**(12) STANDARD PATENT** (11) Application No. **AU 2016214162 B2**
**(19) AUSTRALIAN PATENT OFFICE**

(54) Title
**A thermally insulated container and method for making same**

(51) International Patent Classification(s)
***B65D 81/38*** (2006.01) ***F25D 3/08*** (2006.01)
***B65D 43/02*** (2006.01)

(21) Application No: **2016214162** (22) Date of Filing: **2016.01.29**

(87) WIPO No: **WO16/124891**

(30) Priority Data

| (31) Number | (32) Date | (33) Country |
|---|---|---|
| **1501915.1** | **2015.02.05** | **GB** |

(43) Publication Date: **2016.08.11**
(44) Accepted Journal Date: **2020.03.26**

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(56) Related Art
**US 2014/0054297 A1**
**WO 2014/147425 A2**
**EP 2022728 A1**
**US 2010/0326993 A1**

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 August 2016 (11.08.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/124891 A1

(51) International Patent Classification:
*B65D 81/38* (2006.01) *F25D 3/08* (2006.01)
*B65D 43/02* (2006.01)

(21) International Application Number:
PCT/GB2016/050192

(22) International Filing Date:
29 January 2016 (29.01.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1501915.1 5 February 2015 (05.02.2015) GB

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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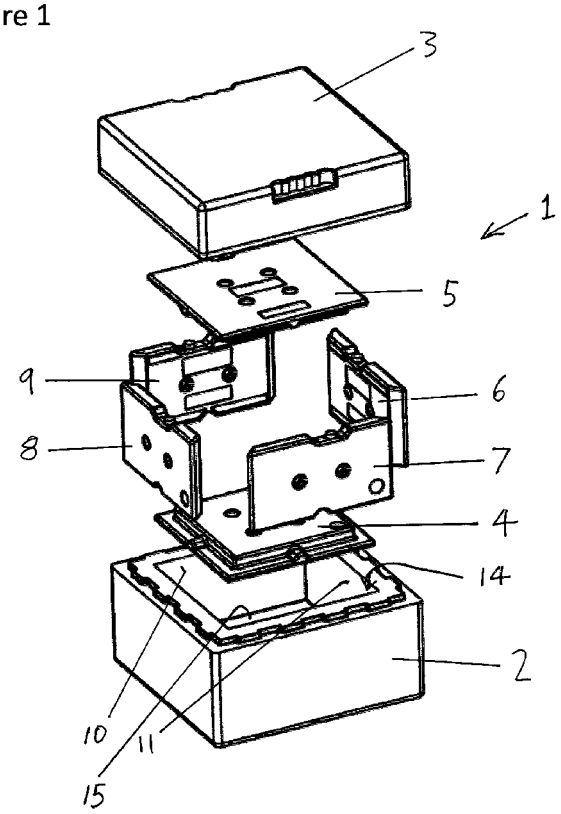
WO 2016/124891 A1

(54) Title: A THERMALLY INSULATED CONTAINER AND METHOD FOR MAKING SAME

Figure 1




(57) Abstract: A thermally insulated container (1) comprising a lid (3) and a main body (2) moulded from a single piece of expanded foam with outwardly tapering inner walls, necessitated by the moulding process. The container (1) is arranged to be closed by the lid (3) so that cool packs (6) to (9) in the container (1) extend from a base inside the main body (2) to inside the lid (3), wherein the inner surface of the walls of the lid (3) are tapered such that positioning the lid (3) on the main body (2), with the cool packs arranged around the inner surfaces of the walls, causes the cool packs (6) to (9) to be aligned so that they extend vertically, perpendicular to an inner surface of the base of the main body (3). A method of moulding such a container is also provided.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

**Published**:

— *with international search report (Art. 21(3))*

# A THERMALLY INSULATED CONTAINER AND METHOD FOR MAKING SAME

## FIELD

The present disclosure relates to a thermally insulated container and has particular, but not exclusive, application to insulated containers, known as insulated shippers, which are used to transport products at stabilised temperatures. The disclosure also relates to a method of making such a container.

## DEFINITION

In the present description and claims, the term "comprising" shall be understood to have a broad meaning similar to the term "including" and will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps. This definition also applies to variations on the term "comprising" such as "comprise" and "comprises".

## BACKGROUND

It is important that some products, for example certain types of pharmaceuticals or biotech products, are maintained within a specified temperature range, typically 2° to 8°C, to prevent the product from being damaged, or its shelf-life being reduced relative to the shelf-life stated on the product. The product may be a very high value medicine or the like, which will be worthless if its temperature is not correctly controlled. This may be problematic during shipment and use of an insulated shipper will often be necessary to make shipment practicable.

Passive insulated shippers comprise an insulated container comprising an insulated outer casing which is lined with, or houses, a number of cool blocks, cool trays, gel packs, cool bricks or similar, which for the purposes of the present specification are collectively referred to as cool packs. These may be cooled until a phase change occurs in the refrigerant in the cool packs, where the subsequent phase change back from a solid to a liquid acts to maintain the contents of the container at a

constant temperature. Examples of materials which change state from a solid to a liquid to produce a cooling effect, are paraffin wax and water-based solutions.

Although reference above and below is made only to cool packs and the requirement to maintain a product at or below a certain temperature, those packs may also be used to maintain a product above a certain temperature, for example to stop a product freezing if it is being shipped in a cold climate. Thus, although for the purposes of this specification they will be referred to only as cool packs and only the case of keeping the product cool will be discussed, it will be appreciated that the disclosure is equally applicable to applications where it is desired to maintain the product above a desired temperature and the description and claims are to be interpreted so as not to preclude such an application.

The container may have an additional layer of insulation panels between the cool packs and an outer insulating layer of foam or a similar material to improve thermal efficiency, for example if the shipment is taking place in a hot climate or over extended period of time.

A passive shipper of the type described above therefore has a number of cool packs which have to be inserted before the shipper is used, in order to permit the cool packs to be cooled before use. It is desirable that the cool packs are standardised, to reduce the number of types of cool packs to assist in selection. It is also desirable that each cool pack can be positioned in one of several orientations, to assist in locating them correctly. It is also desirable that the cool packs be held in place only by the outer insulated walls of the container and possibly any intermediate layer of insulation panels. It is also desirable, especially in the case of disposable shippers which are not intended to be returned, that they are relatively inexpensive to manufacture.

The reference to prior art in the background above is not and should not be taken as an acknowledgment or any form of suggestion that the referenced prior art forms part of the common general knowledge in Australia or in any other country.

SUMMARY

According to a first aspect of the disclosure there is provided a thermally insulated container comprising: a main body moulded from a single piece of expanded foam; a lid; and a plurality of rectangular cool packs, wherein: the main body has a base and four walls which four walls define a mouth of the main body of the container, which mouth is arranged to be closed by the lid of the container, wherein: the inner surfaces of the walls of the main body taper from the mouth of the main body to the base of main body, such that the internal dimensions of the main body are greater at the mouth of the main body than they are at the base of the main body; the lid comprises a roof and four walls protruding downwardly from the roof which walls define a mouth of the lid which mouth of the lid is arranged to engage with the mouth of the main body so that the lid may close the main body of the container; when the container is closed the cool packs extend from towards the base inside the main body to inside the lid towards the roof of the lid; and the inner surface of the walls of the lid are tapered such that positioning the lid on the main body with the cool packs arranged around the inner surfaces of the walls causes the cool packs to be aligned so that they extend vertically perpendicular to an inner surface of the base of the main body.

According to another aspect of the disclosure there is provided a thermally insulated container comprising: a main body moulded from a single piece of expanded foam; a lid; and a plurality of rectangular cool packs, wherein: the main body has a base and four walls which four walls define a mouth of the main body of the container which mouth is arranged to be closed by the lid of the container, wherein: the inner surfaces of the walls of the main body taper from the mouth of the main body to a base of main body, such that the internal dimensions of the main body are greater at the mouth of the main body than they are at the base of the main body; the lid comprises a roof and four walls protruding downwardly from the roof, which walls define a mouth of the lid which mouth is arranged to engage with the mouth of the main body so that the lid may close the main body of the container, wherein the walls of the lid are shorter than the walls of the main body; when the container is closed the

cool packs extend from a position at or near the base inside the main body towards the roof of the lid; and the inner surfaces of the walls of the lid are tapered at an angle greater than the angle of taper of the inner surfaces of the walls of the main body, the taper of the inner surfaces of the walls of the lid being such that positioning the lid on the main body with the cool packs arranged around the inner surfaces of the walls causes the cool packs to be aligned so that they extend vertically

The present disclosure may provide a relatively inexpensive thermally insulated container, because the container may be manufactured comprising only two main parts, a main body and a lid, with the main body at least being integrally moulded from a single piece of expanded foam. The advantage of this is that it avoids any cost associated with assembling different foam panels to form the main body and avoids any weaknesses which may otherwise result from joining different foam panels together, or arising from errors in construction. The disadvantage of the tapered inner walls, necessitated by the one piece moulding process is overcome by the lid subsequently correctly aligning the cool packs to define a parallel sided inner space for the product.

The disclosure permits uniform square or rectangular cool packs and/or insulation panels to be located in the container, internally of the expanded foam walls and for these to be held vertically in place by the lid being put in place, without the requirement for any additional fixings or padding. This permits the cool packs to be easily placed in the container as the number of cool pack types may be kept to a minimum. The cool packs being rectangular may also enable each cool pack to be placed in the container in any of two or more orientations, significantly simplifying the assembly procedure.

Once the cool packs have been assembled in the container, placing the lid on the container causes those cool packs to be vertically aligned and thus provide a parallel walled compartment for any product to be transported. Thus, if the product in plan view is dimensioned to correspond to the footprint inside the wall cool packs,

where they join the base, then once the lid is in place the cool packs will be pressed against the product, both ensuring thermal contact with the product and acting to maintain the product securely in place during transportation.

In the context of the present specification, reference to the inner surfaces of the walls of the lid tapering from the mouth of the lid to the roof of the lid include any chamfering of the mouth of the lid, that is to say the rate of taper need not be uniform between the mouth of the lid and the inner surface of the roof of the lid.

Preferably, the internal dimensions of the main body at the base of the main body are the same as the internal dimensions of the lid at the roof of the lid. In this manner, when the lid is placed on the main body of the container, where the cool packs extend between the base of the main body and the roof of the lid, they will form a rectangular cuboid defining an internal space which may be fill with a product.

Advantageously, the lid is moulded from a single piece of expanded foam, thereby providing the same advantage as explained above with respect to the main body of the container. More preferably the lid and main body are moulded from the same type of expanded foam, such as expanded polystyrene, for they may then have walls of approximately the same thickness, be of similar strength and provide the same thermal insulation properties.

Preferably, the container comprises four wall cool packs dimensioned to fit against respective inner walls of the container. If the container is square these wall cool packs may be identical, permitting them to be interchangeable and for them to be located in any orientation, to assist assembly.

The edges of each cool pack are preferably arranged to abut those of an adjacent cool pack when the lid is closed and preferably the side edges of each cool pack are chamfered at 45° relative to the inner and outer faces, such that they may be locked together by the lid and main body, with the side edges abutting.

In one advantageous embodiment, the container comprises four wall cool packs arranged to line inner walls of the container, a base cool pack arranged to sit in the base of the main body and a top cool pack arranged to sit on the top of the wall cool packs. In this manner, cool packs are provided to all six sides of a product and may ensure that the product is uniformly maintained at the same temperature.

The cool packs may be formed from a rigid material such as high density polyethylene. The provision of rigid packs means that the cool packs themselves may define the internal space and be appropriately dimensioned so that they abut together, so that the mass of the cool packs cannot impact on the product during transportation.

The inner surfaces of the walls of the main body and the inner surfaces of the walls of the lid of the container may be arranged to directly contact the cool packs. Alternatively, a layer of insulation panels may be located between the inner walls of the main body and the cool packs, whereby positioning the lid on the main body, with the insulation panels arranged around the inner surfaces of the walls, causes the insulation panels to be aligned so that they extend vertically from an inner surface of the base of the main body and vertically align the wall cool packs located inside of the insulation panels. In this way, the inner surfaces of the main body and lid of the container act to align the cool packs by acting on the insulation panels between the inner surfaces of the walls and the cool packs.

According to yet another aspect of the present disclosure there is provided a method of forming thermally insulated containers for transporting products, the method comprising, for a first container type: providing a mould tool having dimensions for moulding a main body of a first container type; using the mould tool to mould a main body of a first container from expanded foam; and inserting cool packs around the inner surfaces of the main body of the first container. The method further comprising, for forming a second container type: placing an insert or inserts within the

mould tool for the main body of the first container type; using the mould tool to mould a main body of a second container type from expanded foam, inserting insulation panels in the spaces in the main body formed by said insert or inserts and inserting cool packs around the inner surfaces of the main body or around inner surfaces defined by the insulation panels.

This aspect of the present disclosure provides a method of manufacturing two container types having identical internal and external dimensions, so that each type of container may hold the same type and quantity of product and the same number of containers may be housed within a larger container or placed on a single pallet. However the disclosure permits the thermal properties of those containers types to be different by inserting an insert or inserts during the moulding process to provide additional space in the walls of the container to accommodate additional insulation panels, which may be vacuum insulation panels. These will typically have greater insulation properties than the volume of expanded foam of the walls that would otherwise be present. Thus, if a container is expected to undertake either a shorter journey or a journey at lower ambient temperatures, the first container type may be selected, but if the product is to undertake a longer journey, or a journey in elevated ambient temperatures, then the second container type may be selected having improved thermal insulation properties.

The method may additionally comprise placing an insulation panel in the space in the base of the main body formed by the insert or inserts to provide thermal insulation panels to five sides of the products.

The method may further comprise, for a first container type providing a mould tool having dimensions for moulding a lid of a first container type; and using the mould tool to mould a lid of a first container from expanded foam; and for a second container type: placing an insert or inserts within the mould tool for a lid of the first container type; and using the mould tool to mould a lid of a second container type from expanded foam. In this manner, a lid may also be provided specific to a first or second

container type, so that insulation panels may be accommodated in recesses in the lid formed by the insert or inserts.

The advantages of this aspect of the disclosure is that it may permit the main bodies and lids of two container types to be moulded using common mould tools or components, with it only being necessary to add an insert or inserts to the mould tool to permit additional insulation panels, where these are required, to be accommodated within the container formed by the method.

A method in accordance with this aspect of the disclosure may be advantageously used to form a container in accordance with a first or second aspect of the disclosure.

DRAWINGS

One embodiment of the present disclosure will now be described by way of example only, with reference to the accompanying figures, of which:

Figure 1 is an exploded view of a first container type in accordance with the present disclosure;

Figure 2 is a cutaway side elevation of the container of Figure 1;

Figure 3 is a plan view of the container of Figures 1 and 2 with the lid removed;

Figure 4 is an exploded view of a second container type in accordance with the present disclosure;

Figure 5 is a cutaway side elevation of the container of Figure 4; and

Figure 6 is a plan view of the container of Figures 4 and 5 with the lid removed.

Referring to Figure 1 to 3, a container indicated generally as 1, comprises a main body 2, a lid 3, a base cool pack 4, an identical (but inverted) top cool pack 5 and four identical wall cool packs 6 to 9.

DETAILED DESCRIPTION

The main body 2 and lid 3 are each formed by being moulded from expanded foam polystyrene. With reference to the main body 2, the inner walls surfaces 10 to 13, extending from the mouth 14 of the main body to the inner base surface 15 of the main body, are tapered, as can be most clearly seen from Figure 2. This is necessary in order for the main body 2 to be released from the mould tool that formed it. As seen from Figure 3, this tapering defines a space 16 around the upper portions of the cool packs 6 to 9. Thus, although the cool packs 6 to 9 are prevented from moving inwardly by their chamfered side edges abutting, as shown in Figure 3, without the lid 3 being present they may move outwardly which will then permit a product packed within the space defined inside the cool packs 6 to 9 to move during transportation, which may result in damage to the product. This may also reduce the thermal efficiency of the container, for if correctly positioned the cool packs 4 to 9 themselves may form a barrier to convection currents in the container 1.

As can be seen from Figure 1, base cool pack 4 and top cool pack 5 both have a step formed around their edges, which steps respectively accommodate bottom and top edges of the wall cool packs 6 to 9, providing a stepped flow path for any convection between the cool packs, restricting convection between the bottom and top edges of the wall cool packs 6 to 9 and the respective base and top cool packs 4, 5. The step also ensures that, even when slightly misaligned, the side wall cool packs will remain in close proximity to respective surfaces of the steps around the edges of the base and top cool packs 4 and 5, with the chamfered edges of the side wall cool packs 6 to 9 also acting to reduce convection between adjacent wall cool packs 6 to 9 when they are correctly abutted together.

As can be seen from Figure 2, the lid 3 has an inner roof surface 17 which has the same dimensions as the inner base surface 15. The lid 3 has inner walls surfaces which are also tapered to permit the lid to be released from the inner mould tool. However as the walls of the lid are relatively short they have an increased taper in the form of chamfer 18, so that when the lid 3 is positioned in place, the tapered inner

surfaces of the walls of the lid, including chamfer 18, force the wall cool packs 6 to 9 into a vertical orientation as shown in Figures 2 and 3, acting to correctly lock the cool packs together, minimising any convection currents between the side edges of adjacent cool packs or top and bottom edges of the wall cool packs 6 to 9 and the respective base and top cool packs 4 and 5.

With reference to Figures 4 to 6, these are corresponding views to those of Figures 1 to 3, but show a second type of thermally insulated shipping container, indicated generally as 21. This second type of container 21 comprises the same identical base and top cool packs 4 and 5 and identical side wall cool packs 6 to 9 as the first container type illustrated in Figures 1 to 3. Thus these cool packs 4 to 9 are interchangeable between the two container types 1 and 21. However, the expanded foam main body 22 and lid 23 of the second container type 21 are different from those of the container 1 of Figures 1 to 3. Although the expanded foam main body 22 and lid 23 are produced in the same mould tool as their counterparts 2 and 3, inserts have been added to the mould tool forming the inner surfaces of the main body 22 and lid 23, so that the inner base surface 24 is slightly deeper and respective pairs of opposed inner wall surfaces 25 to 28 are further apart, with the inner surfaces of the lid correspondingly spaced further apart and the inner roof surface 29 of the lid 23 being slightly higher. Into the additional spaces created there is inserted, as shown in Figures 4 to 6, a base vacuum insulation panel 30, an identical top vacuum insulation panel 31 and four identical wall vacuum insulation panels 32 to 35. Here chamfer 36 on the bottom edge of the inner surfaces of the walls of the lid 23 urges the wall vacuum insulation panels 32 to 35 together as shown in Figures 5 and 6, in the same manner as the lid 3, of Figures 1 to 3, directly urges the wall cool packs 6 to 9 together.

With the second container type 21, illustrated in Figures 4 to 6, the lid 23 via the side wall vacuum insulation panels 32 to 35, acts on the wall cool packs 6 to 9 to maintain them in a vertical orientation where they abut closely together, both with each other and with the base cool pack 4 and top cool pack 5, in the same manner as previously discussed with reference to Figures 1 to 3.

Thus, it is seen that by adding an insert or inserts to the mould tool that form the main body 2 and the lid 3, the internal dimensions of the main body and lid can be varied so that if desired the container 21 can be formed to additionally accommodate a layer of vacuum insulation panels, or other types of insulation panels, around the outside of the cool packs, to provide improved thermal efficiency where this is required.

Two embodiments of the present disclosure have been described by way of example only, but it will be appreciated that further modifications will be apparent to those skilled in the art which will fall within the scope of the appended claims.

**CLAIMS:**

1. A thermally insulated container comprising:

a main body moulded from a single piece of expanded foam;

a lid; and

a plurality of rectangular cool packs, wherein: the main body has a base and four walls which four walls define a mouth of the main body of the container which mouth is arranged to be closed by the lid of the container, wherein:

the inner surfaces of the walls of the main body taper from the mouth of the main body to a base of main body, such that the internal dimensions of the main body are greater at the mouth of the main body than they are at the base of the main body;

the lid comprises a roof and four walls protruding downwardly from the roof, which walls define a mouth of the lid which mouth is arranged to engage with the mouth of the main body so that the lid may close the main body of the container, wherein the walls of the lid are shorter than the walls of the main body;

when the container is closed the cool packs extend from a position at or near the base inside the main body towards the roof of the lid; and

the inner surfaces of the walls of the lid are tapered at an angle greater than the angle of taper of the inner surfaces of the walls of the main body, the taper of the inner surfaces of the walls of the lid being such that positioning the lid on the main body with the cool packs arranged around the inner surfaces of the walls causes the cool packs to be aligned so that they extend vertically, perpendicular to an inner surface of the base of the main body.

2. A container as claimed in Claim 1, wherein the internal dimensions of the main body at the base of the main body are the same as the internal dimensions of the lid at the roof of the lid.

3. A container as claimed in Claim 1 or Claim 2, wherein the lid is moulded from a single piece of expanded foam.

4. A container as claimed in any preceding claim, wherein the lid and main body are moulded from the same type of expanded foam.

5. A container as claimed in any preceding claim, wherein the expanded foam is expanded polystyrene.

6. A container as claimed in any preceding claim, comprising four wall cool packs, dimensioned to fit against respective internal walls of the container.

7. A container as claimed in Claim 6, wherein the edges of each wall cool pack are arranged to abut those of an adjacent wall cool pack when the lid is closed.

8. A container as claimed in Claim 6 or Claim 7, wherein the side edges of each wall cool pack are chamfered at 45° relative to inner and outer faces of the cool packs such that the wall cool packs are locked together by the lid and main body to define a space within the wall cool packs for a product to be stored or transported within the container.

9. A container as claimed in any preceding claim, comprising four wall cool packs arranged to line the inner walls of the container, a base cool pack to sit in the base of the main body and a top cool pack to sit on top of the wall cool packs.

10. A container as claimed in Claim 9, wherein the base and top cool packs are substantially identical.

11. A container as claimed in Claim 9 or Claim 10, wherein the four side wall cool packs are substantially identical.

12. A container as claimed in any preceding claim, wherein the cool packs are tray formed and flexible.

13. A container as claimed in any of Claims 1 to 11, wherein the cool packs are blow moulded and rigid.

14. A container as claimed in Claim 13, wherein the cool packs are formed from high density polyethylene.

15. A container as claimed in any preceding claim, wherein the inner surfaces of the walls of the main body and the inner surface of the walls of the lid directly contact the cool packs.

16. A container as claimed in any preceding claim, further comprising a layer of insulation panels located between the inner walls of the main body and the cool packs.

17. A container as claimed in Claim 16, wherein the inner surfaces of the walls of the lid are tapered such that positioning the lid on the main body with the insulation panels arranged around the inner surfaces of the walls causes the insulation panels to be aligned so that they extend vertically, perpendicular to an inner surface of the base of the main body and vertically align the wall cool packs located inside of the insulation panels, so they extend perpendicular to an inner surface of the base of the main body .

18. A container as claimed in Claim 16 or Claim 17, wherein the insulation panels are vacuum insulation panels.

19. A container as claimed in any preceding claim arranged to transport a product.

Figure 1

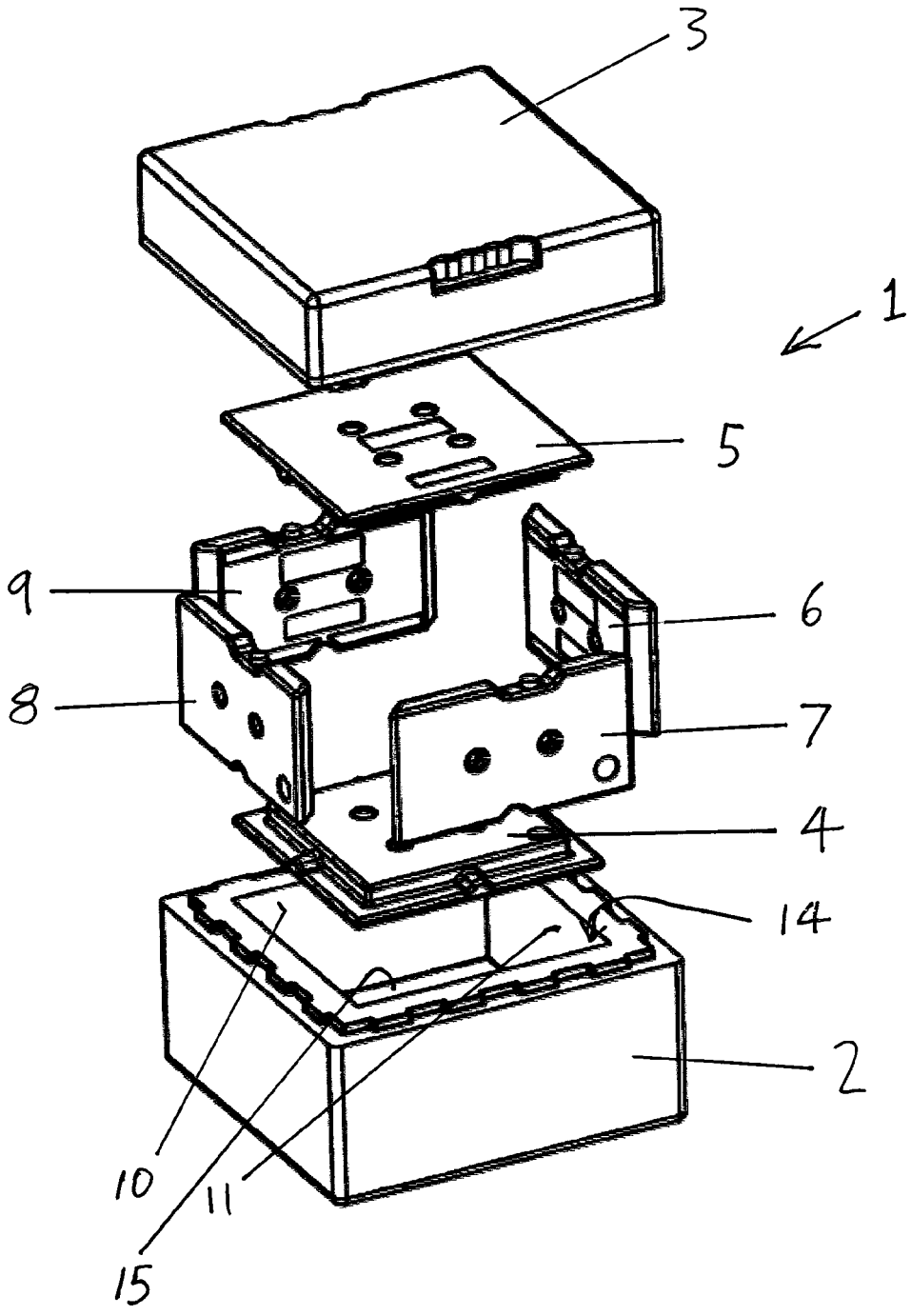


Figure 2

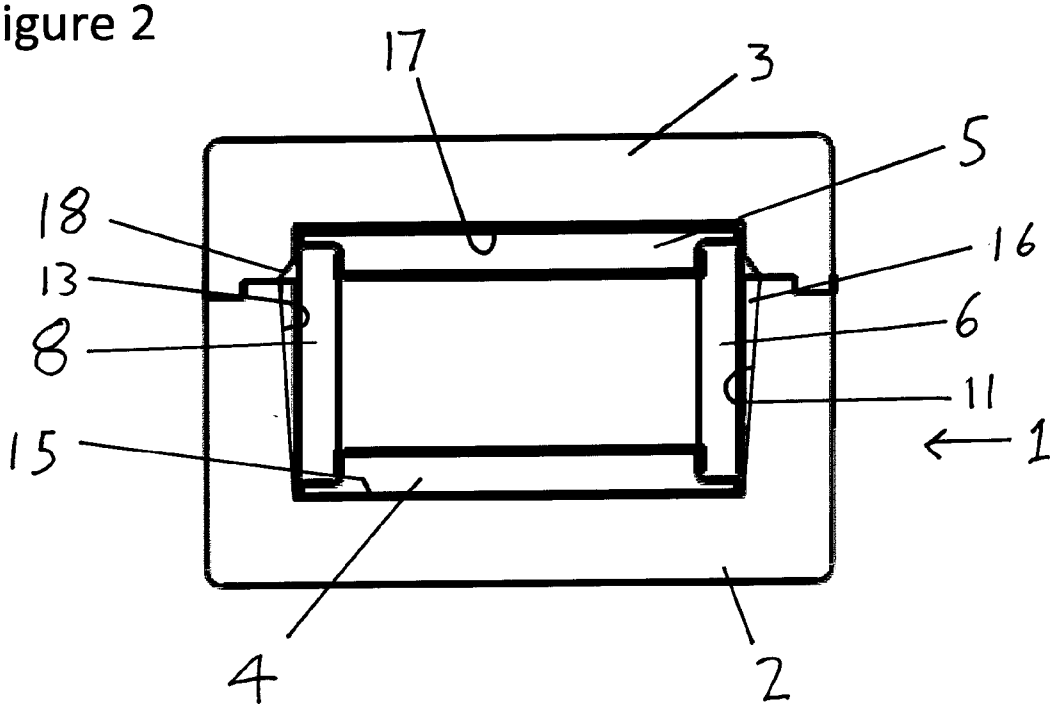



Figure 3

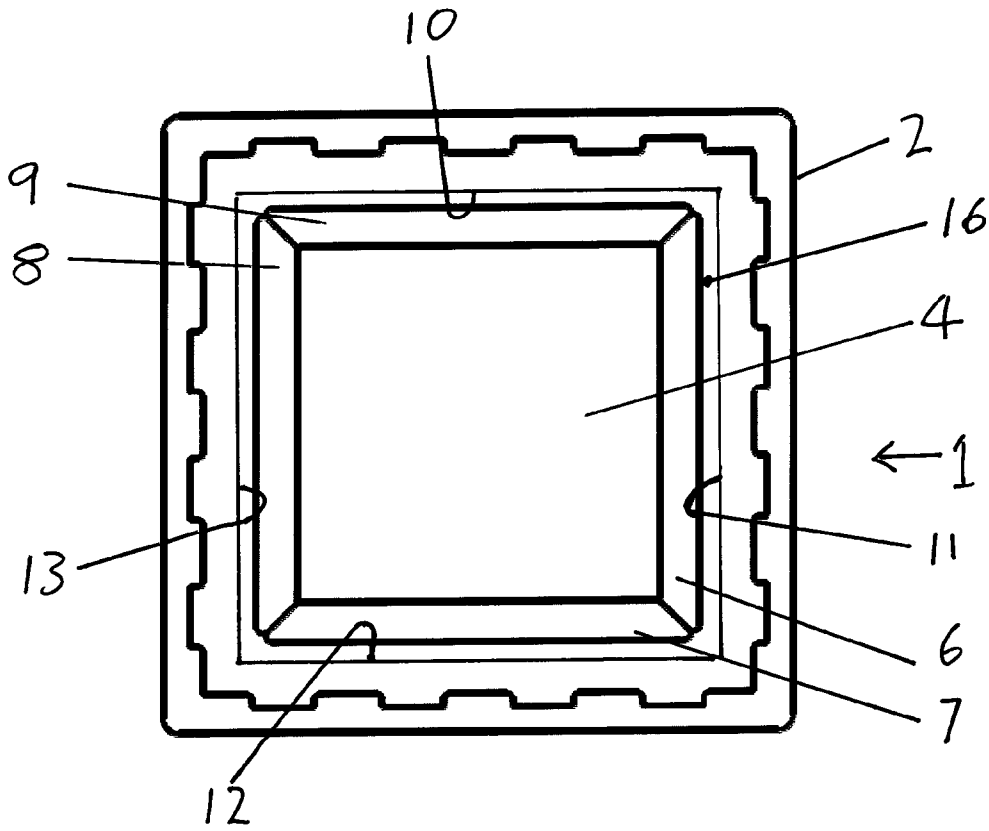


Figure 4

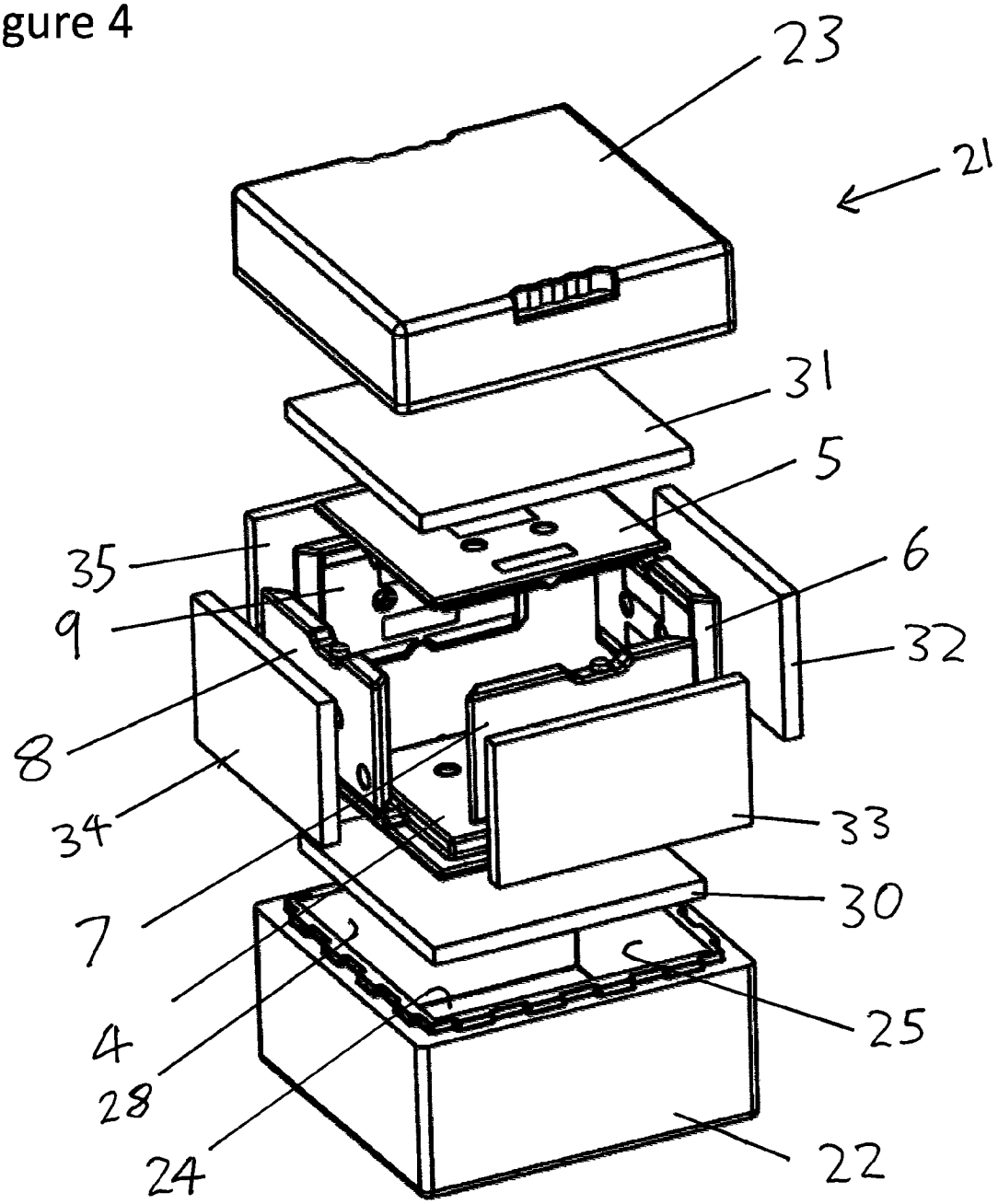


Figure 5

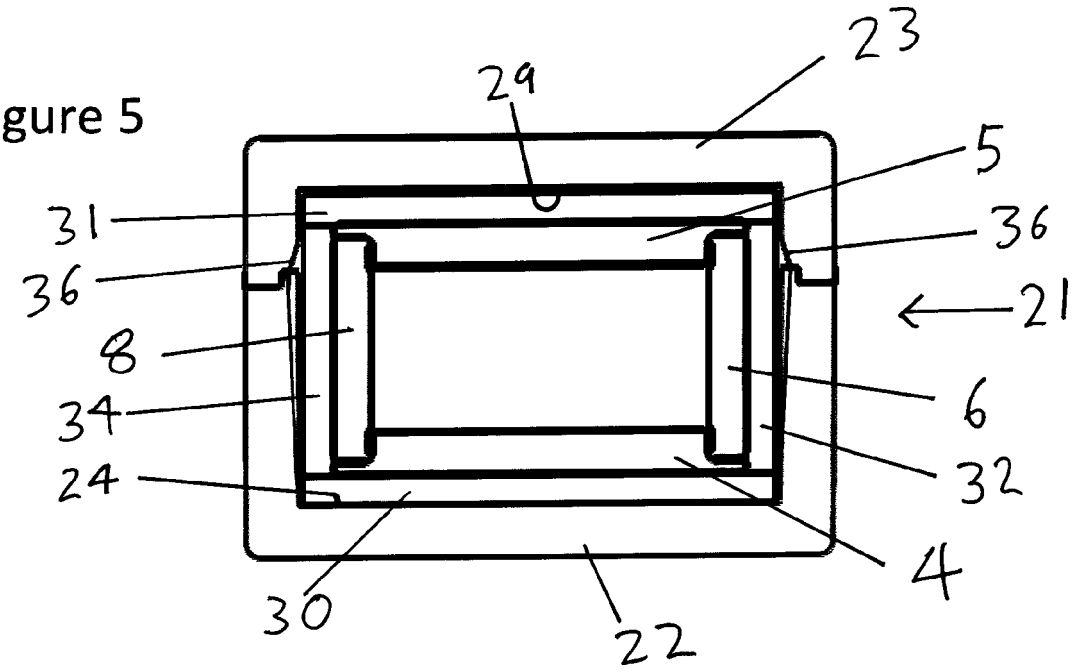



Figure 6