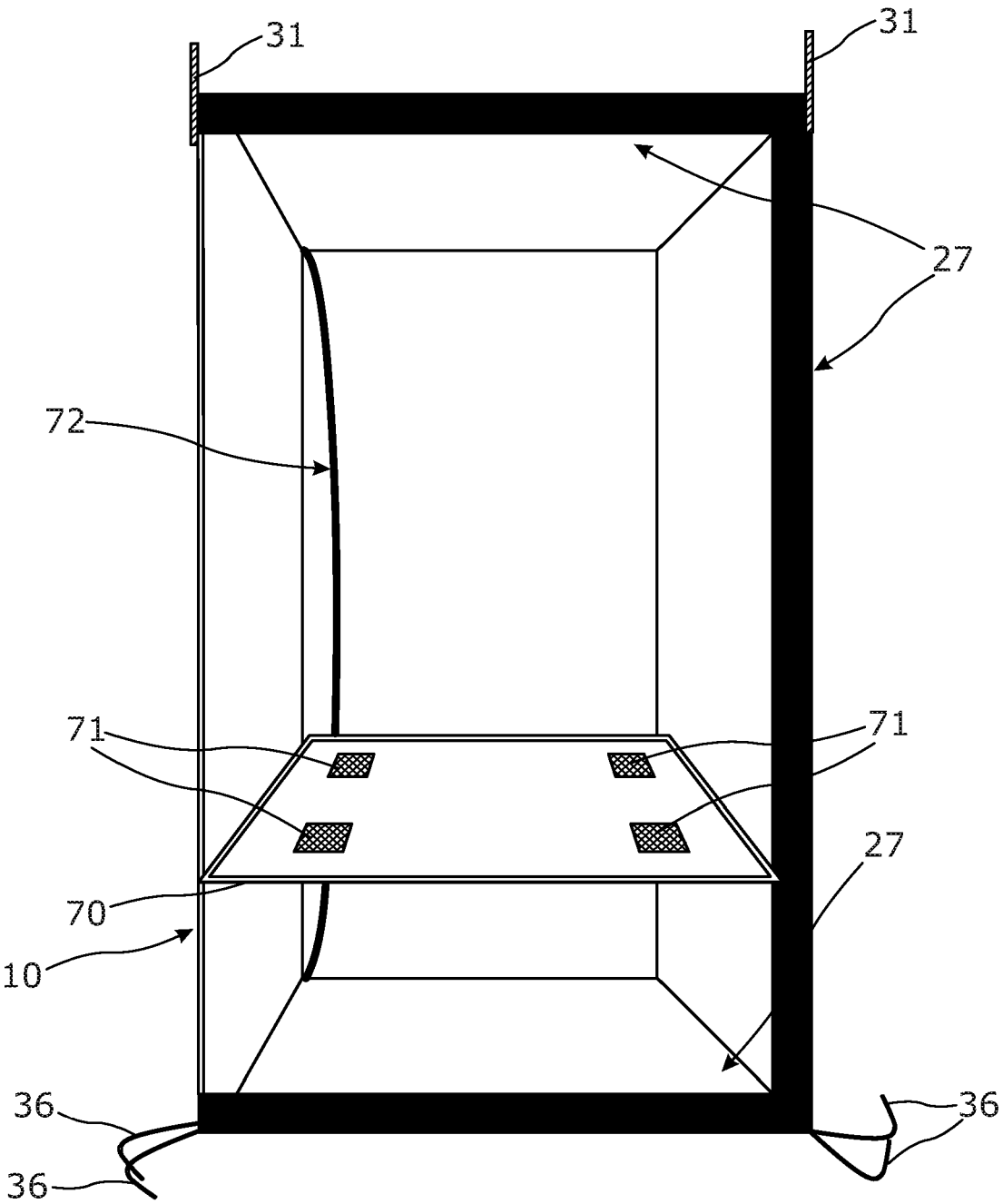

Fig. 7

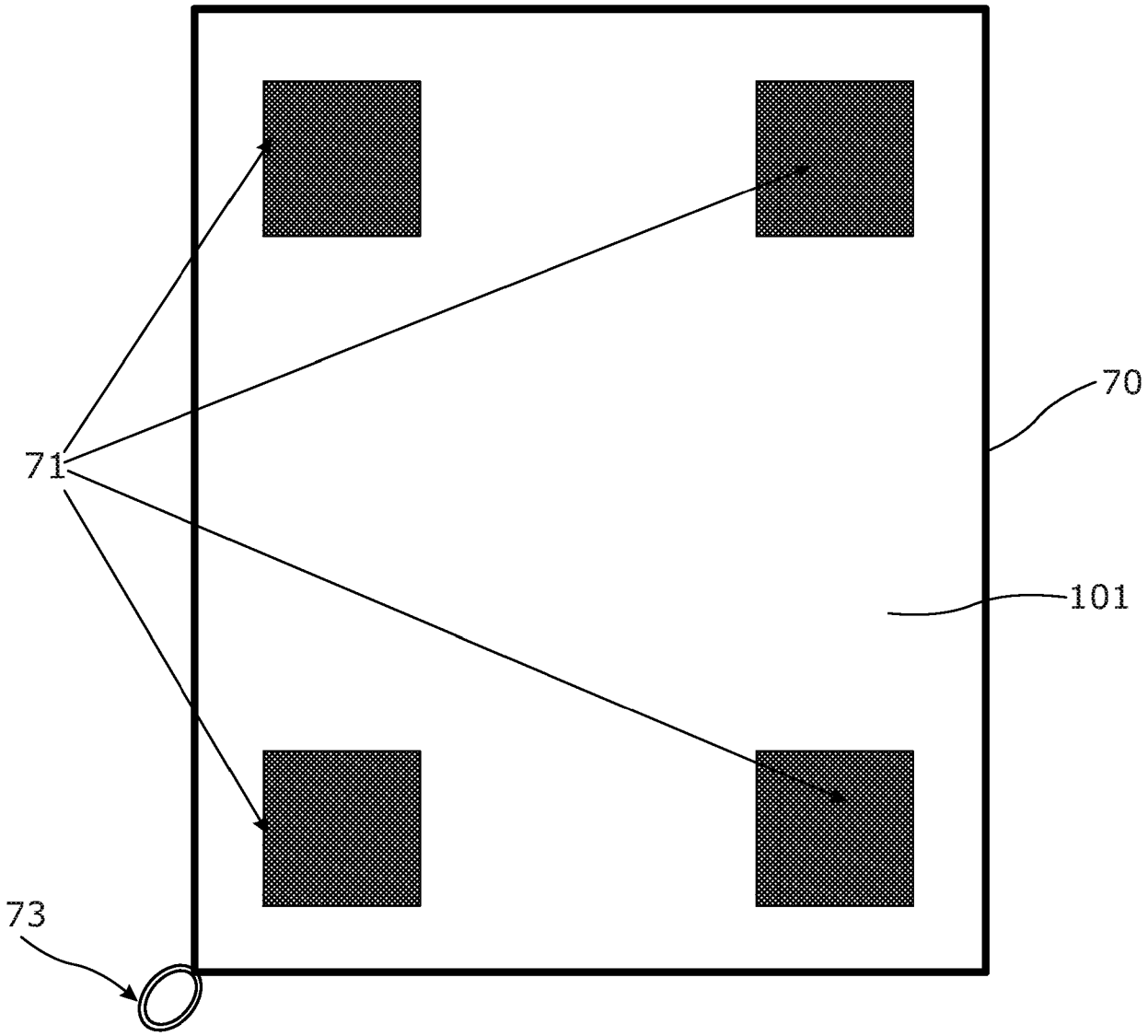

Fig. 8

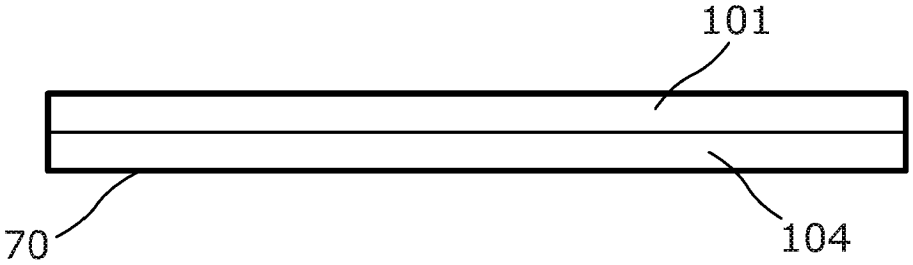

Fig. 11

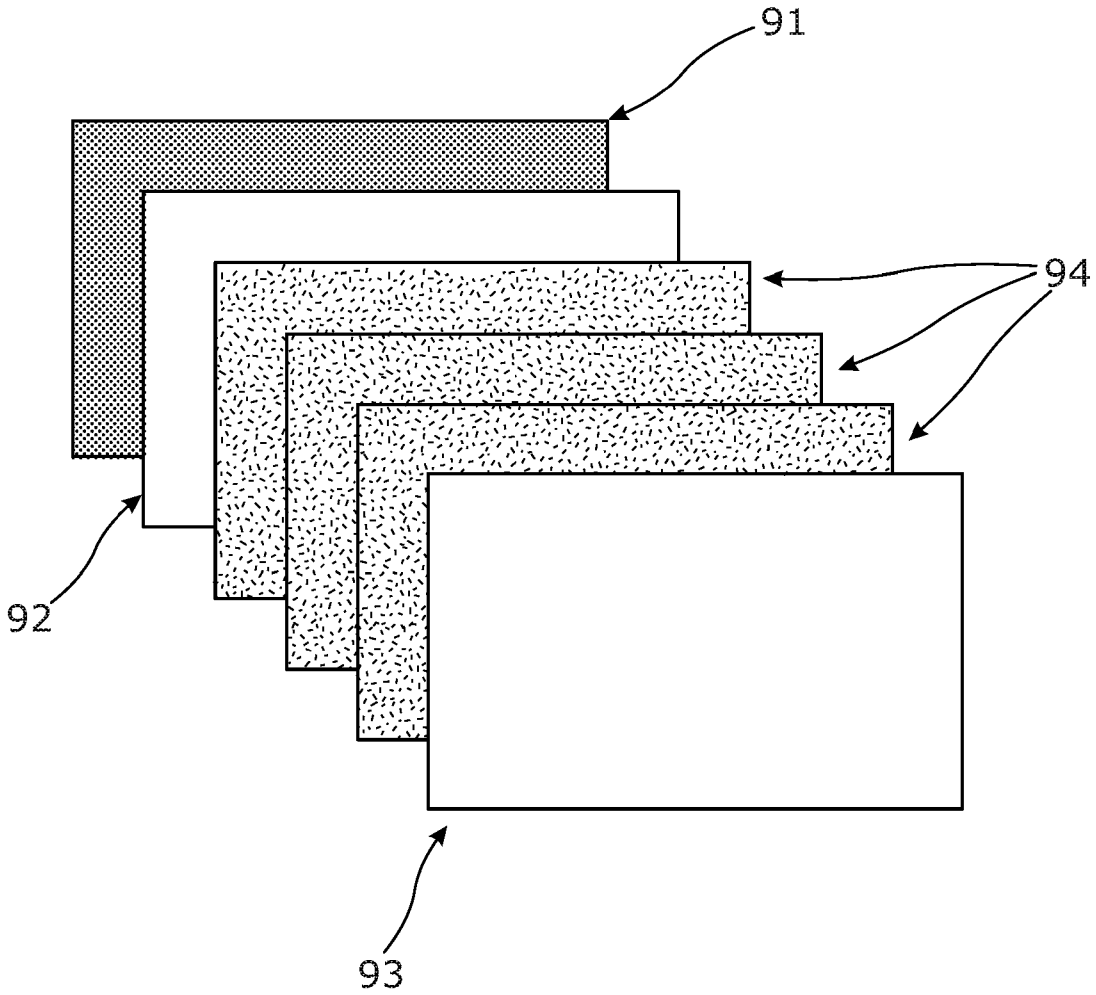

Fig. 9

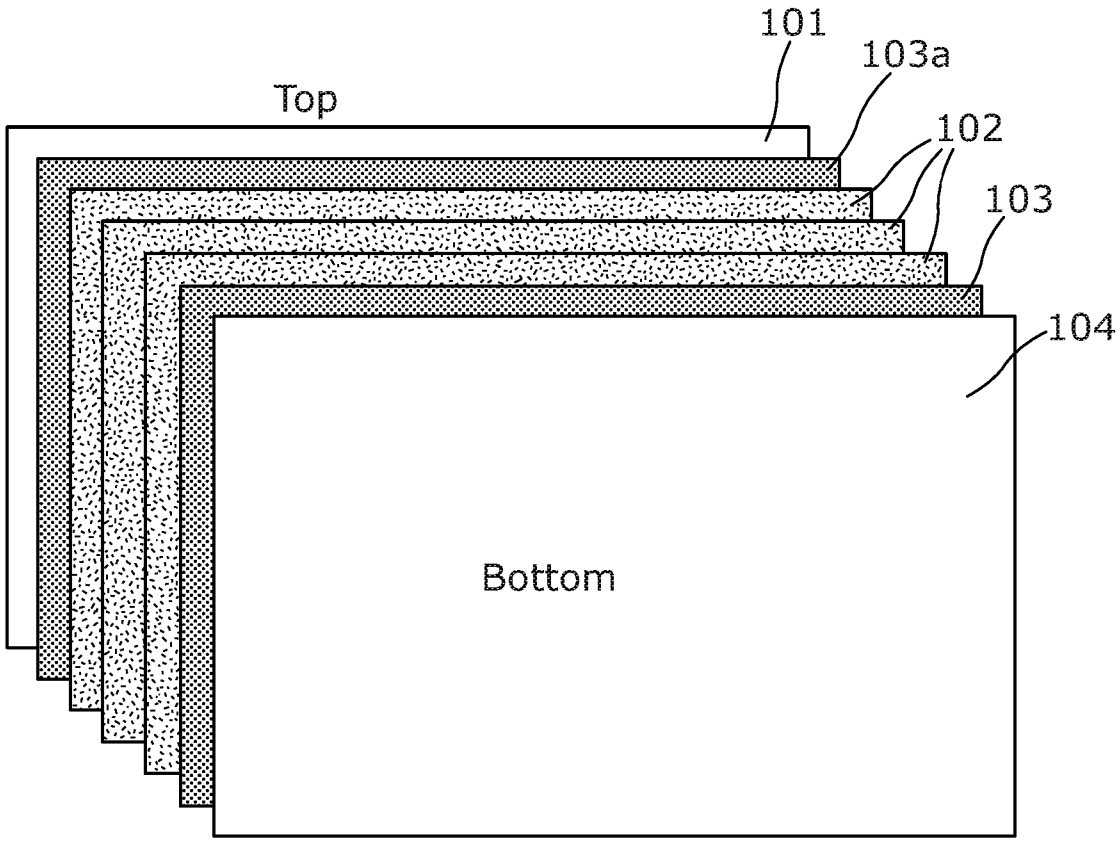

Fig. 10

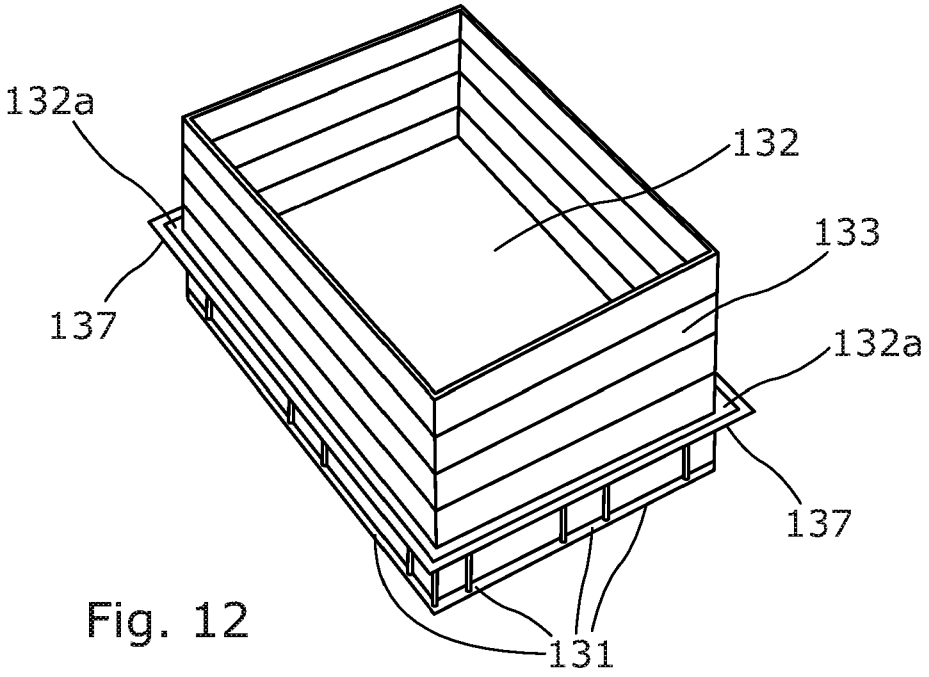

Fig. 12

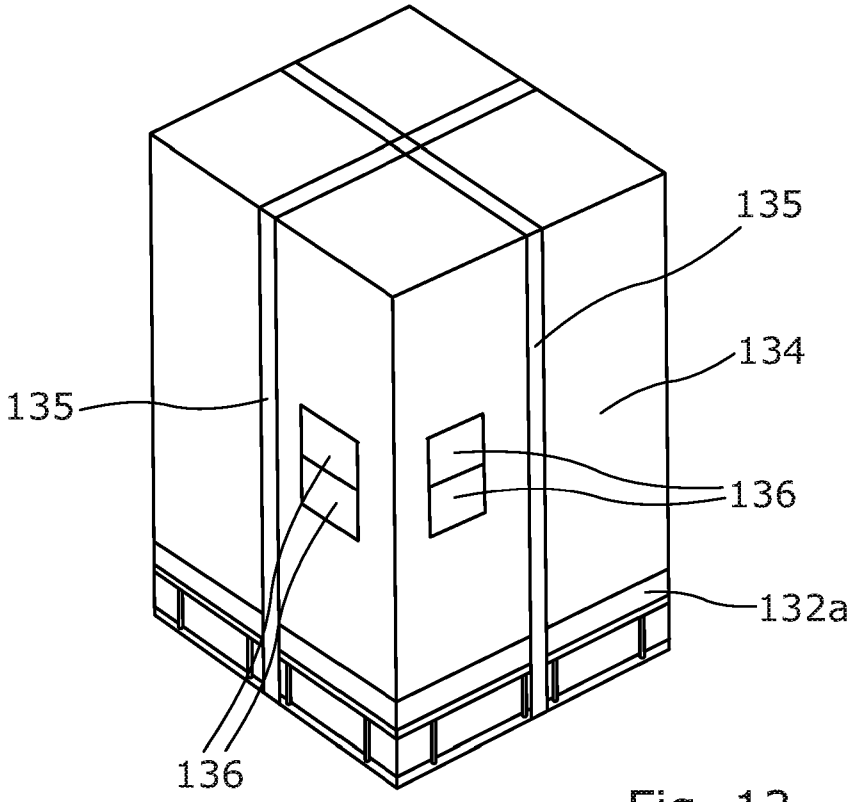

Fig. 13

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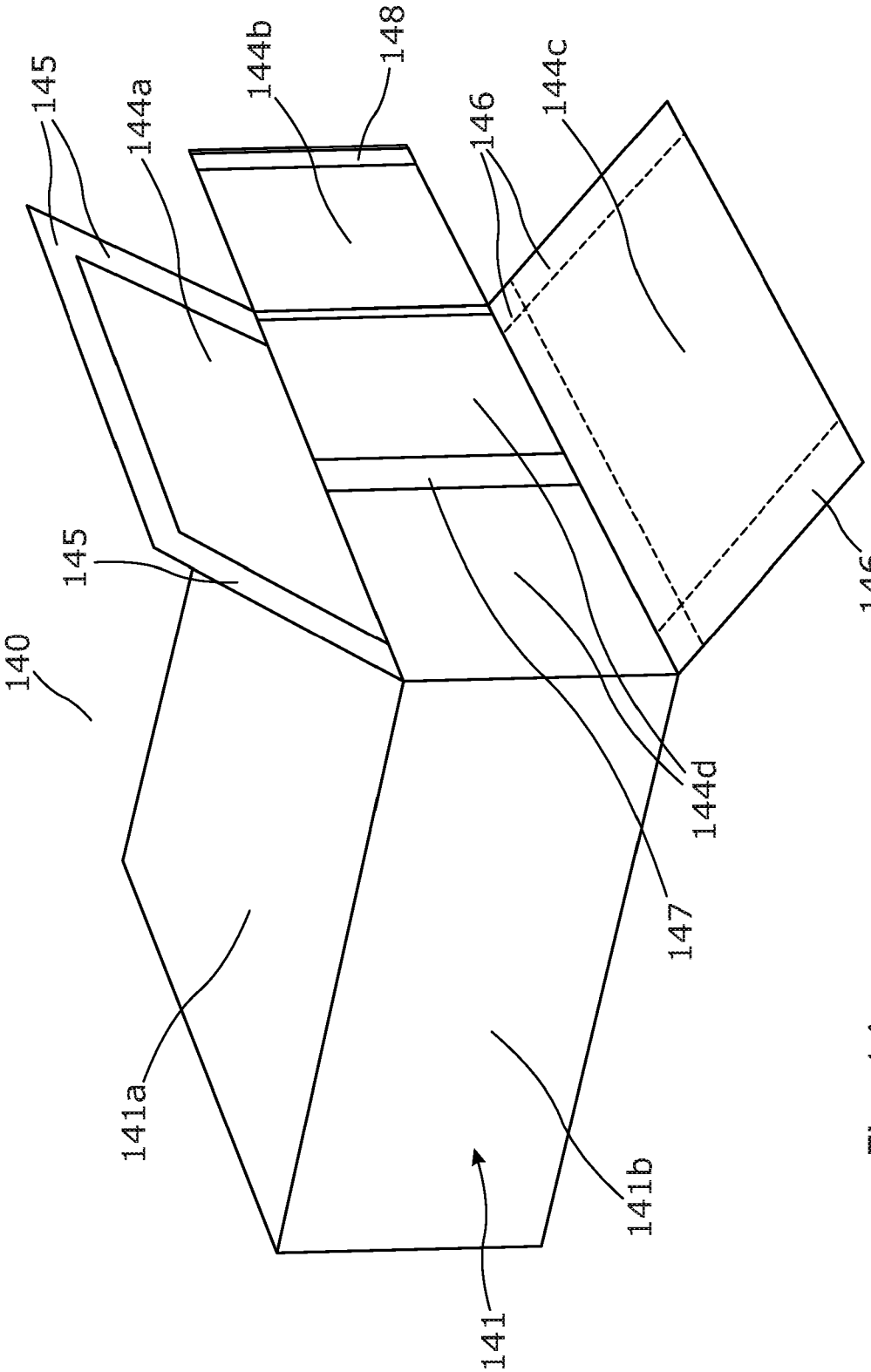

Fig. 14

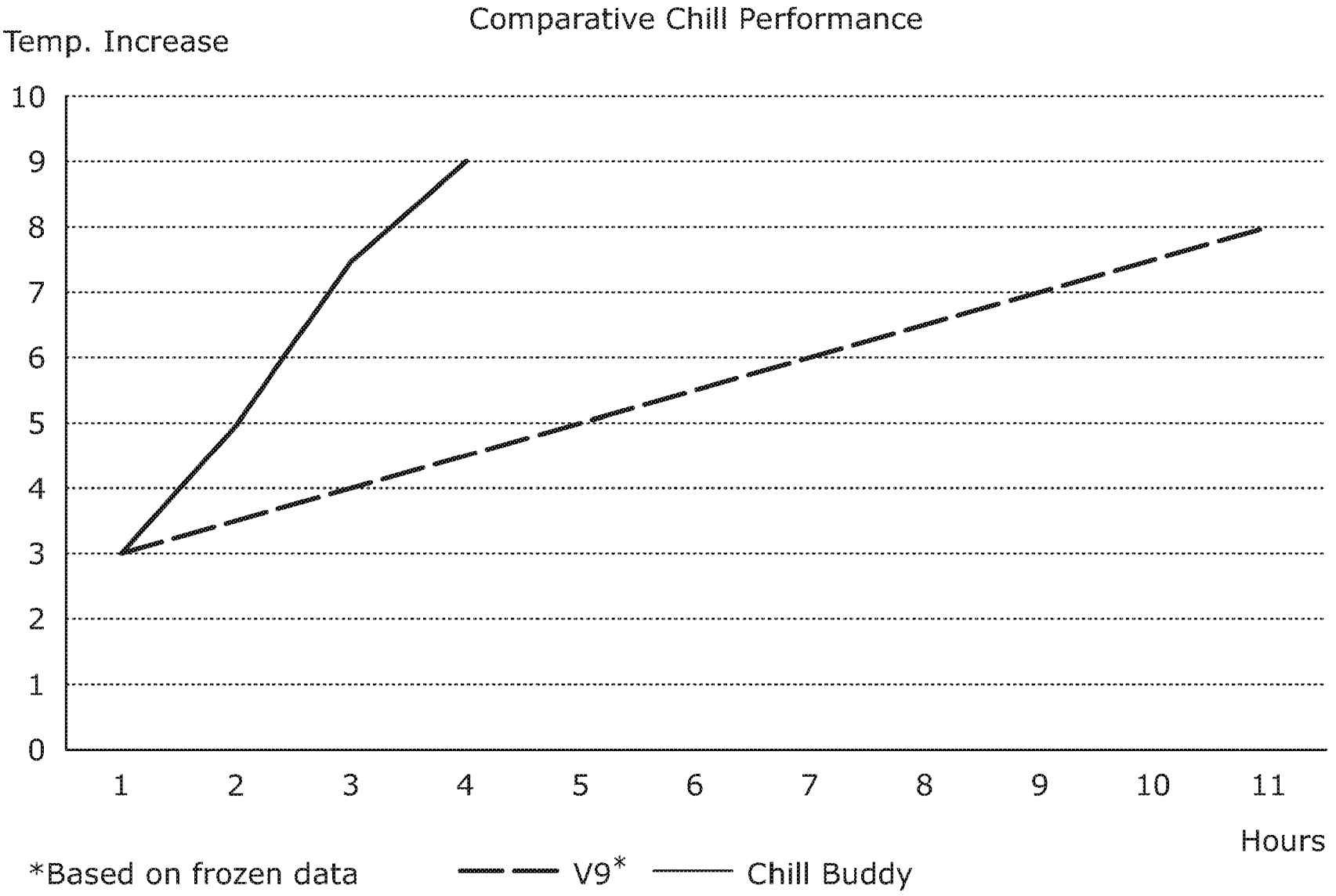
Comparative Chill Performance
Temp. Increase
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
9
10
11
Hours
*Based on frozen data
V9*
Chill Buddy

Fig. 15

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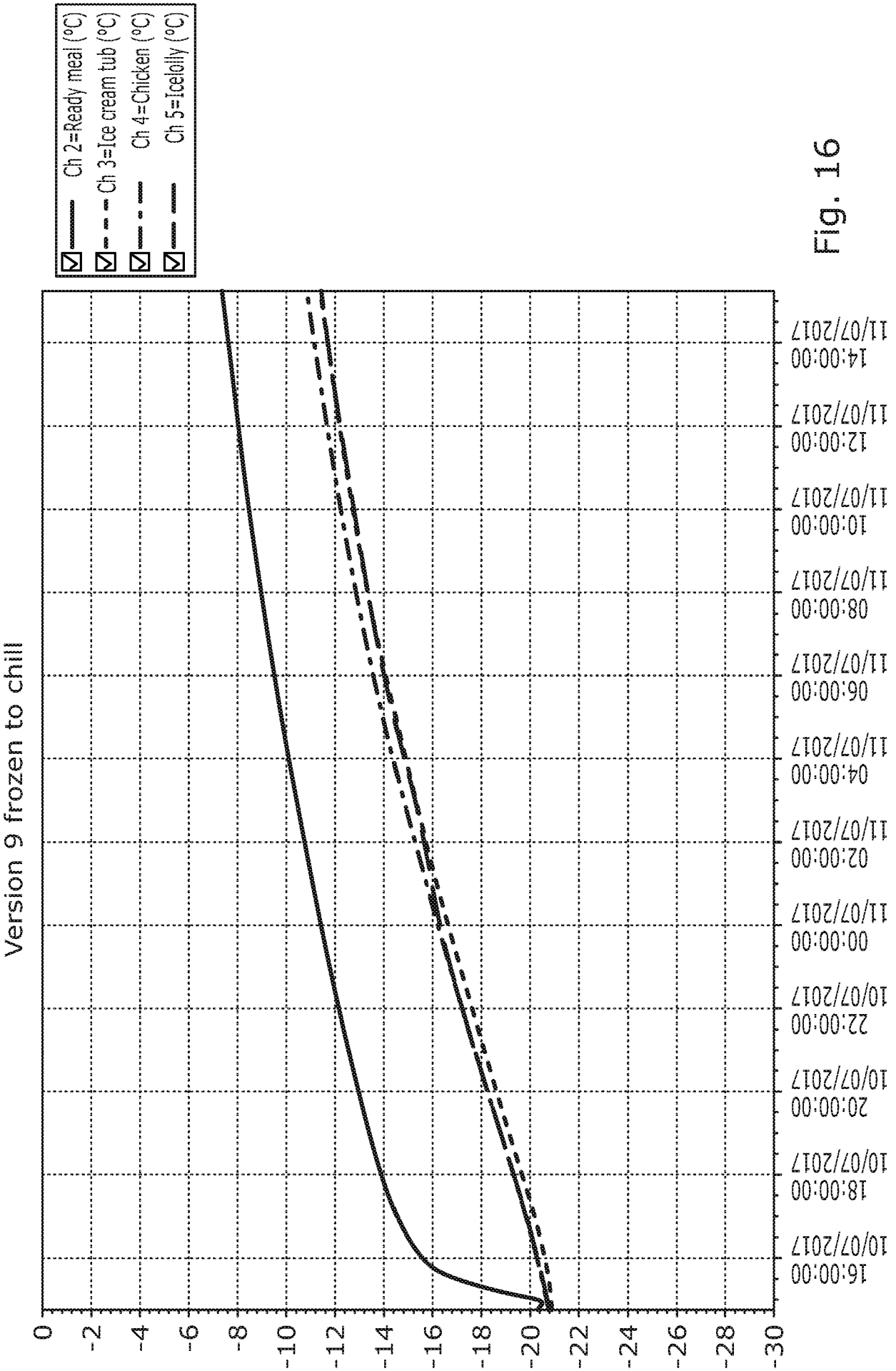


Fig. 16

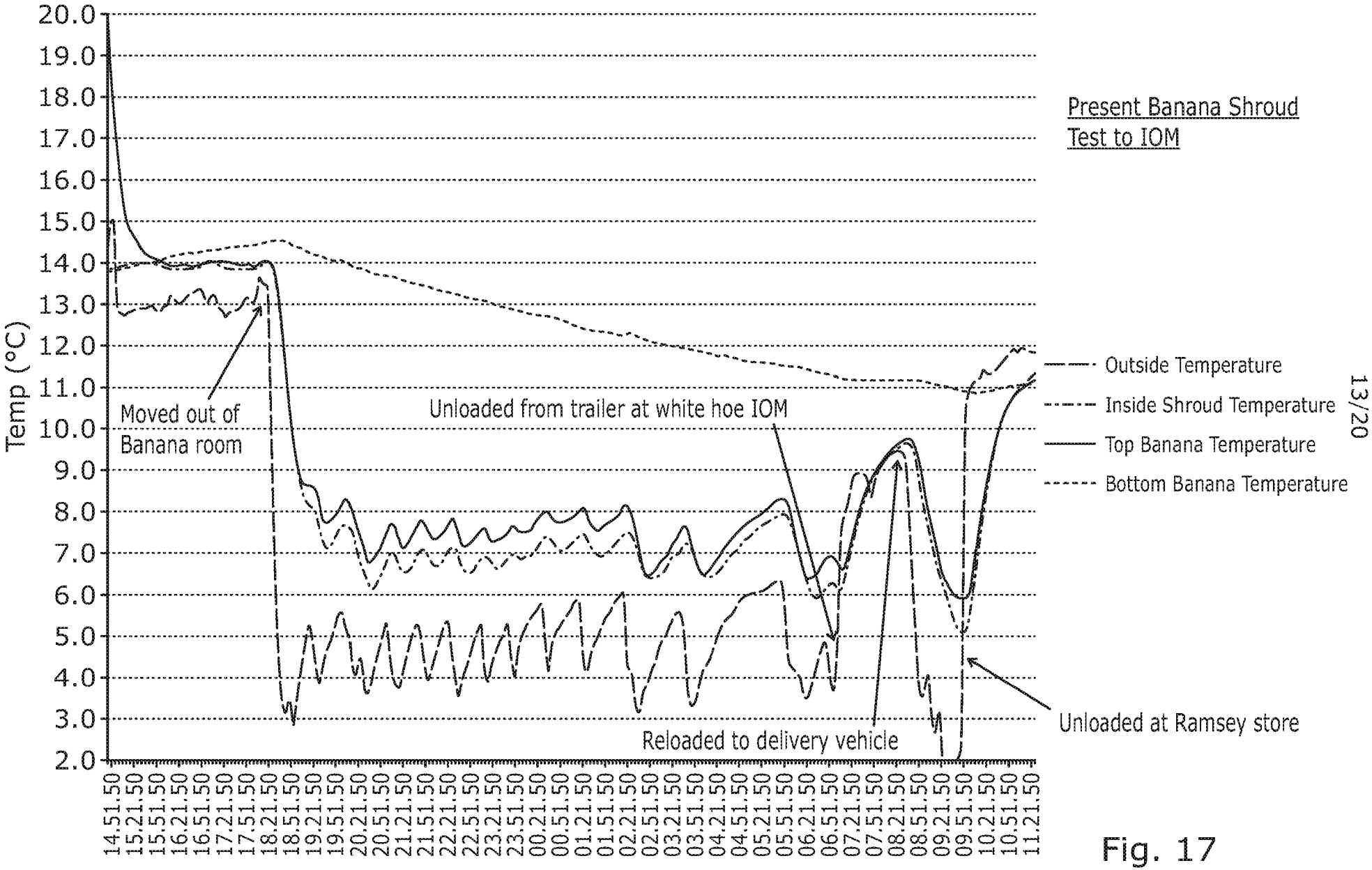
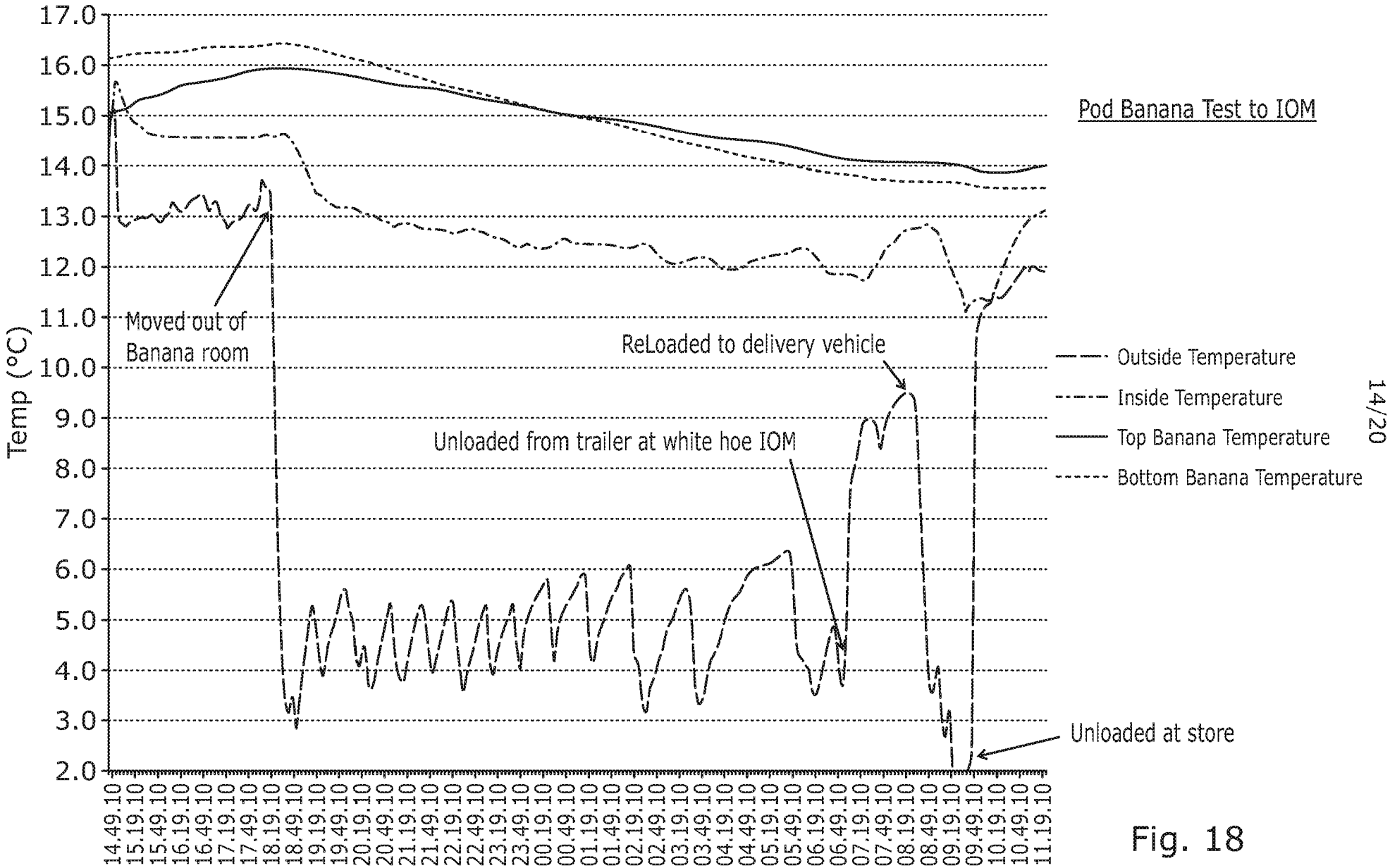

Present Banana Shroud
Test to IOM
Temp (°C)
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
Moved out of
Banana room
Unloaded from trailer at white hoe IOM
Reloaded to delivery vehicle
Unloaded at Ramsey store
Outside Temperature
Inside Shroud Temperature
Top Banana Temperature
Bottom Banana Temperature
14.51.50
15.21.50
15.51.50
16.21.50
16.51.50
17.21.50
17.51.50
18.21.50
18.51.50
19.21.50
19.51.50
20.21.50
20.51.50
21.21.50
21.51.50
22.21.50
22.51.50
23.21.50
23.51.50
00.21.50
00.51.50
01.21.50
01.51.50
02.21.50
02.51.50
03.21.50
03.51.50
04.21.50
04.51.50
05.21.50
05.51.50
06.21.50
06.51.50
07.21.50
07.51.50
08.21.50
08.51.50
09.21.50
09.51.50
10.21.50
10.51.50
11.21.50

Fig. 17


Pod Banana Test to IOM
Temp (°C)
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
Moved out of Banana room
ReLoaded to delivery vehicle
Unloaded from trailer at white hoe IOM
Unloaded at store
Outside Temperature
Inside Temperature
Top Banana Temperature
Bottom Banana Temperature
14.49.10
15.19.10
15.49.10
16.19.10
16.49.10
17.19.10
17.49.10
18.19.10
18.49.10
19.19.10
19.49.10
20.19.10
20.49.10
21.19.10
21.49.10
22.19.10
22.49.10
23.19.10
23.49.10
00.19.10
00.49.10
01.19.10
01.49.10
02.19.10
02.49.10
03.19.10
03.49.10
04.19.10
04.49.10
05.19.10
05.49.10
06.19.10
06.49.10
07.19.10
07.49.10
08.19.10
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09.19.10
09.49.10
10.19.10
10.49.10
11.19.10

Fig. 18

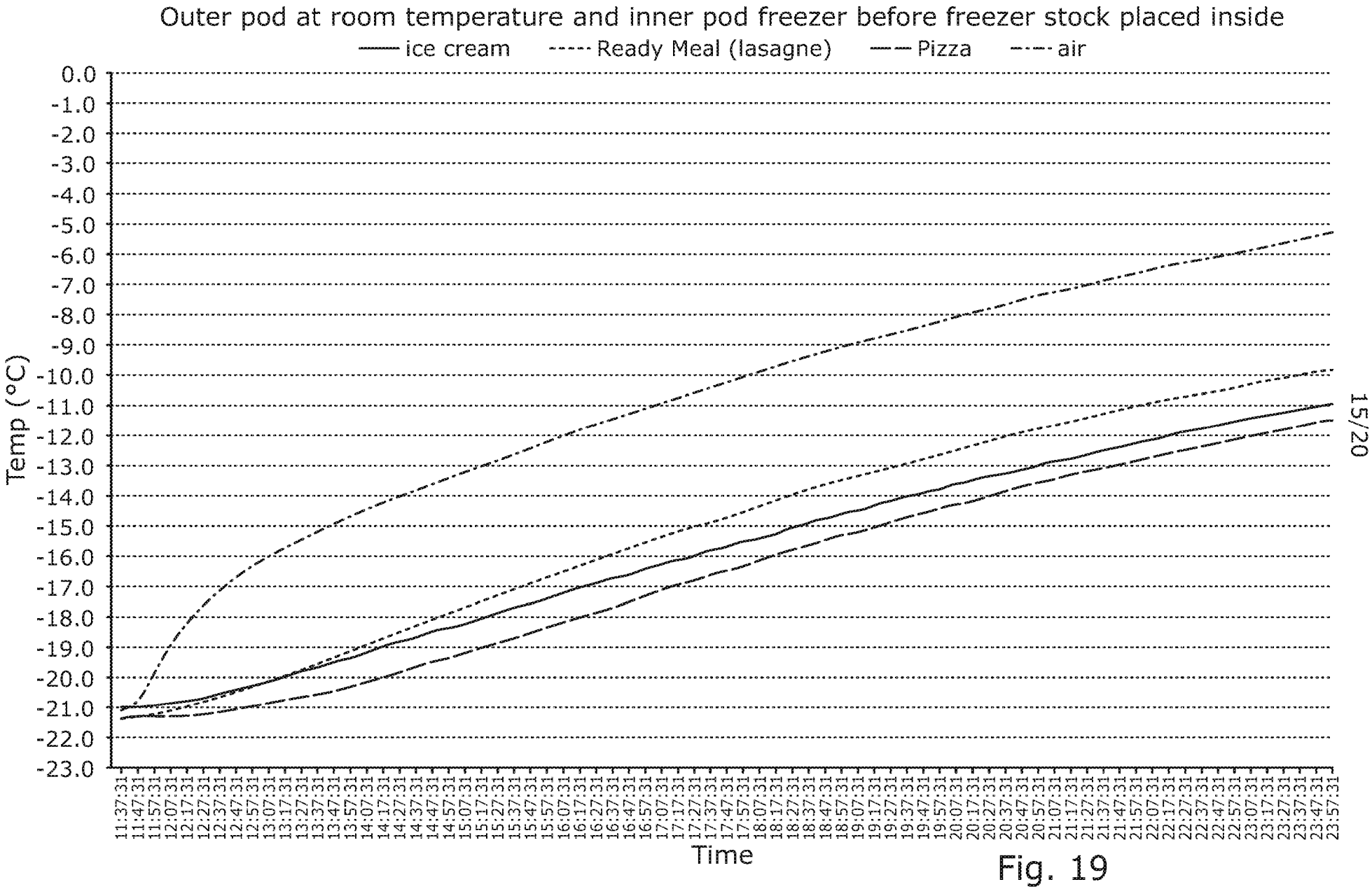
Outer pod at room temperature and inner pod freezer before freezer stock placed inside
ice cream
Ready Meal (lasagne)
Pizza
air
Temp (°C)
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
-14.0
-15.0
-16.0
-17.0
-18.0
-19.0
-20.0
-21.0
-22.0
-23.0
Time

Fig. 19

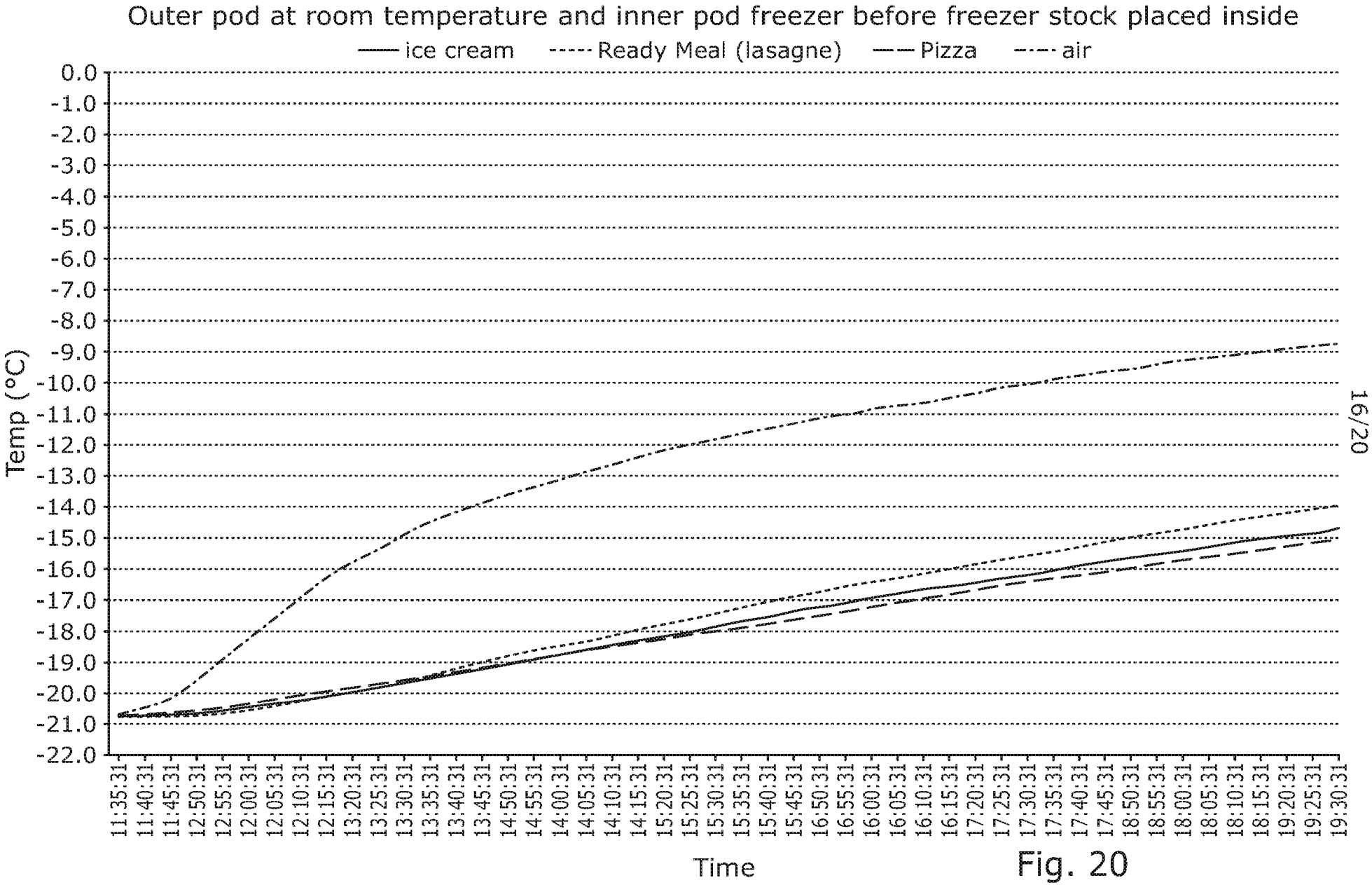
Outer pod at room temperature and inner pod freezer before freezer stock placed inside
ice cream
Ready Meal (lasagne)
Pizza
air
Temp (°C)
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
-14.0
-15.0
-16.0
-17.0
-18.0
-19.0
-20.0
-21.0
-22.0
11:35:31
11:40:31
11:45:31
12:50:31
12:55:31
12:00:31
12:05:31
12:10:31
12:15:31
13:20:31
13:25:31
13:30:31
13:35:31
13:40:31
13:45:31
14:50:31
14:55:31
14:00:31
14:05:31
14:10:31
14:15:31
15:20:31
15:25:31
15:30:31
15:35:31
15:40:31
15:45:31
16:50:31
16:55:31
16:00:31
16:05:31
16:10:31
16:15:31
17:20:31
17:25:31
17:30:31
17:35:31
17:40:31
17:45:31
18:50:31
18:55:31
18:00:31
18:05:31
18:10:31
18:15:31
19:20:31
19:25:31
19:30:31
Time
16/20

Fig. 20

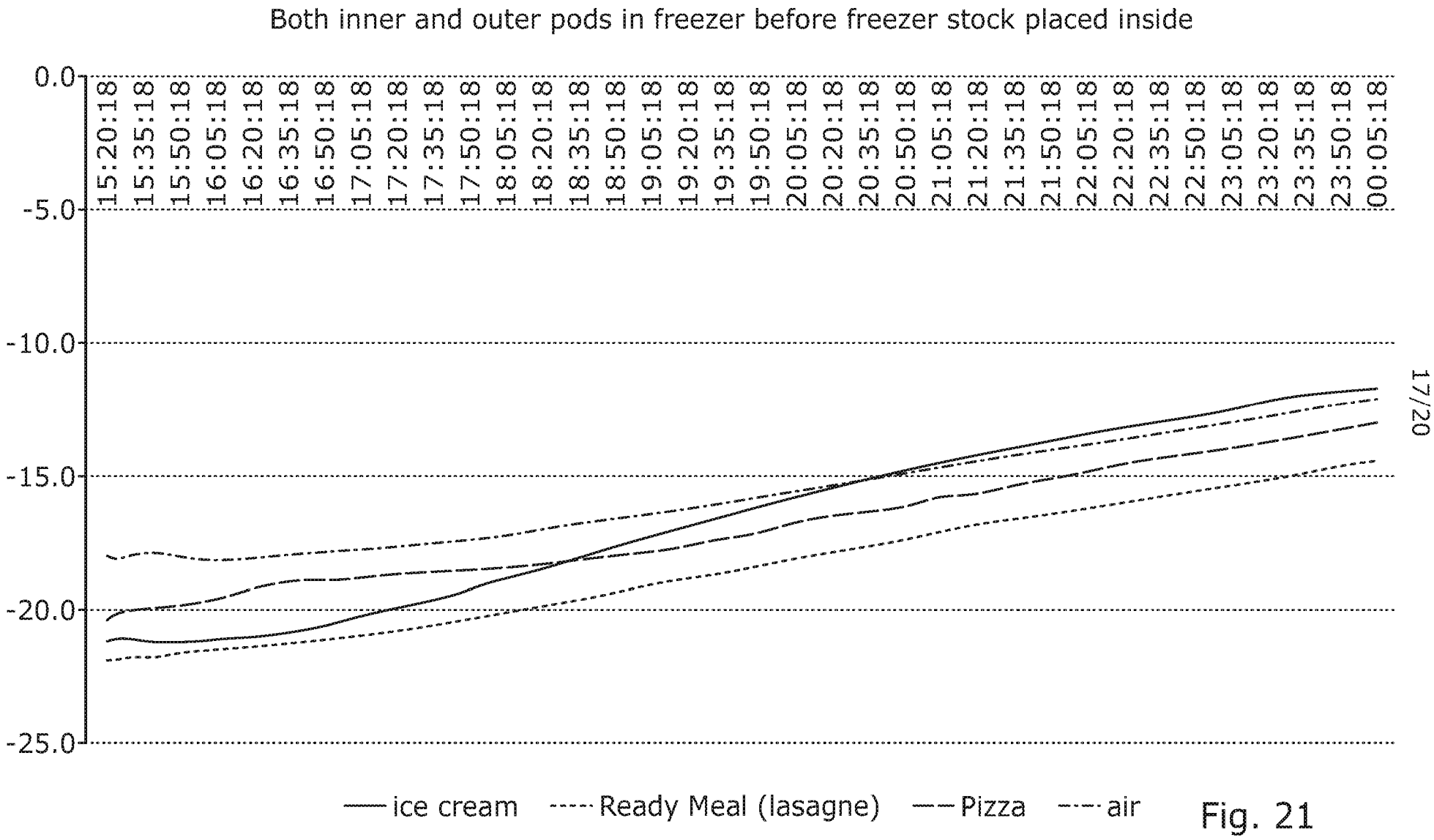
Both inner and outer pods in freezer before freezer stock placed inside
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
15:20:18
15:35:18
15:50:18
16:05:18
16:20:18
16:35:18
16:50:18
17:05:18
17:20:18
17:35:18
17:50:18
18:05:18
18:20:18
18:35:18
18:50:18
19:05:18
19:20:18
19:35:18
19:50:18
20:05:18
20:20:18
20:35:18
20:50:18
21:05:18
21:20:18
21:35:18
21:50:18
22:05:18
22:20:18
22:35:18
22:50:18
23:05:18
23:20:18
23:35:18
23:50:18
00:05:18
ice cream
Ready Meal (lasagne)
Pizza
air

Fig. 21

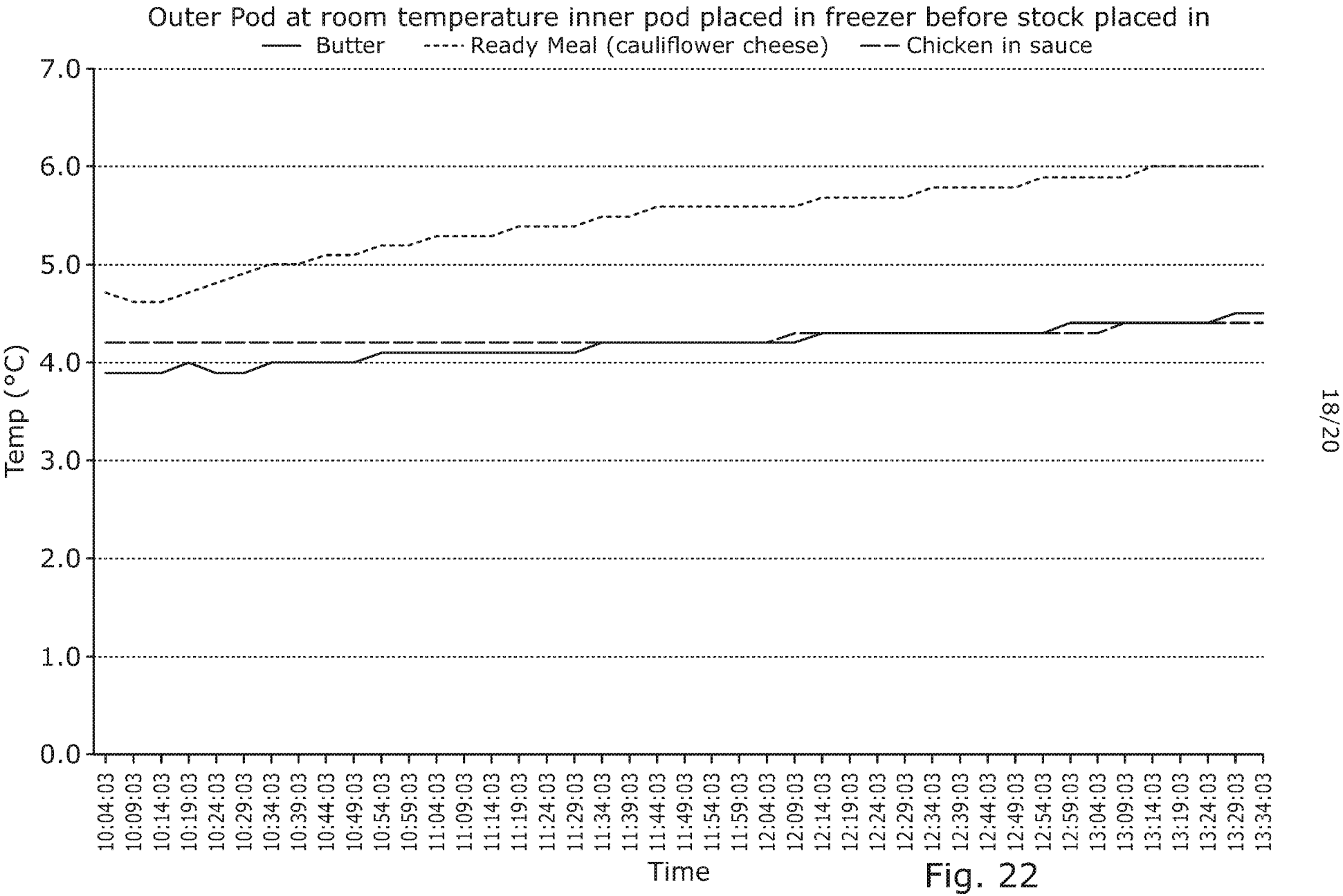
Outer Pod at room temperature inner pod placed in freezer before stock placed in
Butter
Ready Meal (cauliflower cheese)
Chicken in sauce
Temp (°C)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
10:04:03
10:09:03
10:14:03
10:19:03
10:24:03
10:29:03
10:34:03
10:39:03
10:44:03
10:49:03
10:54:03
10:59:03
11:04:03
11:09:03
11:14:03
11:19:03
11:24:03
11:29:03
11:34:03
11:39:03
11:44:03
11:49:03
11:54:03
11:59:03
12:04:03
12:09:03
12:14:03
12:19:03
12:24:03
12:29:03
12:34:03
12:39:03
12:44:03
12:49:03
12:54:03
12:59:03
13:04:03
13:09:03
13:14:03
13:19:03
13:24:03
13:29:03
13:34:03
Time

Fig. 22

14 02 19

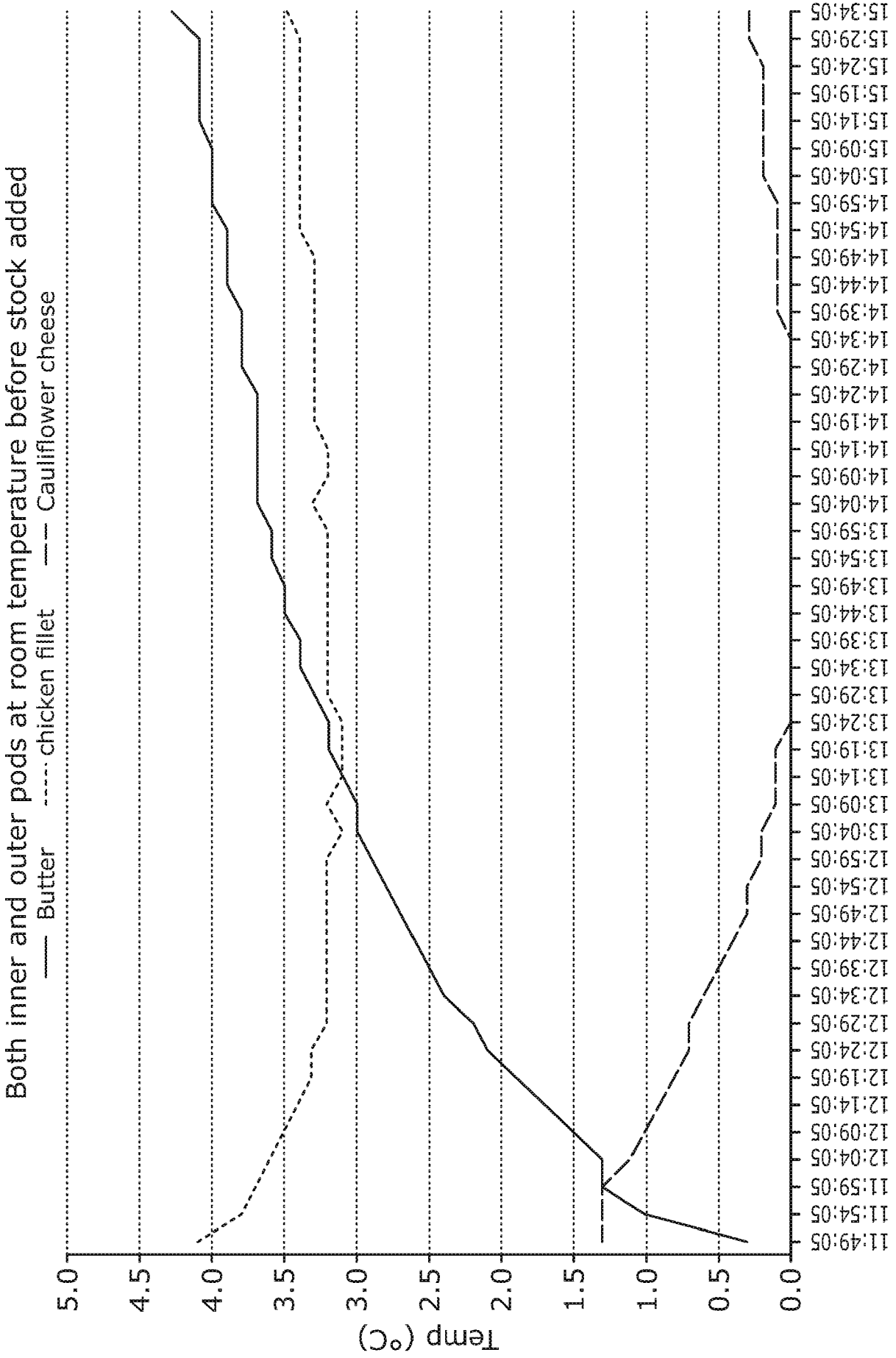

Fig. 23

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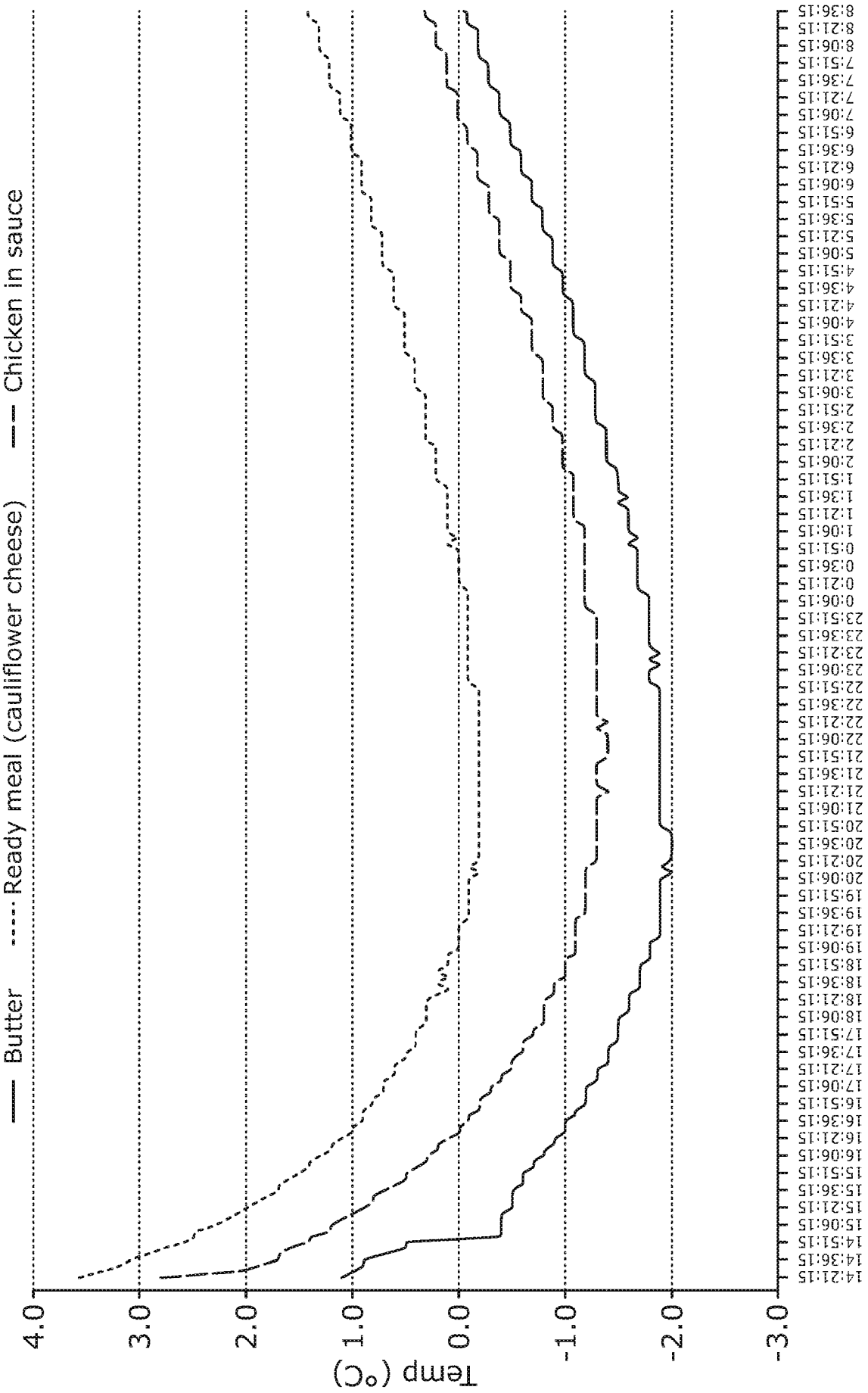

Fig. 24

AN INSULATING COVER OR LINER FOR USE IN THE TRANSPORTATION OF GOODS

Technical Field of the Invention

The present invention relates to the provision of an insulating cover or liner to be used in the transportation of perishable goods. More specifically the present invention relates to a multi-layered cover or liner particularly suitable for the transportation of temperature sensitive goods, especially using roll cages.

Background to the Invention

Many goods that are commonly transported by lorries need to be maintained at a fixed temperature, often at a temperature below 0 °C, for instance, during their transportation from a depot to a store, from depot to depot or alternatively from a depot to a customer's property.

UK industry-accepted temperature ranges for the storage and transport of various perishable goods as shown in Table 1 below:

Storage Type	Accepted	Accepted / report	Reject
Chill	0 to +5	+5 to +8	+8 or greater
Frozen	-15 or colder	-15 to -12	-12 or warmer
Ice cream	-18 or colder	-18 to -15	-15 or warmer
Poinsettia	12 to 16	10 (Soil 10+) to 12	<10
Banana	12 to 14	12 to 14	<12 or >20

Table 1: Accepted temperature ranges for perishable goods in the UK.

It is often the case that frozen goods that need to be maintained at a temperature of less than 0 °C (and ideally at no more than -12°C) are transported in vehicles, such as trucks or vans that incorporate a freezer section which includes a freezer unit. There can be problems associated with the use of trucks or vans incorporating such freezers, for instance the freezer unit that provides cooling itself may break down resulting in the warming of the freezer compartment and thus the spoiling of the food contained therein. Another issue is that the freezer units used to provide cooling have a weight associated with them and thus there is an increase in the fuel that is used by a truck or van that is fitted with a freezer unit.

It is also the case that freezer units associated with vehicles may generate significant noise as the freezer unit ages. There is an additional cost associated with the purchase of vans or trucks that further comprise freezer units, and a subsequent ongoing cost associated with the maintenance of said freezer units.

Freezer sections of vehicles are also of a fixed size and so a large volume of space has to be maintained at the required temperature even when only a small volume of the freezer section is occupied by perishable goods, resulting in high running costs of the freezer section.

Furthermore, when a large volume of the freezer section is empty then the opening and closing of the doors results in the influx large quantities of warmer air such that there is an increase in the work that the freezer unit is required to restore the required temperature and hence there can be a significant increase in the running costs of the freezer unit.

Roll cages are commonly used to move goods onto and off vehicles, such as lorries and vans, roll cages being generally rectangular shaped cages that are mounted

on wheels. Roll cages normally comprise a side opening door to allow goods to be readily loaded into and out of the cage. Likewise, insulated boxes are often used in the delivery of cooled perishable products, particularly frozen goods, directly to customers' homes; and may be placed in lorries for delivery to the customer's address.

Goods that require cooling or temperature maintenance during their transport, especially those that are to be transported for extended periods of time on delivery vehicles, may also be transported on pallets.

A known means of partially addressing the various problems identified above, in relation to transporting chilled or frozen perishable goods (or other temperature-sensitive goods) comprises the provision of insulated shrouds that are designed to be placed around roll cages. An example of such a shroud comprises an outer reflective layer, a central layer comprising a dual layer of laminated bubbled plastic and a second reflective layer, and is sold under the registered UK trade mark "CHILL BUDDY" (RTM). Similar materials are used to manufacture cooling boxes that are also sold under the CHILL BUDDY trade mark (referred to as pods) and that may be used to transport perishable goods.

The existing solutions for the transport of perishable goods, as mentioned above, have limited applicability as they can normally only be used to maintain perishable goods at the required temperature for a limited number of hours when the goods are not located within a freezer unit and/or chill packs must also be used in conjunction with the solutions. Hence, the existing products cannot be used where the delivery times for the goods being transported is longer than 3.5 to 4 hours and the goods are not to be transported in a lorry or truck with a dedicated freezer unit.

It would therefore be advantageous to provide a liner for a frozen goods transportation device, which can be loaded onto vehicles, such as trucks, vans or lorries, and which maintains the frozen or chilled, or other desired goods at temperatures lower than 0°C, -5°C, -10°C and preferably no more than -12°C for at least 5 hours, 6 hours or at least 7 hours.

It would also be advantageous to provide a liner which could be connected to a roll cage, but which could match the configuration, shape and size of goods present within the roll cage, and limit the amount of airspace around the goods, whilst enabling desired, chilled or frozen temperatures to be maintained.

It is therefore an aim of objects of the invention to overcome or mitigate at least one problem of prior art covers or liners for roll cages, pallets or frozen food transport pods.

The present invention seeks to address the particular problems identified above.

Summary of the Invention

According to a first aspect of the invention there is provided an insulating cover or liner for use with a container containing temperature-sensitive perishables comprising, in order:

an outer layer comprising a polymeric material configured to protect the other layers from wear and tear during daily use;

a first heat reflective layer adjacent the outer layer and comprising a metal foil sheet sealed onto a polymeric sheet which is laminated to a sheet of cellular

polyethylene material, the metal foil sheet being aluminium and located on the face of the heat reflective layer adjacent to the outer layer of the cover or liner;

three layers of a thermally insulating material located adjacent to one another in a stack, wherein each insulating layer is a woven or matted fibre layers of polyester; and,

an inner layer comprising a second heat reflective layer, the second heat reflective layer comprising a layer of an aluminium foil on a polyester cloth,

wherein the layers of thermally insulating material are sandwiched between the first heat reflective layer and the second heat reflective layer.

The container is preferably a storage or transport container for perishable goods. Perishable goods include foodstuffs, plants and flowers, pharmaceuticals and medicines, and beverages.

The invention disclosed herein provides a cover or liner that can be used as a liner or cover of a container for storage and transport of temperature-sensitive perishable goods, including chilled or frozen perishable goods, for prolonged periods when a freezer or chiller unit is not available for the transportation or storage of said goods. By "chilled" we mean a temperature of between 0-9C and preferably no more than 8°C. By "frozen" we mean conditions in which comestibles have water which is in the frozen state, and preferably within regulatory definitions of no more than -15°C, (-18°C for ice cream), and preferably no more than -12°C, (-15°C for ice cream). The cover or liner provides advantages in that it allows the weight of vehicles to be reduced as expensive freezer units do need to be provided to keep goods chilled or frozen within the transport containers. There is additionally an increase in the

storage capacity of the vehicles that are used for the transport of goods due to the removal of freezer or chiller units (and the associated bulkheads from vehicles,) as well as reduced fuel usage, reduced cost in new equipment, and reduced maintenance costs. Additionally, where roll cage liners of the type disclosed herein are utilised there is the added benefit that the liners are located within the roll cages and thus there is no increase in the external volume of the roll cages that would be experienced if insulating materials were attached to the exterior of the roll cages. In the event that frozen goods to be transported are to be transported a significant distance, and hence there is a long journey time of over 6 hours, then a vehicle may be fitted with a refrigeration unit rather than one fitted with a freezer unit – providing savings in cost in respect of the cost of running a chiller unit as compared to the cost of running a freezer unit.

For products at more ambient temperatures, or even warmed goods, the cover or liner of the invention prevents rapid warming or cooling and aids in prolonging the lifetime of such goods.

Preferably the outer layer comprises a tear resistant polymeric material. The use of such a material helps to protect the other layers from wear and tear during daily use. The polymeric material may comprise polyester and may comprise a polyvinyl coated polyester. A suitable material for the outer layer is PE580 Matt Tarpaulin fabric, supplied by Lows of Dundee, UK, for example. Any edges or seams of the outer layer may comprise a fabric or webbing covering or tape, which in use, help to mitigate damage and/or heat loss through the edges/seams.

The cover may include one or more pockets. The or each pocket may be used for retaining documents. Alternatively, or additionally, at least one pocket may comprise a removable sensing device. The sensing device may be configured to provide information on one or more parameters of the cover or liner, the container, and/or the goods inside the container, such as temperature, total distance travelled, time elapsed, etc.

Preferably the first heat reflective layer comprises metal foil on a sheet of polymeric material, or a metallised polymeric material. The polymeric material may comprise polyvinyl chloride or polyester. The first heat reflective layer may comprise a metallised polymeric film laminated to a cellular or "bubble" layer. The cells or bubbles of the cellular or bubble layer may be filled with air, nitrogen or other suitable gases.

The layer of metal foil or metallised polymeric material is located on the face of the heat reflective layer that faces the outer layer of the cover or liner.

The metal of the metal foil or metallised polymeric material may be aluminium.

The second heat reflective layer may comprise metal foil on a polymeric sheet. The polymeric sheet of the second heat reflective layer may comprise a polyester material optionally coated with polyvinyl chloride. The polyvinyl chloride may be coated on both sides of the polyester material.

The metal foil of the second reflective layer may comprise a layer of metal foil, such as an aluminium foil. More preferably the layer of metal foil may be located on the face of the heat reflective layer that faces the interior or is the inner face of the

cover or liner, in use. In this way the metal foil of the second heat reflective layer may face any goods or consumables located within the container around, or within which, the liner of the invention is connected.

Preferably the first heat reflective layer is immediately adjacent the outer layer.

Preferably the thermally insulating material is located directly between the first heat reflective layer and the second heat reflective layer.

There may be at least 2, or at least 3 layers of thermally insulating material, such as between 3 and 4 layers. Each layer may comprise the same material or different materials to those adjacent to the layer. In some embodiments all of the layers comprise the same material.

Preferably each layer of the thermally insulating material is independently selected from a fibre layer, a spacer fabric and a cellular material. The thermally insulating material may be selected from wool, cotton, paper, card, a polymeric material or any combination thereof. The polymeric material may be selected from polyester, polyurethane, polyvinyl chloride, polyamide, or any combination thereof, for example.

In some embodiments the liner or cover comprises 3 or more layers of thermally insulating material, each layer being independently selected from the materials described hereinabove, but may, for example comprise the same material. In some embodiments the layer, or all of the layers comprise a fibre layer or spacer fabric which may comprise a polymeric material such as polyester, for example. The fibre layer may comprise woven or unwoven fibres. The woven fibres may comprise

knitted, embroidered, sewn, knotted, spun or matted fibres, for example. In other embodiments at least one layer may comprise a cellular foam material, such as a polyurethane foam material, for example.

In a preferred embodiment there are at least 3 layers of thermally insulating material, each layer comprising polymeric fibres, preferably polyester fibres. It has been found that utilising multiple fibre layers, especially multiple woven or matted fibre layers of polyester, sandwiched between the first and second heat reflective layers, provides optimal thermal insulation whilst still enabling a unitary liner or cover to be bent and shaped to fit around, within or on a roll cage, pallet or frozen goods transport container (such as a pod or crate).

In a particularly preferred embodiment, one or both of the first and second heat reflective layers comprises a metallised cellular polymeric sheet, and there are 2 to 4 layers of polyester thermally insulating material (which may be polyester fibre-based layers).

Each layer of thermally insulating material preferably has a weight of at least 100 g/m², 150 g/m², 175 g/m² or at least 200 g/m².

Each layer of the thermally insulating material may have a thickness of at least 3mm, 4mm, 5mm, 6mm, 7mm, 8mm, 9mm, 10mm, 15 mm, or 20 mm. If there is a single layer of thermally insulating material then the layer may have a thickness of at least 10mm, 15mm or at least 20mm. In embodiments comprising 2 or more layers of the thermally insulating material the total thickness of the layers may be at least 20mm, 30 mm or at least 40 mm. In preferred embodiments, each layer has a

thickness of at least 20 mm and in some embodiments, there are between 2 and 4 layers, preferably 3 layers, each having a thickness of between 20-30 mm.

The one or more layers of thermally insulating material may comprise a material with an insulation rating of at least 0.03 m^2 K/W R-Value and/or no more than 10 m^2 K/W U-value. In some embodiments the thermally insulating material has an R-Value of at least 0.04, 0.05 or 0.06 m^2 K/W. In some embodiments the thermally insulating material has a U-Value of at least 12, 13, 14 or 15 m^2 K/W.

Preferably the liner or cover is a roll cage liner or cover. The roll cage liner or cover may cover at least the top or roof, and side walls, of a roll cage, in use (including the roll cage door) and may comprise at least a roof and a surrounding wall, and in preferred embodiments also a base. In some embodiments the liner or cover is a cover which is arranged to be connected outside the roll cage, whilst in preferred embodiments the liner or cover is configured to be located within the roll cage, and may line the inside of at least the top or roof and side walls of the roll cage, and preferably also the floor of the roll cage. The liner may comprise a single integral liner which is folded to fit the inside of the roll cage. In this way the liner may not comprise any joins or gaps, especially adjacent to any corners or edges of the roll cage. The base may be integral with the wall or may be connected to the wall, for example by stitching.

The roll cage liner or cover may comprise attachment means to attach the liner to the roll cage. The attachment means may comprise hook and loop fasteners (such as VELCRO (RTM) fasteners.

The liner or cover may comprise a door. The door may be located within an opening in the liner or cover, and may be moveably connected, preferably rotatably connected to the opening, or may be completely detachable from and re-attachable to the opening.

The liner or cover and the door may both comprise hook and loop fasteners arranged in use to secure the door in a closed configuration across the opening of the liner. The fastening means located on the door may comprise, in use, a strip of the fastening means extending along at least one and preferably each free edge of the door. The fastening means located on the liner or cover may comprise one or more strips extending along one or more edges of the opening and arranged in use to cooperate with the strip or strips extending along the edge(s) of the door, to secure the door closed, in use. The strip(s) on the door is preferably of greater width than the corresponding strip(s) of fastening means provided along the edge(s) of the opening of the cover or liner. In this way, a user can ensure that an entire door edge is secured the cover or liner, with no gaps enabling air to circulate into or out of the interior of the liner or cover.

The door and/or the opening to the liner or cover may comprise a rigid frame, or may comprise a rigid supporting material. The rigid supporting material may comprise a layer of the door materials and/or the liner/cover materials and may comprise Correx (RTM) for example.

The roll cage liner or cover may further comprise a moveable bulkhead.

The moveable bulkhead may comprise a layered insulating material as detailed above for the liner or cover.

The moveable bulkhead may comprise a heat reflective layer, which may comprise a metal foil affixed to a layer of polymeric material. The heat reflective layer may be connected to a polymeric material comprising multiple air pockets or cells (including "bubble" material) that form a continuous sheet.

The moveable bulkhead may comprise, in order, a first heat reflective layer, one or more layers of thermally insulating material, and a second heat reflective layer. The moveable bulkhead may further comprise a cover which may substantially surround the inner layered structure. The first and second heat reflective layers and the thermally insulating material layers may be as described hereinabove. The cover may comprise a polyester cover.

The moveable bulkhead may be arranged, in use, to be connected within the interior of a roll cage, and preferably spans the entire cross-sectional area of the space within the in the interior of the roll cage.

The moveable bulkhead may be provided for use with a roll cage liner or other container and may have dimensions larger than the interior dimensions of the roll cage container, such that it may abut and press against the inside of the roll cage liner or container, when the liner lines the inside of the roll cage or container, in use.

The moveable bulkhead may comprise an attachment means to enable the attachment of the moveable bulkhead to the roof of the liner or cover. This feature is particularly useful for storing the bulkhead between uses, and for ensuring the bulkhead does not become loose during transport of an empty roll cage lined with the liner. In addition, the bulkhead can be placed against the roof of the liner or cover when the roll cage is filled to the top with goods.

The bulkhead attachment means may comprise hook and loop fasteners.

The moveable bulkhead may be permanently, but moveably, attached to the cover or liner. For example, the moveable bulkhead may be attached to the cover or liner by means of a loop attached to the bulkhead through which a cord passes, the cord being attached to the liner.

The cover of the bulkhead may comprise a single continuous cover extending around the whole bulkhead, which may be a single integral cover or may comprise first and second outer cover layers connected at their edges, for example by stitching.

In other embodiments the liner or cover of the invention may comprise a pallet liner or cover or a temperature-sensitive goods transportation crate or box liner or cover. In these embodiments the pallet, crate or box liner or cover comprises a base panel and surrounding wall. The material of the base panel and surrounding wall may be as described hereinabove in relation to the other embodiments of the first aspect of the invention.

The pallet, crate or box liner or cover may comprise attachment means to attach the base panel to the shroud. More preferably the attachment means comprise hook and loop fasteners.

The pallet, crate or box liner or cover may comprise a base panel that is wider and longer than the width and length of the pallet or base of the crate or box with which the liner or cover is to be used (i.e. it is oversized).

More preferably the liner or cover is a liner or cover for use in the transport of goods contained in transport crates or boxes used in the delivery of temperature-sensitive perishable goods.

In embodiments where the liner or cover is a crate or box liner or cover, it may further comprise an openable and closable lid, which may comprise the same structure and materials as the rest of the liner or cover. The lid may be fixed and/or compressed in a closed position by attachment means such as adjustable straps that attach the lid to a wall of the liner or cover for use in the transport of goods contained in transport crates or boxes. The attachment means may comprise hook and loop fasteners, which may extend along cooperating edges or all edges of both the lid and wall(s).

According to a second aspect of the invention there is provided a movable bulkhead comprising:

an outer layer;

a first heat reflective layer;

one or more layers of a thermally insulating material; and,

a second heat reflective layer.

The moveable bulkhead may be configured for use within a crate or box for the transport of temperature-sensitive goods, or for the inside of a roll cage, especially for connecting to a liner or cover connected to a roll cage. The moveable bulkhead may be as described herein above for the first aspect of the invention.

According to a third aspect of the invention there is provided a roll cage liner or cover comprising an insulated material described hereinabove

According to a fourth aspect of the invention there is provided a pallet liner or cover comprising an insulated material as detailed above.

According to a fifth aspect of the invention there is provided liner or cover, for use in the transport of goods contained in transport crates or boxes used in the delivery of perishable goods, comprising an insulated material as detailed above.

According to a sixth aspect of the invention there is provided use of a liner or cover comprising:

an outer layer;

a first heat reflective layer;

one or more layers of a thermally insulating material; and,

a second heat reflective layer.

as a liner or cover for a roll cage, pallet, or temperature-sensitive perishables transport container.

According to a seventh aspect of the invention there is provided a method of preventing or mitigating temperature changes in or around temperature-sensitive perishable goods, the method comprising the steps of:

a) covering or lining a temperature-sensitive perishable goods container with a liner or cover of the first aspect of the invention; and

b) loading the container with the perishable goods.

The method may comprise preventing or mitigating thawing or heating of frozen or chilled goods, or may comprise preventing or mitigating temperature rises or losses in or around other goods, for example.

The method may comprise providing a moveable bulkhead, as described herein above, and moving the bulkhead to rest on, or be located adjacent to the top of the goods within the container.

The temperature-sensitive perishable goods may be selected from foodstuffs, beverages, plants or flowers, pharmaceuticals or medicines, and ice.

The method may comprise transporting the goods in a non-chilled or chilled goods vehicle, which may be for at least 3 hours, 4 hours, 5 hours, 6 hours or at least 7 hours.

It has been surprisingly found that the liners and covers of the invention enable transport of frozen goods which are at an initial temperature of down to -21°C, and prevent any temperature rise within the frozen products such that the maximum final temperature of the product is -18°C after a period of at least 3 hours and in many embodiments at least 6 hours. This enables transport of the frozen goods over long distances on vehicles without requiring the use of separate freezer units within the vehicles. In addition, for chilled food, the liners and covers of the invention are able to maintain the temperature of chilled foods below 4°C over a period in excess of 17 hours.

Detailed Description of the Invention

In order that the invention may be more clearly understood embodiments thereof will now be described, by way of example only, with reference to the accompanying drawing, of which:

Figure 1 is a front perspective view of an insulating liner located within a roll cage in accordance with a first embodiment of the present invention wherein the door to the liner is shown in an open position.

Figure 2 is a front perspective view of an insulating liner located within a roll cage in accordance with a first embodiment of the present invention wherein the door to the liner is shown in a closed position.

Figure 3 illustrates a left side view of an insulating liner and its door in accordance with a first embodiment of the present invention.

Figure 4 is a sectional side view of the liner along the line A-A on Figure 5 of a strap, in accordance with a first embodiment of the present invention, the strap being provided to attach the roll cage liner to a roll cage.

Figure 5 illustrates a right-side view of an insulating liner and its open door in accordance with a first embodiment of the present invention.

Figure 6 is a sectional view of the liner along the line B-B on Figure 5, in accordance with a first embodiment of the present invention.

Figure 7 illustrates a front view of a liner with an associated moveable bulkhead, the door of the liner being omitted for the sake of clarity, in accordance with a first embodiment of the present invention.

Figure 8 is a plan view of the moveable bulkhead for use with a roll cage liner illustrated in Figure 7.

Figure 9 of the drawings illustrates the multi-layered material which is used to construct a liner for roll cages.

Figure 10 of the drawings illustrate the layers from which a moveable bulkhead is manufactured in accordance with the present invention.

Figure 11 illustrates a side view of a moveable bulkhead in accordance with the present invention.

Figure 12 illustrates a loading pallet, onto which a base panel manufactured in accordance with the present invention has been located and on top of which a pallet collar has been located.

Figure 13 illustrates the loading pallet as illustrated in Figure 12 wherein an insulated cover has been located over the pallet collar and the goods located on said pallet.

Figure 14 illustrates a perspective view of an insulating box in accordance with a third embodiment of the present invention.

Figure 15 provides a graphical comparison of the ability of a CHILL BUDDY (RTM) shroud for a roll cage to maintain the goods contained within the shroud at a temperature below 8°C when the ambient temperature is at 21°C as compared to a roll cage liner manufactured in accordance with the present invention.

Figure 16 provides a graphical representation of the rate of increase in the temperature of frozen goods located in a liner contained within a roll cage when the roll cage and liner are located in a chilled room at a temperature of 5°C.

Figure 17 provides a graphical representation of the rate of decrease in the temperature (°C, over time) of bananas located within a known banana shroud that is presently used to transport bananas in the refrigerated compartment of a truck or van.

Figure 18 provides a graphical representation of the rate of decrease in the temperature (°C, over time) of bananas located within a roll cage liner, in accordance with the present invention, when said bananas are located in the refrigerated compartment of a truck or van.

Figure 19 provides a graphical representation of the changes in the temperature (°C, over time) of perishable (frozen) goods located within a transport crate or box that is contained within a transport crate cover and a roll cage liner, both of which are manufactured in accordance with the present invention, the transport crate cover having been initially cooled in a freezer and the roll cage liner being at room temperature.

Figure 20 provides a graphical representation of the changes in the temperature (°C, over time) of perishable (frozen) goods located within a transport crate that is contained within a transport crate cover and a roll cage liner, both of which are manufactured in accordance with the present invention, the transport crate cover and the roll cage liner both being initially at room temperature.

Figure 21 provides a graphical representation of the changes in the temperature (°C, over time) of perishable (frozen) goods located within a transport crate that is contained within a transport crate cover and a roll cage liner, both of which are in manufactured accordance with the present invention, the transport crate cover and the roll cage liner having both been initially cooled in a freezer.

Figure 22 provides a graphical representation of the changes in the temperature (°C, over time) of perishable (non-frozen) goods located within a transport crate that is contained within a transport crate cover and a roll cage liner,

both of which are manufactured in accordance with the present invention, the transport crate cover having been initially cooled in a freezer and the roll cage liner being at room temperature.

Figure 23 provides a graphical representation of the changes in the temperature (°C, over time) of perishable (non-frozen) goods located within a transport crate that is contained within a transport crate cover and a roll cage liner, both of which are manufactured in accordance with the present invention, the transport crate cover and the roll cage liner both being initially at room temperature.

Figure 24 provides a graphical representation of the changes in the temperature (°C, over time) of perishable (non-frozen) goods located within a transport crate that is contained within a transport crate cover and a roll cage liner, both of which are manufactured in accordance with the present invention, the transport crate cover and the roll cage liner having both been initially cooled in a freezer.

Reference is initially made to Figure 1 of the drawings. Figure 1 of the drawings illustrates a perspective view of an insulating liner (as generally indicated by 10), manufactured in accordance with a first embodiment of the present invention, located within a roll cage (as generally indicated by 11). The door of the roll cage (12) in an open position, the uppermost section of the rear of the roll cage (13), a small section of the base of the roll cage (14), part of the sides of the roll cage (15), and the wheels (16) of the roll cage are all visible in Figure 1.

In Figure 1 the door (21) of the insulating liner (10) is illustrated in an open position, such that an interior side wall (22), the floor (23) and the rear interior rear

wall (24) and the outer top face of the liner (25) are visible. The door (21) may be maintained in a closed position by means of hooked strips (26 and 26a) located on the edges of the door (21) that engage with corresponding looped strips (27 and 27a) (the loop and hook type fastener used herein is commonly sold under the trade mark Velcro) located around the entrance to the interior of the insulating liner (10); the engagement of said strips of hooks 26 and 26a with the looped strips (27 and 27a) enables the door (21) to be maintained in a closed position, as illustrated in Figure 2. Stiffening means in the form of strips of corrugated plastic (sold under the mark Corex, not shown) are located below the hooked strips (26 and 26a) on the edge of the door (21). Further stiffening means in the form of strips of corrugated plastic (not shown) are also provided below the looped strips (27 and 27a) located around the entrance to the interior of the insulating liner (10), between the looped strips (27 and 27a) and the layered structure of the liner on which the looped strips (27 and 27a) are affixed, i.e. the sections of the liner that form the door frame (not illustrated).

Two pockets (29) are provided on the outer face of the door (21). The pockets (29) are manufactured using clear plastic such that documents located in the pockets (29) can be read without the need to remove the documents from said pockets (29).

As previously mentioned above, roll cages are often used in the transport goods, to facilitate the loading of goods onto and off lorries and trucks, particularly in relation to the transport of food products and such food products are often perishable and so need to be maintained a temperature that is lower than the standard ambient temperature. This first embodiment of the invention is specifically adapted for use as a liner of roll cages, but the skilled addressee will appreciate that the embodiment disclosed may be readily adapted to provide a cover for roll cages.

Furthermore, it should be noted from Figure 1 that the door (21) of the liner is significantly larger than the opening in the liner (as generally indicated by 28), and therefore the door (21) is oversized as compared to the opening (28) provided in the liner (10), i.e. the door (21) is longer and wider than the opening - this feature assists in ensuring the door (21) readily closes, even if the liner (10) is bulging due to goods located within the liner (10).

The door (21) is manufactured from the same layered material as the rest of the liner (10)

Reference is now made to Figure 3 of the drawings wherein a view of the left side of the insulating liner (as generally indicated 10) is provided, for the ease of understanding the liner is not shown located within a roll cage. The door (21) of the liner (10) is illustrated in an open position. On the upper section of the left side of the liner (30) a series of straps (31) are provided that enable the attachment of the liner (10) to a roll cage. Each of the straps (31) is provided with a strip of loops (32) at one end and a strip of hooks (33) at the opposite end. The straps (31) are preferentially manufactured from a polyester fabric coated with PVC (poly vinyl chloride), the material typically having a weight in the range of 580 g/m^2 (± 25 g/m^2)

Straps (36) that incorporate loop and hook fastening means may be provided at the lower edge (in use) of where the door (21) and the left side of the liner (30) meet, these straps (36) may be used to assist in attaching the liner (10) to a roll cage.

It will be noted that the door (21) provided in the insulating liner (10) opens sideways. The sideways opening of the door (21) facilitates easy access to the interior of the liner (11).

Reference is now made to Figure 4 of the drawings which comprises an expanded partial side view of a strap (circled in Figure 3) that in use is used to attach the liner (10) to a roll cage (11). Strips of hooks (35) are located on the opposing surface of the straps (31) to which the loops (32) and hooks (33) are situated (the loop and hook type fastener used herein is commonly sold under the trade mark Velcro). When the loops (32) and hooks (33), on the straps (31), are engaged with each other to enable attachment of the liner (10) to a roll cage, the strip of hooks (34) on the door (21) is aligned for engagement with the loops (35) on the straps (31).

As previously noted the door (21) provided in the insulating liner (10) opens sideways, which facilitates access to the interior of the liner (11). Furthermore, the provision of the strip of hooks (34) on the door (21) that align with the loops (35) on the straps (32) enables the door (21) to readily be fixed in an open position during the loading of goods into interior of the liner (10), such that the door (21) does not interfere with the loading process.

Reference is now made to Figure 5 wherein a right-side view of an insulating liner (10), with its door (21) in an open position such that the interior of the door (21) is visible, is illustrated, for clarity's sake the liner (10) is not shown located within a roll cage.

The hooked strips (26 and 26a) located on the edges of the door (21), that engage with corresponding looped strips (27 and 27a) located around the entrance to the interior of the insulating liner (10) that enable the door (21) to be maintained in a closed position, are clearly visible in Figure 5. It will be noted that the hooked strips (26 and 26a) and looped strips (27 and 27a) are provided as wide strips such that the

door (21) readily closes using said strips (26 and 26a, and 27 and 27a) even if the liner (10) is bulging. The hooked strip (26a) vertically located on the edge of the door (21) is a wider strip than the corresponding looped strip (27a) vertically located on the entrance to the interior of the liner (10), this feature also assists in ensuring that the door (21) readily closes even of the liner is bulging readily closes even of the liner is bulging, i.e. the hooked strip (26a) is oversized as compared to the corresponding looped strip 27a).

Also, visible in Figure 5 is a pocket (51) preferably manufactured using clear plastic that is provided for the safe retention of equipment used to measure the temperature within the liner (10).

Reference is now made to Figure 6 which is a sectional view of the liner along the line B-B on Figure 5, viewed in the direction of the arrow C and showing the inner top face (25a) of the liner (10). Referring to Figure 6 it can be seen that the inner top face (25a) of the liner (10), comprises four hooked pads (61). These pads (61) are configured such that they can be engaged with the four looped pads (71) that are located on the uppermost face (in use) of a moveable bulkhead (see below) and may be used to attach the moveable bulkhead to the inner face of the top of the liner (25a) whilst goods are being loaded into or removed from the liner. The base of the liner (10) corresponds to the top of the liner, but does not comprise the four hooked pads (51).

Reference is now made to Figures 7 and 8, wherein Figure 7 illustrates a front view of a liner (10) with an associated moveable bulkhead (as generally indicated by 70), the door of the liner being omitted from Figure 7 for the sake of clarity, and

Figure 8 provides a plan view of said bulkhead (70). The moveable bulkhead (70) is attached to the liner (10) by means of a cord (72) normally manufactured from poly-cotton. The cord (72) is attached to an upper rear corner and an opposing lower rear corner of the liner, such that the cord (72) runs from the bottom to the top of the liner (see Figure 7). The bulkhead (70) incorporates a loop (73) at one corner, as illustrated in Figure 7, through which the cord (72) passes. The Velcro (RTM) pads (71) that are located on the uppermost face (in use) of the moveable bulkhead (70) are also visible in Figures 7 and 8.

The moveable bulkhead (70) is oversized relative to the interior dimensions of the liner (10) such that the bulkhead fits tightly across the width of the liner (10), thus preventing the flow of air from one side of the bulkhead (70) (from above the bulkhead) to the other side of the bulkhead (70) (below the bulkhead), this assists in maintaining the perishable goods located below the moveable bulkhead (70) at the preferred temperature. In use, the bulkhead (70) is located such that abuts the uppermost goods (not shown) located within the liner (10).

Reference is now made to Figure 9 of the drawings wherein the multi-layered material which is used to construct the roll cage liner (10) of the invention is illustrated. The outer layer (91) of the liner is manufactured from a tear resistant material, typically a fabric used to manufacture tarpaulins is used, this normally comprises a polyester fabric coated with PVC (polyvinyl chloride), the material typically having a weight in the range of 580 (± 25 g/m^2).

The first reflective layer (92) of the liner (10) comprises an aluminium foil sheet sealed onto a polyester sheet which is in turn laminated as a sheet of cellular

(bubble) polyethylene material, in which the cells are filled with air. The first reflective layer (92) is orientated such that the heat reflective foil sheet is located facing the outer layer (91), such that in use heat is reflected back away from the interior of the roll cage liner.

The second reflective layer (93) comprises a polyester cloth onto which an aluminium film is affixed, both sides of this laminated structure being coated with PVC. A suitable material may be purchased from THS Industrial Textiles and is sold under product code – P440M.

The technical specifications for the P440M product are provided below:

ALUMINISED (FILM) PVC COATED POLYESTER CLOTH

Finished Fabric Units Value Tolerance

Weight g/m2 540 ±5%

Useable width (standard) mm 1500 ±5%

Roll Length (standard) mtr 50

Maximum operating temp. 0°C 70

Colour White one side – silver film opposite side

Base Fabric g/m^2 440

Coating Flexible plasticized PVC applied to both sides

Tensile Strength 750/700 daN/5cm

Treatment/Coating Details

Weight g/m^2 100 ±10%

(adhesive + aluminium film)

The second reflective layer (93) forms the inner layer of the roll cage liner (10) in the present embodiment of the invention.

Three layers of thermal wadding (94) are located between the first reflective layer (91) and the second reflective layer (92). The wadding comprises CONTROLLATHERM (RTM) 200-gram wadding made from Vilene (RTM) polyester fibre material, having an insulation R-Valve of 0.06 m² K/W and a U-Valve of 15.2 m² K/W.

Reference is now made to Figure 10 of the drawings wherein the layers from which a moveable bulkhead (70) is manufactured are shown. The first outer layer of the bulkhead (101) is manufactured from a polyester fabric (which may be dyed) that has been thermofixed and then coated with two coats of flame retardant (FR) polyurethane (101) and is preferably treated with a fluorocarbon water repellent. A suitable coated polyester fabric is available from Frank Pine Ltd and is sold under the product code 500D PU FR POLYESTER the technical specifications for this product are shown below:

MATERIAL: 500D PU Coated F/R Polyester

DESCRIPTION: A 100% Polyester fabric which is washed dyed and thermofixed then coated with two coats of F/R Polyurethane and treated with a Flurocarbon water repellent.

PHYSICAL PROPERTIES:

PROPERTY	REQUIREMENTS	SPEC/TEST METHOD
Min Coated Weight	**215gsm +/- 10% min**	**BS3424: Part 3: 1982**

(gm^2)		
Yarn Type	**500D FDY Polyester x 500D FDY Polyester**	**BS2862: 1984 (1990)**
Bearing Load (N/50mm) Lengthways Widthways	**1200 750**	**BS3424: Part 4: 1982**
Elongation at break (%) Lengthways Widthways	**45 45**	**BS3424: Part 4: 1982**
Tear Strength (N) Lengthways Widthways	**115 115**	**BS3424: Part 4: 1982 Method B**
Fire Retardency	**PASS**	**BS5867: Part2: 2008**
Hydrostatic Head (cms) as supplied	**>150cm**	**BS3424: Part 26: 1990 Method 29A**

The next layer (103a) of the bulkhead, adjacent to the outer layer (101), comprises a layer of metallised polyester (a layer of aluminium foil located on a sheet of polyester which is affixed to a layer of low density polyethylene bubble laminate (of the type typically sold under the trademark Bubble Wrap) i.e. a sheet of polyethylene comprising multiple air pockets that are joined together to form a continuous sheet). The metallised polyester layer of layer (103a) being located such that it is adjacent to the outer layer (104). The technical specifications for the specific

material used are provided below, although the skilled addressee will appreciate that other similar products are available:

Product Specification - Metallised Polyester to Bubble Laminate provided under the registered trade mark Jiffy (RTM)

PRODUCT DESCRIPTION

Metallised polyester film laminated to low density polyethylene bubble.

PRODUCT DIMENSIONS

Roll Width : 1500mm

Roll Length : 100 metres

Wound on a cardboard core and packaged in a clear polyethylene bag containing product label.

COMPONENTS

1. Metallised Polyester Laminate

- A solvent free adhesive laminate of 12-micron polyester film, barrier metallised, 32 micron low density polyethylene.

2. Polyethylene Bubble

- Low density polyethylene small bubble

Three layers of thermal wadding (102) are located adjacent to layer (103a).

The second outer layer (104) of the bulkhead (70) is manufactured from the same material as the first outer layer.Located between the second outer layer (104)

and the layers of thermal wadding (102) is a layer (103) comprising the same material as layer (103a), the metallised polyester layer of layer (103) being located such that it is adjacent to the second outer layer (104).

A side view of a bulkhead (70) is provided in Figure 11 wherein it can be seen that the first outer layer of the bulkhead (101) and the second outer layer of the bulkhead (104) completely enclose the other layers that make up the bulkhead (70) and the edges of these layers meet, and are connected, around the sides faces of the bulkhead (70). The edges of the layers (101, 104) are stitched together and the stitching and seams covered with insulating webbing material.

The roll cage liner (10) is manufactured according to the following process.

Each of the layers of the material that are to be used to manufacture the panels of the generally elongate box shaped roll cage liner (including the sides, top and bottom and relevantly shaped door and door frame sections) are initially cut to provide appropriately shaped sections of the required material. The layers comprise the outer tear resistant material, a first heat reflective material, three layers of wadding, and an inner heat reflective layer.

1. If required the sections of material may be drilled in the required positions for the attachment of straps (with their associated hook and eye (Velcro type fasteners) or the like, this step may be omitted if the straps are to be attached by means of, for instance, gluing or heat welding.
2. The various layers of material are stacked, in the appropriate order, to form assemblies and are clamped in place.

3. The layers of the individual assemblies of material are then joined together on a Conveyor machine (a modified stitching machine with conveyor originally designed to stitch curtains) by means of stitching.
4. The straps and associated hook and eye fasteners may be attached at this stage, to the assemblies, at the relevant points, by use of appropriate means e.g. gluing/heat welding or stitching.
5. The assemblies are placed on a pattern machine and stitched together to form panels, stiffening means (e.g. Correx (RTM)) may be incorporated around the door frame and into the door at this stage.
6. The various panels from which the roll cage liner (10) is manufactured are then joined together, by means of stitching to form the elongate box shaped liner. Alternatively, the straps (including those with hook and eye (Velcro type strips) may be attached at this stage.
7. A cord (72) is attached to a top interior corner of the liner, the moveable bulkhead panel is attached to the cord by means of the loop (73), the cord (72) is then affixed to opposing bottom corner of the liner to retain the moveable bulkhead within the interior of the liner.
8. Optionally pockets (e.g. (29) and (51), preferably manufactured from clear plastic) may be attached to the liner on the inner or outer surface by the use of suitable attachment means, e.g. gluing, heat welding or stitching
9. The liner (10) is inspected for faults.
10. The liner (10) is then folded up for transit.
11. All panels are stitched together with 36 core spun polyester, and the seams covered with a webbing material.

The moveable bulkhead is made in accordance with the process described above, but the outer layers (101) and (104) of the bulkhead are produced from the thermofixed polyester fabric that has been coated with flame retardant (FR) polyurethane (101) as described above. Additionally, a single layer of the metallised polyester affixed to a layer of low density polyethylene bubble laminate (103 and 103a) is located between each of the outer layers (101 and 104) and the layers of thermal wadding (102), with the metallised polyester layers of layers (103a and 103) being located adjacent to the first and second outer layers (101 and 104) respectively, as described above.

The panels forming the sides of the roll cage liner (10) comprise a cut sizes 650mm wide x 810mm depth x 1500mm high.

In use, the liner (10) is located within a roll cage (11) (with the door of the rollcage (11) in its open position) and the straps (31 and 36) and their associated Velcro (RTM) fastenings are used to attach the liner (10) to said roll cage (11).

Trials have been carried out to establish the ability of a cover for a roll cage, manufactured in accordance with the present invention, to maintain cooled goods at preferred temperatures.

The standard temperatures that are acceptable for the transport of perishable (temperature-sensitive) foods within the UK are provided in the table below.

	Accepted (°C)	Accepted/report (°C)	Reject (°C)

Chill	0 to +5	+5 to +8	+8 or greater
Frozen	-15 or colder	-15 to -12	-12 or warmer
Ice cream	-18 or colder	-18 to -15	-15 or warmer

A series of trials were carried out to determine the performance of the roll cage liner disclosed herein.

The trials were carried out using the following method:

a) a chill chamber at a temperature of 2˚C

b) The temperature of the air in the chill chamber was determined using a V1-2 laser temperature probe. The chill chamber was controlled by thermostat and independently monitored.

c) Comark needle probes were used to determine the core temperature at the centre of the goods under test.

4 probes (1 in centre of Chicken fillet, 1 in centre of Ice cream,

1 probe indicating temperature below bulkhead,

1 probe outside of the roll cage.

d) Cages on loaders manifest and loaded in chill were collected and loaded with normal frozen roll cages

e) Roll cages containing frozen goods were sent out on deliveries, the roll cages being located in a chill chamber for transport purposes.

f) When the goods arrived at the store the roll cages were taken off the vehicle.

Reference is initially now made to Figure 15 wherein a graph provides a comparison of the ability of a CHILL BUDDY (RTM) shroud for a roll cage to maintain goods contained within the shroud at a temperature below 8°C when the ambient temperature is at 21°C. It can be seen from Figure 15 that in the case of the CHILL BUDDY (RTM) goods initially at a temperature of 3°C rise to a temperature of 8°C after approximately 3.5 hours. However, when the corresponding goods are located within a roll cage liner (10, see V9* in Figure 15), manufactured in accordance with the present invention, the goods take over eleven hours to rise to a temperature in excess of -8°C.

Figure 16 provides a graphical representation of the rate of increase in the temperature of ready meals, tubs of ice cream, chicken and ice lollies initially cooled to a temperature of approximately -21 °C and located in a roll cage liner (10), when the roll cage and its associated liner (10) are located in a room at a temperature of 2- 5 °C.

After a period of twenty-four hours the temperature of the chicken and ice lollies located in the liner (in which a moveable bulkhead was used on top of the products) had undergone a rise in temperature from approximately -21 °C to approximately -11 °C, an average increase in temperature of less than 0.5 °C per hour. The ready meals underwent a rise in temperature from approximately -21 °C to a temperature of -7.5 °C. The temperature of all the ice cream tubs, the chicken, and the ice lollies (initially at a temperature of approximately -21°C) located in the roll cage

liner were therefore maintained at a temperature below -15 °C for a period of twelve hours when the roll cage and the associated liner were located in a chill room at a temperature of 2-4 °C which corresponds to the maximum temperature at which a refrigerated room used for the storage of chilled goods should be maintained. This demonstrates that when frozen goods (such as ice cream, ready meals chicken and ice lollies, at an approximate temperature of -21°C) are placed in a roll cage liner of the invention, and the roll cage/liner is placed in a chill room at less than 5°C, then the goods can be maintained at a temperature below -12 °C for prolonged periods (approximately 20 hours) without the use of a freezer. The initial large increase in temperature of the ready meals is an artefact of the density of the ready meals themselves.

Reference is now made to Figures 17 and 18 which provide comparative data (trial data) in respect of changes in the temperature of bananas transported using a commercially available (standard) banana shroud (see Figure 17) and bananas transported using an insulating roll cage liner (10) in accordance with the present invention (see Figure 18); the roll cage liner (10) being used in combination with a moveable bulkhead (70) in accordance with the invention disclosed herein. Figures 17 and 18 provide a plot of time (the time of day being provided) against temperature in degrees centigrade.

For the trial two boxes of bananas were placed within an insulating roll cage liner (10) located within a roll cage (11), the two boxes being of a size such that in combination they covered the base of the roll cage liner (10). A moveable bulkhead (70) was placed on top of the boxes of bananas. Two boxes of bananas were similarly arranged; these boxes being located within a commercially available banana shroud.

Arrangements were made to allow for the measurement of the parameters detailed below, using temperature monitoring equipment, in respect of the known banana shroud and the new roll cage liner (10) in accordance with the present invention:

i) The temperature of the air outside of the known banana shroud or roll cage liner

ii) The temperature of the air around the bananas located within the box

iii) The core temperature of the bananas forming the top layer within the box

iv) The core temperature of the bananas forming the bottom layer within the box.

During the trial, the bananas were subjected to conditions corresponding to the standard refrigeration temperatures that are used to transport perishable goods, i.e. the air temperature outside the roll cage liner and known banana shroud was generally maintained between 3 °C and 6 °C, the air temperature being cooled to a temperature of less than 2 °C towards the end of the trial.

The fluctuations in temperature from 3 °C up to 6 °C observed during the trial, correspond to periods where goods were removed or loaded into the refrigerated section of the truck/van.

During the 15 hour period when the air temperature outside the roll cage liner was maintained at 3 °C to 6 °C, the temperature of the bananas located within the roll cage liner (see Figure 18), at the bottom of the box, underwent a decrease in temperature of 3 °C and the bananas at the top of the box underwent a decrease in

temperature of approximately 2 °C. Overall the temperature of the bananas only fell to a minimum temperature of 13.5 °C during the 15 hour period whilst they were stored in the refrigerated section of a van/truck maintained at a temperature of 3 to 6 °C, and the air surrounding the bananas fell to a minimum temperature of 11 °C.

When an existing banana shroud was subjected to the same conditions, see Figure 17, it was noted that whilst the temperature of the bananas in the bottom of the box only decreased in temperature by approximately 3.5 °C (from approximately 14.5 °C to 11 °C). On the other hand, bananas located in the top of the box underwent a significant decrease in temperature from approximately 14 °C to a minimum temperature of approximately 6.5 °C (the temperature of the bananas generally being between 6 °C and 8 °C) whilst the air temperature was maintained between 3 °C and 6 °C, for a period of 15 hours.

Ideally bananas should be stored at a temperature around 13 °C to avoid chill damage. The results provided above readily demonstrate that bananas can be safely transported in a standard refrigerated lorry or truck, wherein the air temperature is maintained at 3 °C to 6 °C, when a roll cage liner in accordance with the present invention is used to protect said bananas. Bananas transported in this way not being susceptible to the type of damage that is observed when a known standard banana shroud is used under identical conditions.

Reference is now made to Figures 19 to 25 of the drawings which provide graphical representations of the changes in temperature observed in perishable goods located within transport crates that are surrounded by a cover (an inner pod) in the form of an insulating box (140) in accordance with third embodiment of the invention

disclosed herein. The insulating boxes (inner pod/cover) (140) were then placed within a roll cage liner (10) located within a roll cage. The roll cage (11) was then stored at a temperature of 20 °C and temperature probes used to monitor the temperature of the air and the frozen goods within the transport crates, after the insulating box (140) and roll cage liner were sealed.

The frozen goods placed within the transport crate in Figures 19, 20 and 21 comprised ice cream, a lasagne ready meal and pizza.

Figure 19 provides data, temperature (°C) versus time, in respect of frozen goods stored in a transport crate located within a transport crate cover (inner pod/insulating box) (140) and a roll cage liner (outer pod) (10); the transport crate cover (inner pod/insulating box) (140) having been initially cooled in a freezer to a temperature of approximately –21 °C), the roll cage liner being at room temperature, before the frozen goods were placed within the transport crate, and the transport crate cover (140) and roll cage liner (10) were then sealed and stored at a temperature of 20°C. Figure 20 provides data, temperature (°C) versus time, corresponding to Figure 19, but in this case the roll cage liner (outer pod) (10) and the crate cover (insulating box) (140) were at room temperature when the frozen goods were placed within the transport crate located within a cover (inner pod/insulating box) (140) and the roll cage liner (10) and sealed therein, and stored at a temperature of 20 °C.

Figure 21 provides data corresponding to Figures 19 and 20, but in this case the roll cage liner (outer pod) (10) and the crate cover (inner pod, insulating box)(140) were both initially cooled in a freezer prior to frozen goods being placed in the

transport crate and sealed within the transport crate cover (inner pod, insulating box) (140) and roll cage liner (outer pod)(10), and stored at a temperature of 20 °C.

Similar results were also obtained to those illustrated in Figure 19 when the roll cage liner (10) was initially cooled to -21 °C rather than the crate cover, and the crate cover was initially at room temperature.

It can be seen from Figures 19 to 21 that frozen goods may be maintained at lower temperatures for longer periods by initially cooling (using a freezer) the transport crate cover (inner pod/insulating box) (140) and the roll cage liner (10). A lower temperature is maintained for a longer period when only the inner pod (insulating box) (140) is initially cooled in a freezer as compared to when the inner pod (140) and the roll cage liner are not initially cooled, see the relevant data in Table 2 below.

Table 2: Showing the maximum change in temperature observed depending on the conditions that the crate cover and/or roll cage liner are initially subjected to

Conditions in respect of the transport crate cover and the roll cage liner	Approximate Change in core temperatures
Roll cage liner (10) initially at room temperature and transport crate cover (140) cooled in freezer to approx -21°C	Ice cream 2.5 °C after 3.5 h Ready meal 4 °C after 3.5 h Pizza 2.5 °C after 3.5 h

Roll cage liner (10) and crate cover (140) both initially at room temperature	Ice cream 6 ˚C after 3.5 h Ready meal 6.5 ˚C after 3.5 h Pizza 5.5 ˚C after 3.5 h
Roll cage liner (10) and crate cover (140) both initially cooled to -21˚C	Ice cream 3.5 ˚C after 3.5 h Ready meal 2.5 ˚C after 3.5 h Pizza 2.5 ˚C after 3.5 h

It will be noted from Figure 21 that when the transport crate cover (140) and roll cage liner (10) were both cooled in a freezer before the frozen goods were placed within the crate, the air temperature was maintained at a temperature of below - 11˚C after a period of 8 hours and 40 minutes, the initial temperature having been -21 ˚C. The temperature within the crate (of the air and the goods contained therein) only rising above -15 ˚C after approximately 5 hours and 20 minutes.

A series of similar trials were carried out, similar to those described above in respect of Figures 19 to 21, wherein perishable goods that are normally stored in refrigerators were instead placed within the transport crate, i.e. butter, a cauliflower cheese ready meal and a chicken in sauce meal.

In respect of the data illustrated in Figure 22, the transport crate cover (inner pod/insulating box) (140) was initially cooled in a freezer to -21 ˚C and the roll cage liner (outer pod) (10) was at room temperature (20 ˚C)

In respect of the data illustrated in Figure 24, both the transport crate cover (inner pod) (140) and the roll cage liner (outer pod) (10) were initially cooled in a freezer to a temperature of approximately -21°C.

In respect of the data illustrated in Figure 23 the transport crate cover (inner pod) (140) and the roll cage liner (outer pod) (10) were initially at room temperature (20°C).

The data illustrated in Figures 22 to 24 demonstrates that the use of a roll cage liner (outer pod) (10) and a transport crate cover (inner pod /insulating box) (140) used in combination allow for the prolonged storage of non-frozen perishable goods, in a roll cage stored at a temperature of 20 °C. The initial cooling of the transport crate cover (inner pod) (140) in a freezer prior to the insertion of the goods therein resulted in the temperature of the perishable goods only rising by less than 2 °C over a period of approximately 3 ½ hours, see Figure 22.

When the roll cage liner (10) and transport crate cover (140) were initially at room temperature (20° C) the perishable goods located in the transport crate were still only subject to a maximum temperature rise of approximately 4°C in 3 ½ hours, see Figure 23.

When the roll cage liner (10) and transport crate cover (140) were both initially cooled in a freezer at -21 °C the perishable goods placed within the transport crate were initially subject to cooling to a temperature below 0 °C before a slow rise in temperature being observed of less than 1 °C in a subsequent 10-hour period.

Reference is now made to Figures 12, 13 and 14 which illustrate a second embodiment of the invention.

According to a second embodiment of the invention, there is illustrated in Figure 12 a loading pallet (131), onto which a base panel (132) of a liner of the invention has been located. Subsequently a pallet collar (133) has been located on top of the base panel in alignment with the edges of the pallet (131), the skilled addressee will appreciate that the use of the pallet collar (133) is optional. The base panel (132) is manufactured with the same layered structure described above for the manufacture of the moveable bulkhead of the invention, as described above. A section of the base panel (132a) protrudes beyond the edges of the loading pallet, and strips of fastening loops (137) (of the Velcro (RTM) type) are affixed to this protruding section. The strips of the base panel (132a) that protrude beyond the edges of the loading pallet (131) are manufactured such that they may be folded upwards once the pallet collar (133) is in place, if a pallet collar is utilised. Once the goods (not shown) to be transported are located on the loading pallet (131) (on top of the base panel (132)) a generally cube shaped cover/shroud (134) of the liner of the invention may be located over the top of said goods, such that it covers the goods and the pallet collar (133), the edge of the shroud/cover (134) being located such that it abuts the strips of the base panel (132a) that protrude beyond the edges of the loading pallet (131). The shroud (134) is manufactured using the same layered structure as the roll cage liner described above. The lower edge of the shroud (134) has strips of hooks (not shown) affixed along its length on the outer surface of the shroud (134), these hooks being located to engage with the loops (132a) located on the base panel (132) when the protruding strips (132a) of the base panel (132) are folded upwards. Once the hooks located on lower edge of the shroud (not shown) and the strips of loops (137) have been engaged with each other the cover may be affixed in place by the use of straps (135) (webbing

straps) as illustrated in Figure 13. The straps (135) may be used to lower the height of the cover (134) such that the shroud (134) is located adjacent the top of the goods located within the shroud (134), thus reducing the free air space that is contained within the shroud (134). Suitable straps (135) may be purchased from Newlace Ltd, based in Salford, UK the slide release buckle model number being 1602, and the relevant model for the strap being 2824.

The shroud (134) is provided with one or more pockets (136) (that may be used as document pouches) on the outer surface of the shroud (134).

The skilled addressee will appreciate that a pallet liner (not shown) may be provided for the transport of goods using pallets wherein the base panel of the liner does not extend beyond the dimensions of the pallet when good are enclosed by the liner; the base panel and shroud forming a pallet liner of the invention that is located within the confines of the pallet collar if a pallet collar is used.

Reference is now made to Figure 14 of the drawings wherein, in accordance with a third embodiment of the invention there is provided a generally box shaped cover (140, an insulated box cover) for use with crates, boxes and the like, that are used in the delivery of smaller quantities of goods to homes, small shops, offices, etc. whether the goods being delivered are perishable cooled goods such as food (typically delivered by supermarkets) e.g. vegetables and ice cream or food that is hot such as pizzas and takeaway food. It will be appreciated by the skilled addressee that the insulating box (140) may readily be manufactured to a required shape or size. An example of an insulated box cover (as generally indicated by 140) is illustrated in Figure 14. The insulated box cover (140) that is illustrated may be used to surround

existing crates or boxes that are presently used for the delivery of perishable foods to homes, as mentioned above. Alternatively, the insulated box could be sized such that it is located within existing crates or boxes that are used to transport perishable goods.

The insulated cover (as generally indicated by 140) comprises a box shaped enclosure (as generally indicated by 141), the enclosure is comprised of five sides of which two sides (141a and 141b) are visible in figure 14. The open end (not shown) of the box shaped enclosure (141) may be closed off by the use of the foldable extensions (144a, 144b, 144c and 144d), the foldable extension (144d) being illustrated in a position such that it covers the open end of the box shaped enclosure (141). Hook and loop fasteners (such as VELCRO (RTM) fasteners (145, 146, 147 and 148) are located on the foldable extensions (144a, 144b, 144c and 144d) such that they may be engaged to seal off the interior of the insulated cover. It will be appreciated that the hook/loop fastener (146) is located to be engaged with the corresponding fastener (145), and that the fasteners (146) would not normally be visible from the perspective view illustrated in Figure 14, hence the use of a dashed line. Similarly, the hook and eye fasteners (147 and 148) are also positioned for engagement with each other to facilitate the closure of the opening in the box shaped enclosure (141).

It will be appreciated by the skilled addressee that various modifications may be made to the inventions disclosed herein without departing from the scope of said invention; for instance, the box shaped enclosure (141) described above may be modified such that the opening to the box (141) is provided in the upper side (141a), in use, of said box (141) with the opposing face of the box (not shown) forming a base onto which a crate (or box) containing perishable food, or the like, may be placed.

The lid of the box may then be provided with foldable extensions on which fastening means (e.g. fastening loops) may be located such that when the lid is closed the fastening means engage with suitably located fastening means (strips of fastening hooks) that are appropriately located on the sides of the box.

Alternative fastening means to loop and hook fastening means, as described above, may be used, e.g. magnetic closure means, latches, elasticated straps, and the like, as would be known to the skilled addressee.

The above embodiments are described by way of example only. Many variations are possible without departing from the scope of the invention as defined in the appended claims.

CLAIMS

1. An insulating cover or liner for use with a container containing temperature-sensitive perishables comprising:

an outer layer comprising a polymeric material configured to protect the other layers from wear and tear during daily use;

a first heat reflective layer adjacent the outer layer and comprising a metal foil sheet sealed onto a polymeric sheet which is laminated to a sheet of cellular polyethylene material, the metal foil sheet being aluminium and located on the face of the heat reflective layer adjacent to the outer layer of the cover or liner;

three layers of a thermally insulating material located adjacent to one another in a stack, wherein each insulating layer is a woven or matted fibre layer of polyester; and,

an inner layer comprising a second heat reflective layer, the second heat reflective layer comprising a layer of an aluminium foil on a polyester cloth,

wherein the layers of thermally insulating material are sandwiched between the first heat reflective layer and the second heat reflective layer.

2. An insulating cover or liner as claimed in claim 1 wherein the outer layer polymeric material is a polyester.

3. An insulating cover or liner as claimed in claim 1 or 2 wherein the second heat reflective layer polymeric sheet is coated with polyvinyl chloride.

4. An insulating cover or liner as claimed in claim 3 wherein the polyvinyl chloride is coated on both sides of the polyester cloth.

5. An insulating cover or liner as claimed in any preceding claim wherein each layer of thermally insulating material has a thickness of at least 10 mm.

6. An insulating cover or liner as claimed in any preceding claim wherein the layers of thermally insulating material comprise a material with an insulation R-Value rating of at least 0.02 m^2 K/W and/or a U-Value rating of at least 10 m^2 K/W.

7. An insulating cover or liner as claimed in any one of the preceding claims further comprising attachment means configured to attach the liner to a roll cage.

8. An insulating cover or liner as claimed in claim 7 wherein the attachment means comprise hook and loop fasteners.

9. An insulating cover or liner as claimed in either claim 7 or claim 8 wherein the liner or cover further comprises a door, that in use, opens sideways.

10. An insulating cover or liner as claimed in any of claims 7 to 9 wherein the liner or cover further comprises a door and an opening in the liner or cover which both comprise hook and loop fasteners, arranged to cooperate, in use, to secure the door across the opening, in a closed position.

11. An insulating cover or liner as claimed in claim 10 wherein the fastening means provided on the door comprises, in use, at least one strip of

fastening means along at least one edge of the door, that is of greater dimensions than a corresponding cooperating strip of fastening means provided on an edge of the opening of the cover or liner.

12. An insulating cover or liner as claimed in any of claims 7 to 11 wherein the door and/or the opening to the liner or cover comprise a rigid frame or rigid support material.

13. An insulating cover or liner as claimed in any of claims 7 to 12 further comprising a moveable bulkhead.

14. An insulating cover or liner as claimed in claim 13 wherein the moveable bulkhead comprises

an outer layer comprising a tear resistant polymeric material;

a first heat reflective layer directly adjacent the outer layer and comprising a metal foil sheet sealed onto a polymeric sheet which is laminated to a sheet of cellular polyethylene material, the metal foil sheet being aluminium and located on the face of the heat reflective layer adjacent to the outer layer of the moveable bulkhead;

three layers of a thermally insulating material located adjacent to one another in a stack, wherein the thermally insulating material for each insulating layer is a polyester fibre layer; and,

an inner layer comprising a second heat reflective layer, the second heat reflective layer comprising a layer of an aluminium foil on a polyester cloth,

wherein the layers of thermally insulating material are located between the first heat reflective layer and the second heat reflective layer.

15. An insulating cover or liner as claimed in any one of the preceding claims wherein the heat reflective layer comprises a laminate of metal foil affixed to a layer of polymeric material, which in turn is affixed to a polymeric material comprising multiple air pockets that form a continuous sheet.

16. An insulating cover or liner as claimed in either one of claims 13 to 15 wherein the moveable bulkhead is sized such that it is oversized as compared to the interior dimensions of the roll cage liner.

17. An insulating cover or liner as claimed in any of claims 13 to 16 wherein the moveable bulkhead further comprises an attachment means to enable the attachment of the moveable bulkhead to the roof of the liner or cover.

18. An insulating cover or liner as claimed in claim 17 wherein the attachment means is in the form of a hook and loop fasteners.

19. An insulating cover or liner as claimed in any of claims 13 to 18 wherein the moveable bulkhead is permanently but moveably attached to the cover or liner.

20. An insulating cover or liner as claimed in claim 19 wherein the moveable bulkhead is attached to the cover or liner by means of a loop attached to the moveable bulkhead through which a cord passes, the cord being attached to the bulkhead.

21. An insulating cover or liner as claimed in any of claims 13 to 20 wherein the bulkhead comprises heat reflective layers covering all outer faces of the bulkhead.

22. An insulating cover or liner as claimed in any one of claims 1 to 6 comprising a base panel and a shroud.

23. An insulating cover or liner as claimed in claim 22 wherein attachment means are provided to attach the base panel to the shroud.

24. An insulating cover or liner as claimed in claim 23 wherein attachment means comprise hook and loop attachment means.

25. An insulating cover or liner as claimed in any one of claims 1 to 6 wherein the liner or cover comprises an openable and closable lid. 26. An insulating cover or liner as claimed in claim 25 wherein the openable and closable lid is fixed in a closed position by means of attachment means that attach the lid to a wall of the liner or cover.

27. An insulating cover or liner as claimed in claim 25, wherein the openable and closable lid is compressed in a closed position by adjustable straps that attach the lid to a wall of the liner or cover.

28. An insulating cover or liner as claimed in any of claims 1 to 6 further comprising a transparent pocket for the storage of documents.

29. A pallet comprising a liner or cover material as claimed in any of claims 1 to 6 and 22 to 24 located thereon.

30. A perishable goods transport crate or box comprising a liner or cover as claimed in any of claims 1 to 6 and 25 to 27 located thereon or therein.

31. A method of preventing or mitigating temperature rises in perishable goods, the method comprising the steps of:

a) covering or lining a temperature-sensitive perishable goods transport container with a liner or cover of any one of claims 1 to 28; and

b) loading the container with temperature-sensitive perishable goods.