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(54) **THERMALLY INSULATED CONTAINER COVER**

THERMISCH ISOLIERTER BEHÄLTERDECKEL

COUVERCLE DE RECIPIENT A ISOLATION THERMIQUE

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Description

Technical Field:

[0001] The present invention relates to a container cover with port. It particularly relates to the design of a lid assembly suitable for adapting to an insulated container for maintaining the contents below 10°C, even while the container is opened frequently at high ambient temperatures while providing for convenient loading of and easy accessibility to the contents. It also relates to a container equipped with such lid.

Background and Prior art:

[0002] Many perishable food items are transported/stored/distributed to consumers at sub-ambient temperatures, either to prevent their spoilage due to biological actions (as in the case of milk/fish/meat etc.) or to preserve their physical, olfactory and mouth-feel characteristics during consumption (soft drinks, frozen desserts, ice cream etc.). For materials such as ice creams and frozen desserts it is preferable to maintain the temperature below -18°C for obtaining the best consumer acceptability. Containers of different types and sizes are employed for this purpose. They are thermally insulated to reduce the heat load on the stored articles. The thermal insulation can be provided by using low thermal conductivity materials such as expanded polystyrene or polyurethane foams which may be sandwiched between the inner and outer walls of a container or may themselves be moulded in a container form.

[0003] Various improvements in container design/cooling systems such as the use of coolant batteries, use of dry ice, on-board refrigeration systems, partially or fully encapsulating the container with frozen eutectic mixtures, vacuum superinsulation etc. have been employed to maintain the stored material at required temperature. However, frequent opening of the container lid during vending, retail sales and other operations leads to exchange between the external air at ambient temperatures and the cold air inside the container, which results in temperature rise of the contents. The opening leading to the storage cavity of the container is designed to be of large enough dimensions in order to enable easy and quick loading of the material. However, when the lid over the storage cavity is opened every time for retrieval of its contents, the heat exchange is very high leading to rise in temperature of the material thus putting a greater load on the cooling system. The contents are kept below the required temperatures by either increasing the amount of coolant used to maintain the required temperature or resorting to inordinately low coolant temperatures, both of which are uneconomical.

[0004] Containers with lids with discharge aperture suitable for easy dispensing of contents is known in the prior art. US 5743427 discloses a lid of a container with a discharge aperture in the lid to allow the consumption of a drink through the lid but the discharge aperture area is designed only for fluid food stuffs.

[0005] Top covers for ice cream cabinets and ice cube bins with door split down the middle with a hinge to enable access from either side of the cabinet have been previously utilised. Although this design will restrict opening to 50% of the area of the cover it will not significantly and economically protect the contents at very low temperatures.

[0006] WO 9925622 provides a container with a reclosable discharge aperture for food stuffs in particular frozen foods and confections. This invention does not solve the problem of prolonged storage of material under conditions of repeated exposure to high temperature e.g. during vending of foodstuff.

[0007] A purpose of the present invention is to design a lid assembly for an insulated container provided with economical amounts of the cooling system that allows convenient loading and easy and frequent retrieval of the contents while maintaining the temperature of the contents below 10°C for long enough time periods.

Brief Description of the Invention:

[0008] It is a first object of the present invention to provide a thermally insulated lid assembly for an insulated container comprising a thermally insulated rotary lid capable of sealing the opening of the inner cavity of the container adapted to hold the objects to be stored therein, the said rotary lid being provided with at least one eccentrically positioned retrieval port and a thermally insulated plug for the said port.

[0009] The rotary lid can rotate around one axis or more than one. In a preferred embodiment, the rotary lid rotates around one axis. In this preferred embodiment, the lid assembly is seated on and rotates over a circular opening of the container leading to the inner storage cavity. The rotation of the lid is facilitated by providing advantageous features such as smooth contact surfaces, lubrication, guided ball bearings in a channel, etc.

[0010] In another preferred embodiment of the invention, the rotary lid is provided with a fixed or detachable cooling arrangement such as one or more eutectic pads etc. The face of the rotary lid on the inner cavity side can be provided with cooling means such as eutectic/coolant pads and devices to hold them in place. This allows for a further cooling capacity within the container while, in the prior art, where lids, when opened, show the whole container opening, it is not possible to have additional cooling means beneath the lid.

[0011] The retrieval port provided in the rotary lid is located eccentrically in order to maximise the area swept by the port over the storage cavity and hence provide a better view of the contents and facilitate access to the specific item from the storage cavity. The plug of the port is opened to retrieve the contents during vending. The port can be of any geometrically regular shape such as circular, oval, square, rectangular, triangular or any other irregular shape.

[0012] Preferably, the area of the port with respect to the lid is less than 40%, preferably less than 25%, even more preferably less than 10%. The plug may be free, hinged, flippable or otherwise fastened to the rotary lid or the outer part of the container.

[0013] In a preferred embodiment, the lid is transparent. This allows for seeing the inside of the container and rotating the lid in order to have the port above the product to be taken out.

[0014] It is a second object of the invention to provide a container equipped with such lid.

[0015] The insulated storage container may be designed to have any suitable shape such as a parallelopiped, cube, sphere, cylinder or other attractive geometry. The container can be employed in the horizontal position with the major dimension parallel to the ground or in the vertical position with the major dimension perpendicular to the ground. The mouth and lid can be placed on top of the container or on any of its sides.

[0016] The container, rotary lid and the plug for the port may be made from any suitable material capable of withstanding low temperatures. The examples of suitable materials of construction are low carbon steel, stainless steel, galvanised iron, aluminium, polymeric materials such as high/medium/low density polyethylene, linear low density polyethylene, polyvinyl chloride, polycarbonate, polyester, thermally insulating foams such as polyurethane foam and expanded polystyrene foam etc.

[0017] The container, rotary lid and the plug of the port can be thermally insulated using polyurethane foam, expanded polystyrene foam, vacuum superinsulation, glass wool, vacuum panels containing powder or open cell polyurethane foam or any other suitable material known in the art.

[0018] The preferred mode of thermal insulation for the container is multilayer vacuum superinsulation. The vacuum in the annular space between the outer envelope and inner cavity is preferably of the order of 500 Pa or lower. In the annular space, materials such as open cell polyurethane foam, speciality silica, multi-layered sheets of low thermal emmissivity alternating with low thermal conductivity spacer materials etc. may be provided to enhance structural integrity and/or minimise radiative heat transfer. The preferred materials are multi-layered foils of aluminium spaced with thermal insulator or aluminised mylar films. The preferred thermal insulation for the outer rotary lid and the plug to the port is by using polyurethane foam, expanded or extruded polystyrene foam.

[0019] The insulated container is provided with additional cooling means and preferably a coolant with a heat absorption capacity of >50 joules/gram in the temperature range of 10°C and -80°C.

[0020] A suitable coolant for the container as well as the rotary lid can be particles of dry ice. Alternatively, one can use sealed pads containing different coolants as specified above which can be in the form of bags, arrays of ampoules, bottles, blocks, sachets, blister packs etc. to serve as "coolant batteries" for this purpose. The coolant within the pads may be partially or fully frozen at a low enough temperature. The pads may be loose filled or they can be stacked along the inner surface of the container using a retainer device to improve accessibility of the stored food articles. The coolant pads may also be attached to the surface under the rotary lid. Optionally, the cooling surface may be provided in the form of pads or jackets fixed to the inner cavity of the container and cooled/frozen in place using primary refrigeration liquid such as R-12, CARE-30 circulated through conduits of appropriate design attached to the coolant pads/jackets. The source of primary refrigerant may be attached to the container or may be located separately and coupled to the container as and when required. As another option, the sealed jackets/pads fixed to the inner vessel may be cooled using secondary refrigerant brines such as aqueous solutions of freezing point depressants or eutectic mixtures of salts in water circulated through conduits of appropriate design. The source of circulating secondary refrigeration brines may be attached to the container or may be located externally and coupled to the container as and when required.

[0021] Alternatively, the inner cavity of the container may be cooled directly employing primary refrigerant liquid such as R-12, CARE - 30 etc. circulated in coils/jackets/conduits of appropriate design. The source of primary refrigerant may be attached to the container or may be located separately and coupled to the container as and when required. As another option, the inner cavity of the container may be cooled using secondary refrigerant brines such as aqueous solutions of freezing point depressants or eutectic mixtures of salts in water circulated through coils/jackets/conduits of appropriate design. The source of circulating secondary refrigeration brines may be attached to the container or may be located externally and coupled to the container as and when required.

[0022] The coolant jackets and pads and conduits can be made from suitable material of construction capable of withstanding low temperatures. The examples of such materials have been described above. It can be in the form of single unit packs or as detachable/removable units of varying form, shape and size. They can be in the form of discrete arrays of ampoules, capsules or blister packs which are preferably flexible yet self standing when placed in position. They can also be in the form of continuous mats of interconnected blister packs, ampoules or capsules.

Detailed description of the invention

[0023] The principal and other objects of this invention and its advantages will now be described in greater detail with reference to non-limiting exemplary embodiments of the invention described hereunder.

Example 1.

Construction of container:

[0024]

Figure 1: Describes the constructional features of the insulated container.

[0025] The container was double walled with walls (wl and w2). The inner vessel forming the internal cavity (IC) and the outer envelope (OE) were made from aluminium alloy sheet, 3mm thick. The inner vessel had a diameter of 460mm and height of 470mm. The outer envelope had a diameter of 540mm and height of 645mm. The volume of the inner cavity was 75 litres and the empty weight was 30.0kg. The annular space (AS) between the inner vessel and outer envelope was evacuated to a vacuum of - 1.33 X 10^{-4} Pa. Additionally, multi-layered sheets of aluminium alternating with paper were provided to minimise radiative heat transfer. Zirconium "getters" to scavenge gases were also provided in the annular space in order to prolong service life, and minimise heat ingress.

[0026] The cooling medium was provided in the form of pads filled with a eutectic coolant at -23°C in the inner storage cavity. The freezing/melting temperature of the eutectic coolant was ~ -23°C with a heat absorption capacity of - 230 Joules/gram.

[0027] The opening (O) was circular in cross section, located on top of the container and comprised of fibre reinforced plastic neck (N) and a circular aluminium ring (AR) at the top. The diameter of the mouth was 450mm.

[0028] Figure 2 shows a schematic view of the rotary lid assembly and plug to the port. The rotary lid (RL) forming the lid was constructed of linear low density polyethylene and insulated with polyurethane foam (TI) of density 40kg per cubic metre. The top plate (TP) of the rotary lid rests on the aluminium ring (AR as in Figure 1) and can be rotated in place. The insulation thickness in the lid was 125mm. The lid was provided with a square port (P) of side 180mm. The plug (PL) of the port was constructed of linear low density polyethylene and insulated with polyurethane foam (TI) of density 40kg per cubic metre. The insulation thickness in the plug was 125mm. The rim of the opening of the inner cavity and the lid were polished smoothly to minimise friction and allow easy rotation of the lid. Two handles (H1 and H2) were provided on the outer rotary lid and one handle (H3) on the plug to the port.

[0029] The weight of the port plug with handle was 0.5kg and the weight of the entire rotary lid assembly was 3.0kgs.

Example 2.

Performance evaluation of the container Described in Example 1 in comparison to the container without the port:

[0030] The performance of the insulated containers listed below were assessed.

Container 1: As per example 1 with 3kg coolant.
Container 2: As per container 1 but lid was not rotary and did not have a port. The entire lid had to be lifted to retrieve the products.
Container 3: As per Container 1 but had only 1.5kg of the coolant.

Pre-cooling:

[0031] The containers were pre-cooled from the ambient temperature of 30°C to a temperature of ~ -20°C by loading 2.0kg of pre-frozen pads containing eutectic coolant at -23°C described above.

Performance Evaluation:

[0032] The coolant pads loaded for pre-cooling the containers were removed after two hours. Fresh pre-frozen coolant pads at -23°C were loaded into each of the vacuum insulated containers. After loading the pads, 15 litres of ice-cream were loaded into each of the containers. The temperature of the ice cream was -20°C. These containers were now used to store ice creams over a period of time ensuring frequent opening of the cover to the port in container 1 and 3 and the entire lid in container 2 (every 10 minutes for 90 seconds). The temperature of one sample of ice cream

was measured at regular intervals. The data are presented in Table 1.

Table 1

	Ice Cream temperature (°C)			
	0 hour	6hours	12 hours	24 hours
Container 1	-20	-19.8	-19.5	-18.6
Container 2	-20	-18.5	-16.5	-14.0
Container 3	-20	-19.8	-19.5	-14.0

[0033] This shows that the insulated container with a port can preserve ice creams at the desired temperature for a longer time and enable in economising the amount of coolant used by 50%.

Example 3.

Assessment of performance and convenience of use

[0034] The performance and convenience of use of the insulated containers, listed below were assessed.

Container 1: As per example 1.
Container 2: As per container 1 but lid was not rotary and did not have a port. The entire lid had to be lifted to retrieve the products.
Container 3: As per container 1 but lid was not rotary and had six ports.

[0035] Table 2 lists the design features of the lids on the above containers.

Table 2

Design and Constructional features of lid		
	Placement of Coolant	Limitations on coolant placement
Container 1	1.5kg below lid 1.5kg at bottom of container	None
Container 2	3.0kg at bottom of container	Cannot be placed below lid since the coolant would be exposed to high ambient temperature frequently.
Container 3	3.0kg at bottom of container	Cannot be placed below lid since there are six ports in the lid.

[0036] The observations on convenience of use are summarised in Table 3

Table 3

Convenience of use				
	Weight lifted per retrieval by the operator	Visibility of Product per opening as a % of area of opening	Accessibility of Product	Remarks
Container 1	Wt. Of Plug (500gms)	100%	Easy	Best Option
Container 2	Wt. Of Lid (3kg)	100%	Very Easy	Heavy weight to be lifted per retrieval
Container 3	Wt. Of Plug X 4 (2kg)	20%	Easy	Heavy weight to be lifted per retrieval and limited visibility of product per opening

[0037] The temperature of one sample of ice cream was noted at regular intervals. The data are presented in Table 4. The pre-cooling and performance evaluation procedure is as described under Example 2.

Table 4

	Ice Cream temperature after (°C)			
	0 hour	6hours	12 hours	24 hours
Container 1	-20	-19.8	-19.5	-18.6
Container 2	-20	-18.5	-16.5	-14
Container 3	-20	-19.0	-17.5	-15.3

[0038] This shows that the insulated container with a rotating lid and port is convenient to use, provides easy accessibility and clear visibility of the contents and can preserve ice creams below the desired temperature for a longer time as compared to the other containers.

[0039] The proposed lid assembly as described above has several advantages over the conventional designs. These are:

(a) it minimises the weight of the thermally insulated plug that has to be lifted every time the contents have to be retrieved from the inner storage cavity as compared to a large port/multiple port designs,
(b) gives greater visibility and accessibility to the products in the storage cavity,
(c) allows coolant pads to be placed over a large surface area under the rotary lid without the risk of exposing the coolant pads to the ambient temperatures during every opening of the plug,
(d) it minimises the number of times the thick insulated plug is opened for product retrieval, and
(e) provides superior thermal protection to the products in the storage cavity.

Claims

1. A thermally insulated lid assembly for an insulated container comprising a thermally insulated rotary lid (RL) capable of sealing an opening of an inner cavity (IC) of the container adapted to hold objects to be stored therein, the said rotary lid (RL) being provided with at least one eccentrically positioned retrieval port and a thermally insulated plug (PL) for the said port.

2. A thermally insulated lid assembly according to claim 1 wherein the area of the port with respect to the lid (RL) is less than 40%, preferably less than 25%.

3. A thermally insulated lid assembly according to claim 1 wherein the lid (RL) is transparent.

4. A thermally insulated container comprising a thermally insulated rotary lid (RL) capable of sealing an opening of an inner cavity (IC) of the container adapted to hold objects to be stored therein, the said rotary lid (RL) being provided with at least one eccentrically positioned retrieval port and a thermally insulated plug (PL) for the said port.

5. A thermally insulated container according to claim 4 wherein the area of the port with respect to the lid (RL) is less than 40%, preferably less than 25%.

6. A thermally insulated container according to claim 4 wherein the lid (RL) is transparent.

7. A thermally insulated container according to claim 4 wherein the face of the rotary lid (RL) on the inner cavity side is provided with cooling means.

Patentansprüche

1. Wärmeisolierte Deckelanordnung für einen isolierten Behälter mit einem wärmeisolierten Drehdeckel (RL), mit welchem eine Öffnung eines Innenhohlraums (IC) des Behälters, der zum Halten von darin aufbewahrten Gegenstände ausgelegt ist, verschließbar ist, wobei der Drehdeckel (RL) mit mindestens einer exzentrisch positionierten Bereitstellungsöffnung und einem wärmeisolierten Stopfen für diese Öffnung versehen ist.

2. Wärmeisolierte Deckelanordnung nach Anspruch 1, wobei die Fläche der Öffnung in Bezug auf den Deckel (RL) weniger als 40%, vorzugsweise weniger als 25%, beträgt.

3. Wärmeisolierte Deckelanorndung nach Anspruch 1, wobei der Deckel (RL) durchsichtig ist.

4. Wärmeisolierter Behälter, welcher einen wärmeisolierten Drehdeckel (RL) umfasst, mit welchem eine Öffnung eines Innenhohlraums (IC) des zum Halten von darin gelagerten Gegenständen ausgelegten Behälters verschließbar ist, wobei der Drehdeckel (RL) mit mindestens einer exzentrisch positionierten Bereitstellungsöffnung und mit einem wärmeisolierten Stopfen (PL) für diese Öffnung versehen ist.

5. Wärmeisolierter Behälter nach Anspruch 4, wobei die Fläche der Öffnung in Bezug auf den Deckel (RL) weniger als 40%, vorzugsweise weniger als 25%, beträgt.

6. Wärmeisolierter Behälter nach Anspruch 4, wobei der Deckel (RL) durchsichtig ist.

7. Wärmeisoierter Behälter nach Anspruch 4, wobei die Fläche des Drehdeckels (RL) an der Innenhohlraum-Seite mit Kühlmitteln versehen ist.

Revendications

1. Couvercle à isolation thermique pour un conteneur isotherme comprenant un couvercle rotatif à isolation thermique (CR) capable de sceller une ouverture d'une cavité intérieure (CI) du conteneur adapté pour supporter des objets devant y être stockés, ledit couvercle rotatif (CR) étant pourvu au moins d'un orifice d'extraction placé de façon excentrique et d'un bouchon mâle à isolation thermique (BM) pour ledit orifice.

2. Couvercle à isolation thermique selon la revendication 1, dans lequel la zone de l'orifice par rapport au couvercle (CR) est inférieure à 40%, de préférence, inférieure à 25%.

3. Couvercle à isolation thermique selon la revendication 1, dans lequel le couvercle (CR) est transparent.

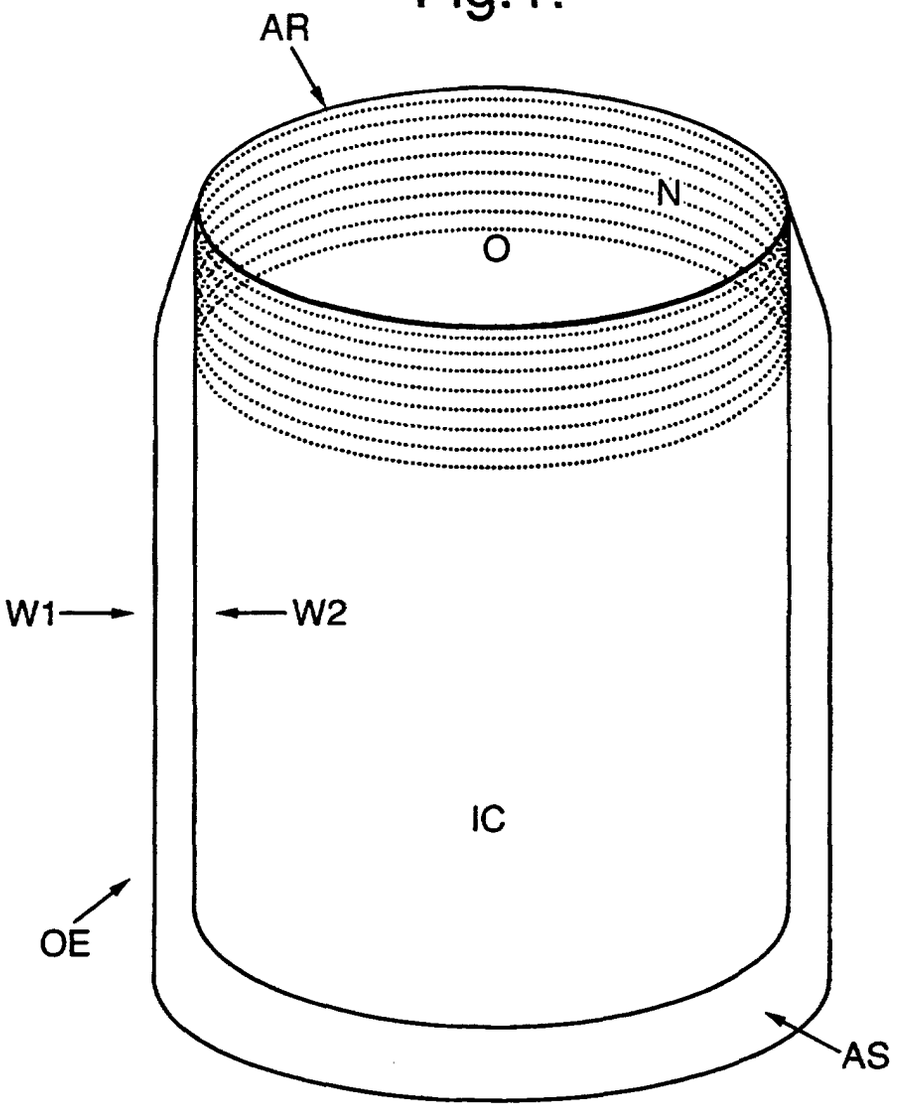
4. Couvercle à isolation thermique comprenant un couvercle rotatif à isolation thermique (CR) capable de sceller une ouverture d'une cavité intérieure (CI) du conteneur adapté pour supporter des objets devant y être stockés, ledit couvercle rotatif (CR) étant pourvu au moins d'un orifice d'extraction placé de façon excentrique et d'un bouchon mâle à isolation thermique (BM) pour ledit orifice.

5. Couvercle à isolation thermique selon la revendication 4, dans lequel la zone de l'orifice par rapport au couvercle (CR) est inférieure à 40%, de préférence, inférieure à 25%.

6. Couvercle à isolation thermique selon la revendication 4, dans lequel le couvercle (CR) est transparent.

7. Couvercle à isolation thermique selon la revendication 4, dans lequel la face du couvercle rotatif (CR) sur le côté intérieur de la cavité est pourvue de moyens de refroidissement.

Fig.1.



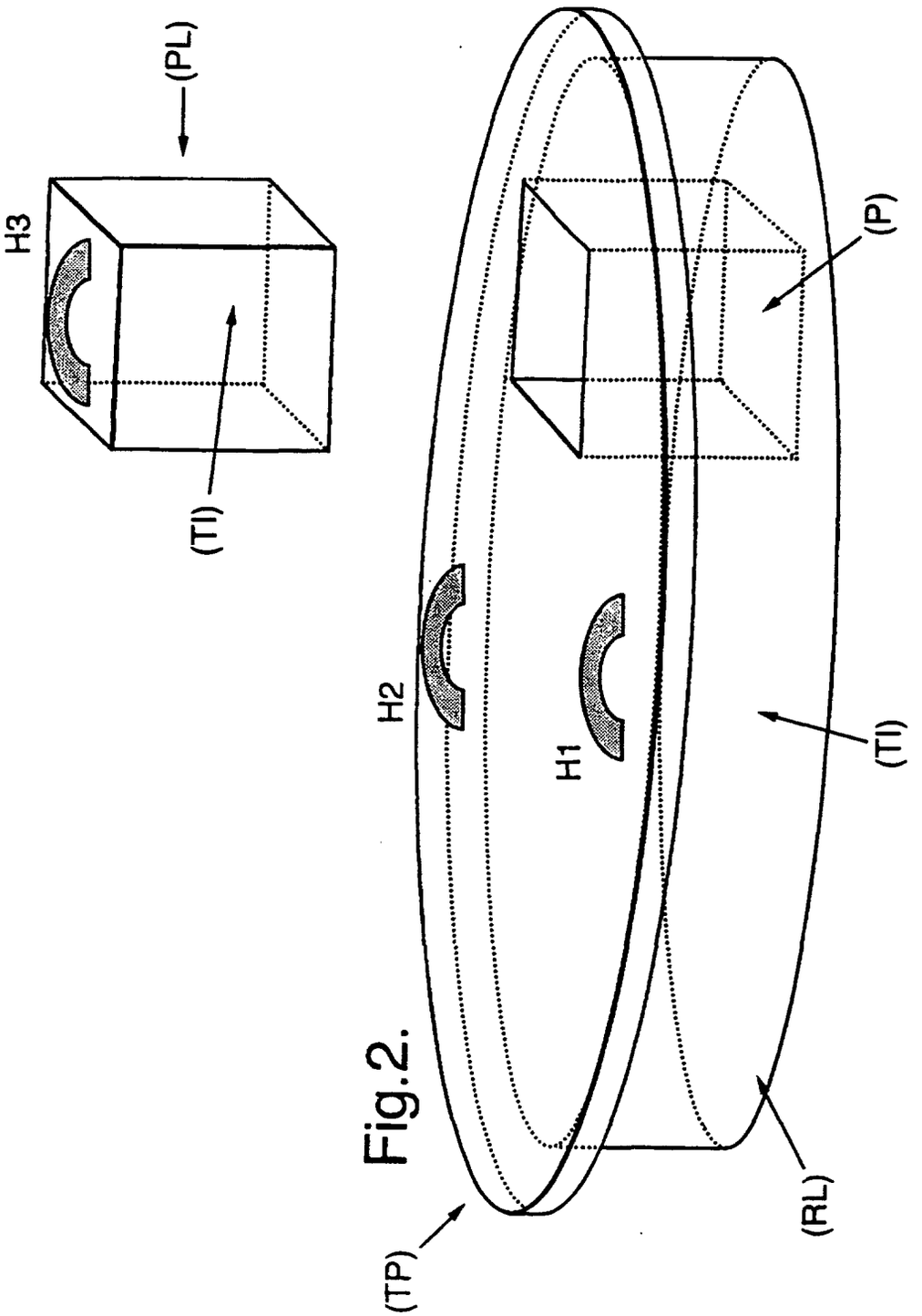


Fig.2.