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(54) **CONTAINER WITH MULTIPLE COMPARTMENTS THAT ALLOW MIXING BEFORE OPENING**

(57) The present disclosure relates to a container comprising a first and a second compartment (111,121) that allow mixing of the contents of the compartments before opening of the container. The compartments are separated by a rupturable membrane (130) that breaks when the pressure inside the first compartment increases-

es, allowing the contents of the first compartment (111) to mix with the contents of the second compartment (121) while the container remains sealed. The container finds a variety of uses, including for food products, paints, adhesives, and in the healthcare sector.

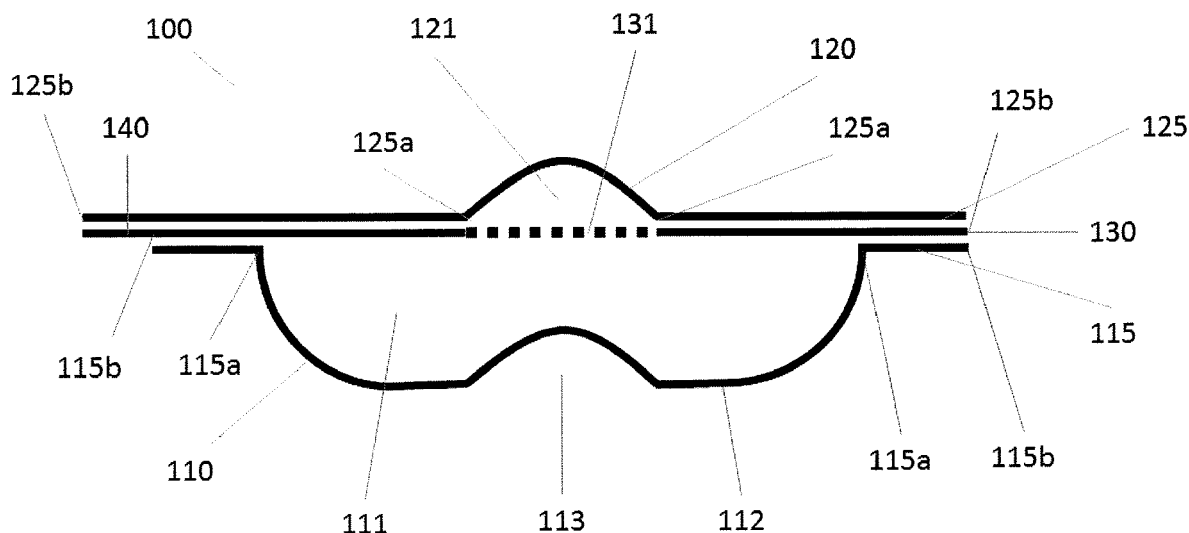


Fig. 1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a container comprising a first and a second compartment that allow mixing of the contents of the compartments before opening of the container. The compartments are separated by a rupturable membrane that breaks when the pressure inside the first compartment increases, allowing the contents of the first compartment to mix with the contents of the second compartment while the container remains sealed. The container finds a variety of uses, including for food products, paints, adhesives, and in the health-care sector.

BACKGROUND OF THE DISCLOSURE

[0002] It is often desirable or even necessary to store a product as two or more separate components prior to use. For instance, epoxy adhesives are formulated as a two component mixture comprising a resin and a hardener which are stored separately and which must only be mixed immediately prior to use. Unique packaging solutions have been devised to make these types of adhesives easier to use. For instance, WO00/09416 discloses a thermoformed piece having two wells which are covered with a sealing layer. The thermoformed piece is capable of being manipulated to cause the wells to combine and effect mixing of the resin and hardener without the sealing layer being compromised. The end of the thermoformed piece may then be broken off to allow the contents of the well to be extruded through an outlet from the combined well.

[0003] It is also often desirable to store a product as two or more components prior to use in the food industry, particularly in so called "ready meals" or microwavable food solutions. For instance, if a sauce such as gravy was allowed to mix with potatoes during storage of the food, the potatoes would soak up the sauce and would not go crispy during cooking. Another reason to keep components separate is due to unwanted chemical reactions between food components, which may lead to discolouring rendering the food unappetising.

[0004] US2006/0068063 discloses a microwaveable food container in which a sauce may be stored in the lid portion of the container. After heating the food, a dividing section can be removed to allow the contents of the lid section to mix with the underlying food.

[0005] EP0974531 discloses a microwaveable food container in which compartments in the lid section are capable of rupturing when the pressure in the compartment increases during cooking. Prior to use, the container must be opened and a dividing membrane removed prior to heating the contents.

[0006] US2013/0074455 discloses a microwaveable food container in which a rupturable pouch is contained in the foil lid such that when pressure generates during

cooking, the pouch opens and allows the contents to mix. The pouch optionally has a perforation to render it weaker.

[0007] While each of these solutions provide their advantages, there remains a need for containers that allow components to be stored separately and mixed prior to use in a controlled manner and without opening the container. This is particularly important for applications that may be sensitive to contamination by oxygen or bacteria, or to prevent unwanted chemical reactions between the components.

SUMMARY OF THE DISCLOSURE

[0008] The present disclosure relates to a container comprising

a sealing layer having a first side and a second side, the second side of the sealing layer being on the opposing face to the first side of the sealing layer; a first formed section bonded to the first side of the sealing layer via a first seal; and a second formed section bonded to the second side of the sealing layer via a second seal; wherein the first formed section and sealing layer together define a first compartment; the second formed section and sealing layer together define a second compartment; and the sealing layer comprises a rupturable zone that separates the first and second compartments that, when ruptured, allows the first and second compartments to come into fluid communication with one another in a combined compartment.

[0009] The present disclosure also relates to a container comprising

a first formed section; a second formed section; and a sealing layer, wherein the first formed section is bonded to a first side of the sealing layer by a first seal having an inner and outer perimeter, said first formed section forming a first compartment with said sealing layer, the second formed section is bonded to a second side of the sealing layer by a second seal having an inner and outer perimeter, said second formed section forming a second compartment with said sealing layer, the second side of the sealing layer being on the opposing face to the first side of the sealing layer, said first compartment being in registration with said second compartment, such that the inner perimeter formed by the second seal is congruent with or lies within the outer perimeter formed by the first seal, and wherein the sealing layer comprises a rupturable

zone in the area where the sealing layer separates the first and second compartments.

[0010] The container is thus constructed such that when the rupturable zone is ruptured, the first and second compartments form a combined compartment.

[0011] The present disclosure also relates to a method of forming a container comprising:

providing a first material, a second material and a sealing layer having a first and a second side, the first side being on the opposing face to the second side;

sealing the first side of the sealing layer on the first material to form a first compartment, and sealing the second side of the sealing layer on the second material to form a second compartment;

wherein

the sealing layer comprises a rupturable zone that separates the first and second compartments that, when ruptured, allows the first and second compartments to come into fluid communication with one another in a combined compartment.

[0012] The present disclosure also relates to a method of forming a container comprising:

providing a first material, a second material and a sealing layer having a first and a second side, the first side being on the opposing face to the second side;

sealing the first side of the sealing layer on the first material to form a first compartment, and sealing the second side of the sealing layer on the second material to form a second compartment;

wherein

said first compartment is in registration with said second compartment, such that the inner perimeter formed by the second seal is congruent with or lies within the outer perimeter formed by the first seal, and

wherein the sealing layer comprises a rupturable zone in the area where the sealing layer separates the first and second compartments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Figure 1 shows a schematic of the container of the disclosure.

Figure 2a shows a plan view of a container of the disclosure.

Figure 2b shows a side view of a container of the disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0014] The present disclosure relates to a container comprising two compartments on either side of a sealing layer, wherein the compartments are in registration such that the first compartment and the second compartment are separated only by the sealing layer having a rupturable zone.

[0015] When the rupturable zone is ruptured, the first and second compartments come into fluid communication with one another in a combined compartment, which is defined by the volume of the first and second compartments combined (i.e. the first and second compartments together make up the combined compartment, and the contents of the first and second compartments are in fluid communication in the combined compartment).

[0016] By "sealing layer" is meant a thin film of material that is capable of forming a seal with other materials, particularly polymeric materials such as thermoformable materials, on both its first and second side. Typically, the sealing layer is capable of forming a seal by heat sealing. The first and second seals are thus typically formed by heat sealing.

[0017] By "first side" or "second side" of the sealing layer is meant the planar surfaces of the sealing layer rather than the thin edge portions. The first and second sides are the opposite faces of the sealing layer.

[0018] The sealing layer is bonded to the first/second formed sections via a first/second seal to form the first/second compartments respectively. As the compartments are completely enclosed volumes, the seal forms a continuous loop which has an "inner perimeter" that is inside the first/second compartment, and an "outer perimeter" that is outside the first/second compartment.

[0019] Typically, at least one of the first or second seals is peelable, with the first seal most often being peelable.

[0020] By "peelable" is meant capable of being pulled apart, such that the sealing layer can be peeled off the formed section.

[0021] The peel strength of a seal may be measured using ASTM F88, typically with a test speed of 100 mm/min, and usually with Technique A (unsupported).

[0022] Typical values for a peelable seal are below 30 N/15 mm, desirably below 20 N/15 mm, for example from 2 to 30 N/15 mm, or from 2 to 20 N/15 mm.

[0023] Peel strength values of from 2 to 6 N/15 mm are generally regarded as 'easy opening'. To ensure the container is not opened unintentionally (e.g. during transport), it is desirable that the peel strength is above these lower levels, e.g. above 5 N/15 mm, desirably above 6 N/15 mm or above 7 N/15 mm.

[0024] More desirable peel strength values are therefore from 5 to 20 N/15 mm, or from 6 to 15 N/15 mm or from 7 to 12 N/15 mm.

[0025] By way of example, peel strength values for a typical 'tray' application (e.g. microwaveable food products) are from 6 to 15 N/15 mm, more typically from 7 to 12 N/15 mm.

[0026] Typically, the first/second and combined compartments are water tight. Optionally, the first/second and combined compartments are water tight and air tight.

[0027] By "water tight" is meant that liquids such as water cannot escape from the compartment, i.e. the compartments are sealed with no holes or openings which allow liquids to leak out.

[0028] By "air tight" is meant that the compartment is sealed to be gas impermeable.

[0029] A gas impermeable material (or e.g. compartment) typically has an oxygen transmission rate as measured according to ASTM F1927 (in ml/m²/24 hrs measured at 23°C, 50% relative humidity) of below 100, more typically below 50, desirably below 20, more desirably below 10, even more desirably below 1.

[0030] Typical requirements for the oxygen transmission rate of packaging materials are below around 10 for fresh food, and below 0.5 for fruit juices or dried foods such as coffee, powdered milk.

[0031] A water tight material (or compartment) may further be characterised by its water vapour transmission rate (WVTR), for example as measured by ASTM F1249. A water tight material typically has a WVTR as measured according to ASTM F1249 (in ml/m²/24 hrs measured at 25°C, 75% relative humidity) of below 10, more typically below 5, more typically below 2, desirably below 1.

[0032] Typically, the first compartment contains a first substance, and the second compartment contains a second substance.

[0033] The first and second substance can be solid, liquid or gas, typically solid or liquid, with liquids being the most commonly used. Typically, at least one of the first or second substances is a liquid.

[0034] Suitable first and second substances include food products, paints, adhesives, and healthcare/medical products. The container disclosed herein allows the two substances to be stored isolated from one another, and then mixed prior to use in a controlled atmosphere and environment before the container is opened. Thus, the rupturable zone that separates the first and second compartments acts as an easily rupturable membrane that, when broken, allows the first and second compartments to come into fluid communication with one another in a combined compartment.

[0035] For instance, the first substance could be a fruit juice, while the second substance is a vitamin or other food supplement. The container disclosed herein allows the vitamins to be added to the juice just before it is served. In this way, acid sensitive vitamins/supplements could be added to acidic juices just before serving without any risk of degradation during storage of the product.

[0036] The first formed section typically contains a feature comprising a first recess and a first rim, wherein the entire perimeter of the first rim lies in a plane and the first recess is entirely on one side of that plane. In this way, when the first formed section is bonded to the sealing layer, the sealing layer can remain flat and form a seal with the entire perimeter of the first rim of the feature to

form the first compartment from the first recess.

[0037] In a similar manner, the second formed section also typically contains a feature comprising a second recess and a second rim, wherein the entire perimeter of the second rim lies in a plane and the second recess is entirely on one side of that plane. In this way, when the second formed section is bonded to the sealing layer, the sealing layer can remain flat and form a seal with the entire perimeter of the second rim of the feature to form the second compartment from the second recess.

[0038] Although the flat rims allow the sealing layer to bond to the formed sections around the entire rim, this does not mean that the seal is always formed across the entire width of the rims. Indeed, often the first and/or second seal extend partially across the first/second rim. An advantage of bonding the sealing layer only partially across the first/second rim is the sealing layer becomes easier to peel apart from the first/second formed section, facilitating easy opening of the container.

[0039] Thus, the first rim of the first formed section has an inner and outer perimeter, and the inner and outer perimeter of the first seal are congruent with or lie within the inner and outer perimeter of the first rim. Likewise, the second rim of the second formed section has an inner and outer perimeter, and the inner and outer perimeter of the second seal are congruent with or lie within the inner and outer perimeter of the second rim.

[0040] In this context, "lie within" means are located between the inner and outer perimeter. It is of course self-evident that the perimeters of the first/second seal cannot lie outside the perimeters of the first/second rim, as the seals are formed by bonding the sealing layer to the first/second formed section.

[0041] The first and second recesses are typically formed from a continuous piece (i.e. the first and second recess do not contain any openings or holes), such that when the sealing layer is bonded to the first/second rim, the first/second compartments are sealed.

[0042] The first and/or second formed sections may contain additional recesses that, together with the sealing layer, may make up additional compartments in the container. For instance, the first formed section may contain additional recesses that, together with the first side of the sealing layer, form a third compartment, fourth compartment etc. The third and additional compartments may optionally have counterpart compartments on the second side of the sealing layer in registration therewith, depending on the intended use of the container.

[0043] The first and second compartments are formed on opposite sides of the sealing layer. In other words, a first surface of the sealing layer is used to form the lid of the first compartment, and the second surface of the sealing layer is used to form the lid of the second compartment. In view of this, the first surface of the sealing layer is capable of bonding to the first formed section and second surface of the sealing layer is capable of bonding to the second formed section.

[0044] Typically, the sealing layer is a three layer com-

posite film comprising a first bonding layer, a structural layer, and a second bonding layer.

[0045] The first and second bonding layers are the layers of the sealing film that are capable of forming the seal with the formed section. The first and second bonding layers will typically be made from the same material.

[0046] Typically, the first and second bonding layers will be formed from a heat sealable material. Typical heat sealable materials are polymers with a relatively low melting point (e.g. 80-150°C, typically 100-130°C), such that when exposed to heat sealing conditions (temperatures of typically 120-160°C and pressure) the polymers melt and form a bond.

[0047] Suitable heat sealable materials include polyethylene and polypropylene, with polyethylene being particularly suitable. An exemplary material that may be used is CA7230 of Borealis, which is a low density polyethylene that can be formed into films.

[0048] The structural layer of the sealing layer provides structural strength to the layer, so typically it is unaffected by heat sealing, and has relatively high tensile strength and tear strength. This allows the sealing layer to act as a lid to the first compartment which is capable of being removed in an easy manner such as by peeling off. The structural layer may also provide the barrier properties for the sealing layer, preventing the substances in the first and second compartments from mixing. Alternatively, the barrier properties may be provided by an additional layer, such as a metalised (or foil) layer.

[0049] Typical materials for the structural layer include polymers such as polyesters or polyolefins; metal foils such as aluminium foil; paper, or metalised polymers.

[0050] Exemplary materials for the structural layer include polyesters such as polyethylene terephthalate (PET, such as Ramapet N180 from UAB Indoramer Polymers), polyolefins such as polypropylene, and polyvinyl alcohols (such as Eval F104B from Eval Europe). Typically, the structural layer is oriented to improve its strength. For example, the structural layer may be formed from oriented polyethylene terephthalate (O-PET, such as Mylar 800 from DuPont Teijin Films) or oriented polypropylene (O-PP).

[0051] The formed section may be made from a variety of materials, with the first and second formed section being made from the same or different materials. Typically the formed section comprises a polymeric material.

[0052] By "formed section" is meant a component that is formed into a three-dimensional shape, such that together with a sealing layer (which is typically planar) it may form an enclosure.

[0053] Typically, the formed section is formed by thermoforming a thermoformable material. In these embodiments, the formed section may be called a thermoformed section.

[0054] Typically, the material used to form the formed section will be a multilayer material comprising a thermoformable layer, an optional barrier layer, and a bonding layer.

[0055] The bonding layer is the layer of the material that is capable of forming the seal with the sealing layer. Typically, the bonding layer is formed from a heat sealable material as described above with reference to the sealing layer.

[0056] The thermoformable layer will be formed from any suitable material including polyolefins, polystyrene, polycarbonate, amorphous polyethylene terephthalate (Apet), and polyvinyl chloride, more desirably polyesters such as polyethylene terephthalate, and polyolefins such as polyethylene or polypropylene.

[0057] The optional barrier layer is included if the first and second compartments are required to be gas impermeable. Suitable materials for the barrier layer include ethylene vinyl alcohol copolymer.

[0058] Alternatively, one or both of the formed sections may be made by injection moulding. Suitable materials for injection moulding are known in the art, and include polyamides such as nylon, polyethylene terephthalate, polyolefins such as polyethylene and polypropylene, polystyrene, polyvinyl chloride, and polylactic acid.

[0059] The first and/or second formed sections may also be formed by blow moulding, either prior to formation of the container as a separate manufacturing step, or as an integral step in the method of forming the container.

[0060] The first and second formed sections are bonded to the opposite sides of the sealing layer so as to be in registration with one another, such that the inner perimeter formed by the second seal is congruent with or lies within the outer perimeter formed by the second seal. This ensures that the first and second compartments are separated only by the sealing layer.

[0061] Typically, the inner perimeter formed by the second seal is congruent with or lies within the inner perimeter formed by the second seal.

[0062] The outer perimeter of the second seal may lie completely within the inner perimeter of the first seal. However, typically, the first and second seal overlap to some extent.

[0063] Typically, the outer perimeter of the second seal is congruent with the outer perimeter of the first seal. However, if the outer perimeters of the first and second seals are completely congruent, then the container may be difficult to open unless the first formed section, sealing layer or second formed section comprises a portion that extends beyond the first and second seals. This portion can then be gripped and used to pull apart the seal, enabling the sealing layer to be removed from the first or second formed section, opening the container to allow access to its contents.

[0064] By "opening the container" is meant interfering with the integrity of the first, second or most typically combined compartment to allow the contents thereof to be accessed. Most typically, this is done by peeling apart the seal between the sealing layer and the first or second formed section. Typically, the container is opened after the rupturable zone has been ruptured and the contents have been mixed in the combined compartment. As used

herein, "opening the container" is therefore typically synonymous with "opening the combined compartment".

[0065] The container may comprise a tab that allows the container (i.e. first, second or most typically combined compartment) to be opened by peeling apart the first and/or second seals.

[0066] The tab may be formed from the first formed section, second formed section, sealing layer, or any combination thereof. Typically, the tab is formed from a portion of the first formed section, second formed section and/or sealing layer that extends beyond the outer perimeter of the first and/or second seals.

[0067] Often, the relative size and shape of the first and second compartments will mean that the first compartment is larger and will more naturally act as the base of the container, while the second compartment is smaller and effectively is located on the lid of the container, in which case the tab is typically formed from the sealing layer optionally together with the second formed section. This more easily allows the sealing layer to be peeled away from the first formed section, removing the 'lid' of the first compartment.

[0068] For instance, the tab could be formed from the sealing layer and second formed section that extends beyond the outer perimeter of the first seal. The tab could be formed from a portion where the first formed section, sealing layer and second formed section are all in registration and congruent with one another, but the sealing layer is not bonded to the first formed section. Alternatively, the sealing layer and second formed section may also extend beyond the outer perimeter of the rim of the first formed section.

[0069] Forming the tab from at least one of the first or second formed sections is advantageous, as these typically have a higher tensile and tear strength than the material used to form the sealing layer. A tab formed from the sealing layer alone would typically not be strong enough, and there is a risk that such a tab may simply tear or break when it is pulled.

[0070] The tab is typically sized to allow it to be easily held by a person between their pinched fingers, such that a person may pinch the tab and peel the container apart. The tab may comprise two flaps that are held with either hand, such that one flap is held with the left hand and one flap held with the right hand and the container is peeled apart. Alternatively, the tab may comprise one flap shaped such that the container may be peeled open by one hand when the container is held in the user's other hand, or when the container is standing on a surface optionally supported by a user's other hand.

[0071] The sealing layer furthermore comprises a rupturable zone in the area where the sealing layer separates the first and second compartments.

[0072] By "rupturable zone" is meant an area where the sealing layer has been structurally compromised to reduce its strength. In this way, the sealing layer is more easily broken in the rupturable zone, allowing the first and second compartment to come into fluid communica-

tion with one another (i.e. be formed into a single compartment) when the rupturable zone is broken.

[0073] Typically, the rupturable zone is formed by laser etching the sealing layer. For instance, in a sealing layer comprising a three layer film as described above, the rupturable zone may be formed by laser etching the sealing layer to remove the second bonding layer and at least part of the structural layer (typically all of the structural layer) of the sealing layer. This forms a rupturable perforation in the sealing layer which has reduced tensile strength and tear strength allowing the sealing layer to be more easily broken.

[0074] Suitable apparatus for laser etching films are known in the art.

[0075] The rupturable zone can in principle be any shape, such as a line, or more than one intersecting lines. Alternatively, the rupturable zone could be in the form of an incomplete shape such as a crescent or three sided square, so as to form a flap that is capable of opening when the rupturable zone breaks.

[0076] When the rupturable zone breaks, the first and second compartments are combined into a single compartment (i.e. the combined compartment). However, this occurs without the first and second seals being compromised. The first and second compartments therefore combine and allow mixing of their contents without the container as a whole being opened.

[0077] The rupturable zone is typically ruptured due to a build-up of pressure in the second compartment. The increased pressure causes the rupturable zone to break without compromising the first seal.

[0078] When the contents of the second compartment are liquid, the liquid components become forced through the rupture in the rupturable zone due to the increased pressure in the second compartment. In such embodiments, it is preferable that the rupturable zone ruptures to leave a narrow opening. The pressure then forces the liquid through the narrow opening to form a spray, which facilitates rapid mixing with the contents of the first compartment.

[0079] A suitable shape for the rupturable zone to promote such jet formation is a single slit.

[0080] In contrast, when the contents of the second compartment are a viscous liquid (e.g. a gel), or a solid such as a powder, it is advantageous for the rupturable zone to form a wide opening when rupturing. This allows the contents to be more easily transferred from the second compartment to the first compartment. When the contents of the first compartment are a liquid, the container can be manipulated to allow the liquid contents to wash out the second compartment.

[0081] Suitable shapes for the rupturable zone to promote easy transfer of solids or viscous liquid components are flaps or crossed slits.

[0082] The increase in pressure may be caused by the contents of the second compartment being heated, for example if the container is placed in an oven or microwave.

[0083] The increase in pressure may also be caused by the second compartment being deformed, for example by being squeezed or pressed by a person's finger. To facilitate this possibility, the second formed section is typically formed from a deformable material.

[0084] By "deformable material" is meant a material that is capable of being deformed or bent out of shape without breaking or cracking. Typically, a sheet of "deformable material" is capable of being folded in two without breaking or cracking.

[0085] The first and second formed sections may in principle be formed from any materials. However, in practice some materials may be more suitable depending on the end use.

[0086] For instance, in embodiments where the rupturable zone is intended to break when the contents of the second compartment are heated, the first formed section, sealing layer and second formed section are typically formed from materials capable of tolerating heat, and particularly both heat and microwave radiation.

[0087] In embodiments where the rupturable zone is intended to break due to the second compartment being deformed, the second formed section is typically formed from a deformable material.

[0088] In embodiments where the container is used to house food products or medical products, the first and second formed sections and the sealing layer are typically formed from materials that can tolerate heat, such as pasteurisation conditions or autoclave sterilisation, and/or ionizing radiation, such as ionizing radiation capable of causing sterilisation by irradiation.

[0089] Alternative forms of sterilisation may also be used, such as gas sterilisation (e.g. ethylene oxide sterilisation). Typically, these sterilisation methods involve lower temperatures (e.g. 30-50°C), but the materials used in the container must be compatible with the sterilisation gasses.

[0090] The first and second compartments are on opposite sides of the sealing layer. It is typical that the first compartment forms the base of the container that rests on the underlying surface, with the second compartment effectively being bonded to and protruding above the lid of the first compartment. When intended to be oriented in this way, the first compartment should be capable of supporting the weight of the second compartment. As such, the first formed section is typically configured to be capable of holding its shape, for example by having features that help the compartment retain its shape and prevent buckling such as striations, grooves or indents. The first formed section may also be formed from a more rigid material or be thicker than the second formed section, to provide greater strength.

[0091] To ensure the container is stable when on a flat surface, it is that the first formed section may contain a flat bottom. The centre of mass of the container typically lies within the perimeter formed by the flat bottom, such that the container is less prone to toppling over.

[0092] Typically the flat bottom of the first compartment

is parallel to the plane formed by the sealing layer, and that the second compartment is in registration with the flat bottom. The flat bottom may contain a feature which is complementary in shape to the second compartment, and which is oriented in registration with the second compartment. In this way, multiple containers can be stacked on top of one another, with the second compartment of a first container fitting in the feature having the complementary shape in the bottom of a second container stacked on top of the first container.

[0093] The first and second compartments can be of equal volume. However, typically, the second compartment is smaller than the first compartment.

[0094] The first compartment is typically in registration with said second compartment, such that the inner perimeter formed by the second seal is congruent with or lies within the outer perimeter formed by the first seal.

[0095] Ultimately, the relative size of the first and second compartments will depend on the end use.

[0096] For instance, the first compartment may hold a food product such as a yoghurt, while the second compartment holds a topping such as a syrup, in which case the second compartment is typically around 10-20% the volume of the first compartment. The syrup can then be squeezed out onto the yoghurt before sealing layer (i.e. the lid of the first compartment) is peeled off and removed.

[0097] Another example of a use is a paint product, in which the first compartment contains a first paint, while the second compartment contains a second paint. The paint may be used by simply removing the sealing layer (i.e. the lid of the first compartment) and using the first paint, or alternatively by releasing the contents of the second compartment then removing the lid to provide a paint mixture of first and second paint.

[0098] For instance, the first paint could be a white paint and the second paint could be a coloured paint, in which case the container is capable of providing either a white paint or a coloured paint.

[0099] In principle, the second formed section could provide multiple compartments, with a second, third, fourth etc. compartment being formed on the same side of the sealing layer and each having a rupturable zone separating the respective compartment from the first compartment.

[0100] For instance, in the case of paints, the container would then be capable of providing paints of a variety of shades depending on which paint components are added from the second, third, fourth etc. compartments to the first compartment.

[0101] A further example where multiple compartments may be desirable is microwaveable meals. For instance, the first formed section may contain three recesses that form three compartments together with the first side of the sealing layer, a first and third compartment. The second compartment is then in registration with the first compartment, whilst the third compartment has no counterpart compartment on the second side of

the sealing layer. In use, the first compartment may contain a stir fry style sauce and the third compartment contains rice, whilst the second compartment contains a nut product such as peanuts. The container then allows the nut product to be separated from the stir fry style sauce, such that consumers with nut allergies can choose not to add this ingredient when preparing the meal.

[0102] Still a further example of a multi-compartment container has a first compartment containing a meat such as steak, and a third compartment containing vegetables, both formed from the first formed section in combination with the first side of the sealing layer. The container has a corresponding second and fourth compartment in registration with the first compartment, both formed from the second formed section and the second side of the sealing layer, and both having a rupturable zone in the sealing layer separating them from the first compartment. The second compartment and fourth compartment may then contain alternative sauces for the meat, such as peppercorn sauce or red wine sauce. The consumer can then choose which sauce to have with the meat, and press on either the second or fourth compartments to add the sauce prior to heating.

[0103] A further use of the container is for two component adhesive compositions. In such embodiments, the first compartment could hold the resin component, and the second compartment could hold the hardener. Once the hardener is combined with the resin component, the lid can be removed and the adhesive applied as needed.

[0104] The container finds particular use in the healthcare sector, as it allows mixing of the two components in a sealed and sterile environment.

[0105] One example in the healthcare sector would be to reconstitute a lyophilised protein or antibody prior to use. For example, the first compartment could contain a sterile liquid such as a buffer or saline solution, and the second compartment could contain the lyophilised protein or antibody.

[0106] A further use is to prepare a mixture from a concentrate which is diluted prior to use, for example prior to intravenous injection. In which case the first compartment against contain a sterile liquid such as a buffer or saline solution, and the second compartment could contain the drug concentrate.

[0107] In many instances in the healthcare sector, it is preferable for the container to allow the contents to be extracted with a syringe without opening the container by peeling apart the first or second seal. This allows mixtures for intravenous use to be prepared and directly transferred to a syringe or intravenous drip without exposing the contents to a non-sterile environment.

[0108] Thus, the container may contain a membrane that is puncturable by a syringe. Typically, the sealing layer is puncturable by a syringe. This allows the contents of the container to be removed using a syringe without peeling the sealing layer away to open the container.

[0109] The container is typically arranged such that the second compartment is effectively bonded to the lid of

the first compartment. In use, the container therefore allows the contents of the second compartment to be mixed with the contents of the first compartment before the container is opened. Effectively, the sealing layer acts as a lid to the first compartment which can be removed to access the contents.

[0110] When the sealing layer is removed, the first formed section acts as an open housing that holds the mixed contents of the first and second container. These contents may be poured out and/or removed with a utensil such as a brush, spoon, knife, spatula, syringe or the like.

[0111] The first formed section may be shaped to allow pouring of its contents. In other words, the first formed section typically comprises a spout or the like to ensure that liquid contents can be poured out in a more controlled manner.

[0112] As set out above, the container disclosed herein may find many different uses. The shape and size of the container therefore can vary quite significantly depending on its intended use. For instance, even in the food industry there is a significant amount of variation in the possible and suitable sizes that could be used.

[0113] For example, a yoghurt pot is typically around 100-150 ml for a single serving pot. In this embodiment, it would also be shaped to be capable of being held in a human hand, while also capable of being used while standing on a surface. In contrast, packaging for microwave dinners will typically comprise a wide tray shaped like a shallow bowl. These are more suited to being used while standing on a flat surface, and are shaped such that they can be carried while holding the rim of the first formed section (i.e. the first rim). Nevertheless, by way of guidance, suitable volumes of the first and second compartment are provided below.

[0114] Typically, the overall volume of the container (i.e. the combined compartment) is from 10 to 2000 ml, such as from 10 to 1000 ml, or from 10 to 250 ml or from 15 to 150 ml.

[0115] Typically, the volume of the first compartment is from 5 to 1950 ml, such as from 5 to 950 ml, or from 5 to 200 ml, or from 10 to 130 ml.

[0116] Typically, the volume of the second compartment is from 1 to 1000 ml, such as from 1 to 500 ml, or from 1 to 50 ml, or from 2 to 20 ml.

[0117] The first and second compartment come into fluid communication with one another once the rupturable zone is ruptured to form a combined compartment. To ensure that the contents of the first and second compartments can mix, the total volume of the first substance and second substance is typically less than the volume of the first compartment. This way, the contents can mix in the combined compartment but, once settled, will fit within the first formed section, or in other words the volume that corresponds to the first compartment prior to formation of the combined compartment. This allows the combined compartment to be opened with the mixture of first and second substances being able to remain in the

first compartment once the lid is removed.

[0118] As the first and second substances may be mixed without the container being opened, it is preferable that the first and second substances do not effervesce upon mixing. Any effervescence that did occur on mixing would increase the pressure in the combined compartment which may lead to rupture of the first and/or second seal in an unpredictable and uncontrolled manner.

[0119] The container disclosed herein typically comprises two formed sections that sandwich a sealing layer. The container may be made by sealing the layer to the pre-shaped formed sections, or by pre-bonding the sealing layer to the material, thermoforming the material, filling the compartments and finally sealing the container.

[0120] Thus, the method disclosed herein may comprise

- i. providing a second material in the form of a second formed section;
- ii. sealing a second side of a sealing layer to the second formed section to form a second compartment; and
- iii. sealing a first formed section to the first side of said sealing layer to form a first compartment.

[0121] Thus, the second compartment is typically produced before the first compartment. This is the typical method of manufacturing the container disclosed herein, since the perimeter formed by the second seal is typically congruent with or lies within the perimeter formed by the first seal. In areas where the second seal lies within the first seal, the face on the first side of the sealing layer opposite the second seal defines the wall of the first compartment and is therefore within the first compartment. It is not therefore possible to apply any pressure to this part of the sealing layer to urge it against the second formed section and form the second seal, since any means needed to apply that pressure (e.g a mechanical press) would need to be within the first compartment, which is not possible.

[0122] In some embodiments, the outer perimeter of the second seal lies within the outer perimeter of the first compartment.

[0123] While this construction is possible, the outer perimeter of the first seal is typically congruent and in registration with the outer perimeter of the second seal in the container. In embodiments with this construction, typically the inner perimeter of the second seal lies within the inner perimeter of the first seal when the second compartment has a smaller volume than the first compartment.

[0124] Of course, the container disclosed herein typically contains the first and second substance in the first and second compartments respectively. The method disclosed herein therefore typically includes the steps of providing a first substance and providing a second substance.

[0125] Thus, the method may comprise the step:

sealing the first side of the sealing layer on the first formed section to form a first compartment containing a first substance, and sealing the second side of the sealing layer on the second formed section to form a second compartment containing a second substance.

[0126] The method therefore typically comprises:

- i. providing the second material in the form of a second formed section;
- ii. sealing the second side of the sealing layer to the second formed section to form the second compartment containing a second substance; and
- iii. sealing the first material in the form of a first formed section to the first side of said sealing layer to form a first compartment containing a first substance.

[0127] Alternatively, the method may comprise:

- a. providing a first thermoformable material as the first material, the sealing layer, and a second thermoformable material as the second material;
- b. bonding the first thermoformable material to a first side of the sealing layer and the second thermoformable material to the second side of the sealing layer, wherein the bonding pattern between the first thermoformable material and the first side of the sealing layer comprises a first channel, and the bonding pattern between the second thermoformable material and the sealing layer comprises a second channel;
- c. thermoforming the first thermoformable material by forcing air through the first channel to urge the first thermoformable material to deform, then sealing the first channel to form a first compartment, and thermoforming the second thermoformable material by forcing air through the second channel to urge the second thermoformable material to deform, then sealing the second channel to form a second compartment.

[0128] Step c. may be carried out stepwise (i.e. the first thermoformable material is deformed, then second thermoformable material is deformed, or vice versa), or simultaneously. Likewise, the complete first compartment may be formed before the second thermoformable material is deformed (i.e. the first thermoformable material is deformed and the channel sealed prior to thermoforming of the second thermoformable material) and vice versa, or alternatively the thermoforming may occur followed by the sealing steps to form the compartments.

[0129] Typically, in step a. the first thermoformable material, second thermoformable material and sealing layer are all in sheet form.

[0130] By "sheet form" is meant the materials are planar. Typically, the materials will be in the form of a sheet

from a roll in a continuous production process.

[0131] In this method, the thermoforming step is carried out after the sealing layer has been prebonded to the thermoformable materials by forcing air through the channel to urge the thermoformable materials to deform. The thermoforming steps may be carried out stepwise in any order, or simultaneously.

[0132] The bonding step between the first thermoformable material and the sealing layer typically forms a first pocket and a first channel, such that the first pocket forms a first enclosure which is accessible only via the first channel. Likewise, the bonding step between the second thermoformable material and the sealing layer typically forms a second pocket and a second channel, such that the second pocket forms a second enclosure which is accessible via the second channel.

[0133] Typically, air is forced through the first/second channel using a spigot which is inserted into the respective channel. The thermoforming mould can then clamp around the spigot forming a tight seal, allowing the shape to be precisely controlled once the air is forced into the first/second pocket.

[0134] Following thermoforming, the spigot can be removed and the first and second channels sealed to form the first and second compartments of the container from the first and second pockets respectively.

[0135] Of course, the container typically contains the first and second substance in the first and second compartments respectively. This method therefore typically comprises:

- a. providing a first thermoformable material as the first material, the sealing layer, and a second thermoformable material as the second material;
- b. bonding the first thermoformable material to a first side of the sealing layer and the second thermoformable material to the second side of the sealing layer, wherein the bonding pattern between the first thermoformable material and the first side of the sealing layer comprises a first channel, and the bonding pattern between the second thermoformable material and the sealing layer comprises a second channel;
- c. thermoforming the first thermoformable material by forcing air through the first channel to urge the first thermoformable material to deform, then sealing the first channel to form a first compartment containing a first substance, and thermoforming the second thermoformable material by forcing air through the second channel to urge the second thermoformable material to deform, then sealing the second channel to form a second compartment containing a second substance.

[0136] The first and second substances are typically introduced into the first and second compartments through the first and second channels respectively. The method therefore typically comprises:

- a. providing a first thermoformable material as the first material, the sealing layer, and a second thermoformable material as the second material;
- b. bonding the first thermoformable material to a first side of the sealing layer and the second thermoformable material to the second side of the sealing layer, wherein the bonding pattern between the first thermoformable material and the first side of the sealing layer comprises a first channel, and the bonding pattern between the second thermoformable material and the sealing layer comprises a second channel;
- c. thermoforming the first thermoformable material by forcing air through the first channel to urge the first thermoformable material to deform, introducing a first substance to the volume formed after thermoforming of the first thermoformable material via the first channel, then sealing the first channel to form a first compartment containing a first substance, and thermoforming the second thermoformable material by forcing air through the second channel to urge the second thermoformable material to deform, introducing a second substance to the volume formed after thermoforming of the second thermoformable material via the second channel then sealing the second channel to form a second compartment containing a second substance.

[0137] The first and second substances are introduced into what become the first and second compartments via the first and second channels respectively. These introducing steps may utilise the same spigot as used during thermoforming, or alternatively different spigots.

[0138] As set out above, step c. may be carried out stepwise (i.e. the first thermoformable material is deformed, then second thermoformable material is deformed, or vice versa), or simultaneously. Likewise, the complete first compartment may be formed before the second thermoformable material is deformed (i.e. the first thermoformable material is deformed, the first substance introduced and the channel sealed prior to thermoforming of the second thermoformable material) and vice versa, or alternatively the thermoforming and introducing in the first (or second) section may occur, followed by thermoforming and introducing in the second (or first) section, finally followed by the sealing steps to form the compartments containing the first and second substances. Any or all of the thermoforming, introducing and sealing steps could also be simultaneous.

[0139] Typically, the first and second channels are sealed simultaneously. This is easy to do by heat sealing the perimeters of the first and second compartments to finalise the container. However, this may be difficult if the second seal lies within the perimeter of the first seal, as it is often then not possible to heat press the second seal at these locations. The seal to form the second compartment is then typically formed first.

[0140] There is a great deal of flexibility in the order of

steps. The thermoforming of both the first and second materials may occur before either the first or second substances are introduced, or alternatively one compartment may be thermoformed, filled with substance and sealed followed by the second compartment.

[0141] When producing the container, the rupturable zone can already be present on the sealing layer prior to formation of the first and/or second compartments, or the rupturable zone may be formed after formation of the second compartment and prior to formation of the first compartment.

[0142] Typically, the rupturable zone is present on the sealing layer prior to formation of the first and second compartments.

[0143] In either method, the container may be formed from pre-cut materials and sealing layer, or from larger samples of the materials that are cut to shape during or after the process, or a mixture of both.

[0144] It is more cost efficient to produce the containers in a continuous process, and therefore the method typically uses rolls of sealing material, and also typically rolls of thermoformable materials.

[0145] The method therefore typically includes a step of die-cutting the materials to shape. This die cutting step can in principle occur at any stage, for instance after the formation of the second compartment the compartment may be die-cut to shape and transferred for bonding to the first thermoformable material to form the first compartment.

[0146] Alternatively, the first compartment may be formed while the sealing layer is still in roll form (said sealing layer having bonded thereto one or more second compartments). In which case, the container is finally formed by die-cutting the container after formation of the first compartment.

[0147] Also disclosed is a process for mixing a first and a second substance in a controlled environment comprising:

providing a container disclosed herein having a first substance in the first compartment and a second substance in the second compartment;
rupturing the rupturable zone in the sealing layer to allow the first and second compartments to come into fluid communication with one another in a combined compartment, and
mixing the first and second substances.

[0148] Typically, the rupturing step is effected by causing the pressure in the second compartment to increase, such as by pushing on the second formed section to deform it.

[0149] A schematic of the container is shown in Figure 1. The container 100 comprises the first formed section 110, second formed section 120 and sealing layer 130. The first formed section 110 and sealing layer 130 together define the first compartment 111, while the second formed section 120 and the sealing layer 130 form the

second compartment 121.

[0150] The sealing layer 130 is bonded to the first formed section 110 by the first seal 115 having an inner 115a and outer 115b perimeter and to the second formed section by the second seal 125 having an inner 125a and outer 125b perimeter. It is further characterised by the rupturable zone 131 which is located between the first compartment 111 and the second compartment 112.

[0151] To help the 'lid' be removed from the container, a tab 140 is formed by the sealing layer 130 and second formed section 120 extending beyond the first formed section 110. The tab 140 is shown as extending beyond the outer perimeter 115b of the first seal 115. An alternative configuration that could be used would be for the tab to be formed from a portion where the first formed section, sealing layer and second formed section are all in registration and congruent with one another, but the sealing layer is not bonded to the first formed section.

[0152] To aid in stability, the first formed section 110 may have a flat bottom 112. The flat bottom includes a feature 130 which is complementary in shape to the second compartment 121 and oriented in registration with the second compartment 121, to allow stacking of the container 100.

[0153] Figure 2a shows a plan view of a container with the measurements of the diameter of the first compartment, the second compartment, the seal and the tab indicated in the figure. Figure 2b shows a side view of the same container again with various dimensions, where the first and second compartments can be seen either side of the sealing layer. The striations on the side of the base compartment provide support for the container, helping it support its own weight and particularly the weight of additional containers during stacking.

[0154] Although the container described herein is indicated as comprising three components (the first formed section, the second formed section and the sealing layer), it should be recognised that additional components may be present in the container, such as decorative components (e.g. stickers, labels etc.), or structural components (e.g. further components that provide support to the first, second and/or combined compartments, or layers that improve the strength of the sealing layer e.g. at the tab).

Claims

1. A container comprising
a sealing layer having a first side and a second side, the second side of the sealing layer being on the opposing face to the first side of the sealing layer;
a first formed section bonded to the first side of the sealing layer via a first seal; and
a second formed section bonded to the second side of the sealing layer via a second seal;
wherein
the first formed section and sealing layer together

- define a first compartment;
the second formed section and sealing layer together
define a second compartment; and
the sealing layer comprises a rupturable zone that
separates the first and second compartments that,
when ruptured, allows the first and second compart-
ments to come into fluid communication with one an-
other in a combined compartment.
2. A container comprising
a first formed section;
a second formed section; and
a sealing layer,
wherein
the first formed section is bonded to a first side of
the sealing layer by a first seal having an inner and
outer perimeter, said first formed section forming a
first compartment with said sealing layer,
the second formed section is bonded to a second
side of the sealing layer by a second seal having an
inner and outer perimeter, said second formed sec-
tion forming a second compartment with said sealing
layer, the second side of the sealing layer being on
the opposing face to the first side of the sealing layer,
said first compartment being in registration with said
second compartment, such that the inner perimeter
formed by the second seal is congruent with or lies
within the outer perimeter formed by the first seal,
and
wherein the sealing layer comprises a rupturable
zone in the area where the sealing layer separates
the first and second compartments, such that when
the rupturable zone is ruptured the first and second
compartments form a combined compartment.
3. The container of claim 1 or claim 2, wherein the first,
second and combined compartments are water and
air tight.
4. The container of any preceding claim, wherein the
sealing layer is a three layer composite film compris-
ing a first bonding layer, a structural layer and a sec-
ond bonding layer.
5. The container of any preceding claim, wherein the
first and second seals are formed by heat sealing.
6. The container of any preceding claim, wherein the
rupturable zone is formed by laser etching the seal-
ing layer.
7. The container of any preceding claim, wherein the
first compartment contains a first substance and the
second compartment contains a second substance
and wherein the first and second substances are se-
lected from, for example, food products; paints; a
two component adhesive comprising a hardener and
a resin; healthcare products.
8. The container of any preceding claim, wherein the
first seal is peelable.
9. The container of any preceding claim, wherein the
first and second sections are thermoformed sec-
tions.
10. A process for mixing a first and a second substance
in a controlled environment comprising:

providing a container as defined in any preced-
ing claim having a first substance in the first com-
partment and a second substance in the second
compartment;
rupturing the rupturable zone in the sealing layer
to allow the first and second compartments to
come into fluid communication with one another
in a combined compartment, and
mixing the first and second substances.
11. The process of claim 10, wherein the rupturing step
is effected by causing the pressure in the second
compartment to increase.
12. A method of forming a container, comprising:

providing a first material, a second material and
a sealing layer having a first and a second side,
the first side being on the opposing face to the
second side;
sealing the first side of the sealing layer on the
first material to form a first compartment, and
sealing the second side of the sealing layer on
the second material to form a second compart-
ment;
wherein
the sealing layer comprises a rupturable zone
that separates the first and second compart-
ments that, when ruptured, allows the first and
second compartments to come into fluid com-
munication with one another in a combined com-
partment.
13. A method of forming a container comprising:

providing a first material, a second material and
a sealing layer having a first and a second side,
the first side being on the opposing face to the
second side;
sealing the first side of the sealing layer on the
first material to form a first compartment, and
sealing the second side of the sealing layer on
the second material to form a second compart-
ment;
wherein
said first compartment is in registration with said
second compartment, such that the inner perim-
eter formed by the second seal is congruent with

or lies within the outer perimeter formed by the first seal, and
 wherein the sealing layer comprises a rupturable zone in the area where the sealing layer separates the first and second compartments, such
 that when the rupturable zone is ruptured the first and second compartments form a combined compartment.

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14. The method of claim 12 or claim 13, wherein the container is as defined in any of claims 1-9, such that the first formed section is formed from the first material, and the second formed section is formed from the second material.

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15. The method of any of claims 12 to 14, comprising the steps:

- i. providing the second material in the form of a second formed section;
- ii. sealing the second side of the sealing layer to the second formed section to form the second compartment containing a second substance; and
- iii. sealing the first material in the form of a first formed section to the first side of said sealing layer to form the first compartment containing a first substance

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16. The method of any of claims 12 to 14, comprising the steps:

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- a. providing a first thermoformable material as the first material, the sealing layer, and a second thermoformable material as the second material;
- b. bonding the first thermoformable material to a first side of the sealing layer and the second thermoformable material to the second side of the sealing layer, wherein the bonding pattern between the first thermoformable material and the first side of the sealing layer comprises a first channel, and the bonding pattern between the second thermoformable material and the sealing layer comprises a second channel;
- c. thermoforming the first thermoformable material by forcing air through the first channel to urge the first thermoformable material to deform, then sealing the first channel to form a first compartment, and thermoforming the second thermoformable material by forcing air through the second channel to urge the second thermoformable material to deform, then sealing the second channel to form a second compartment.

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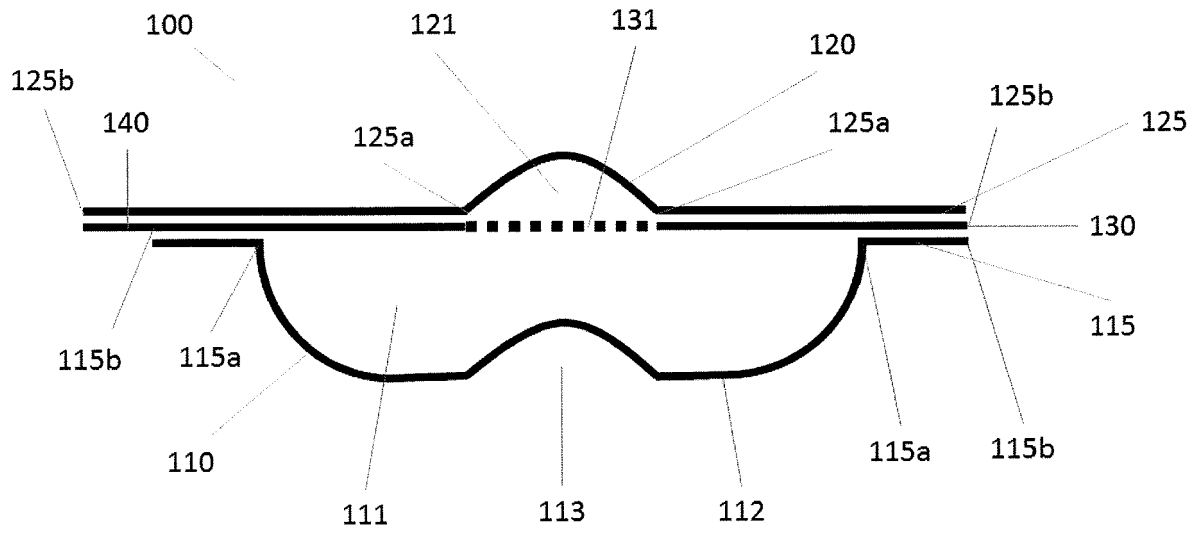


Fig. 1

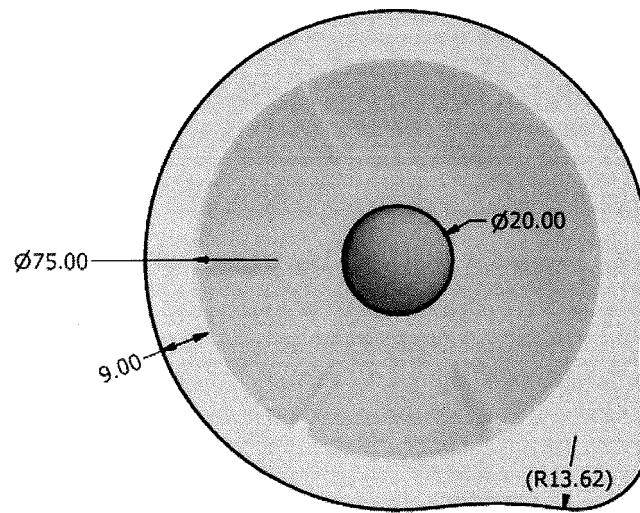


Fig. 2a

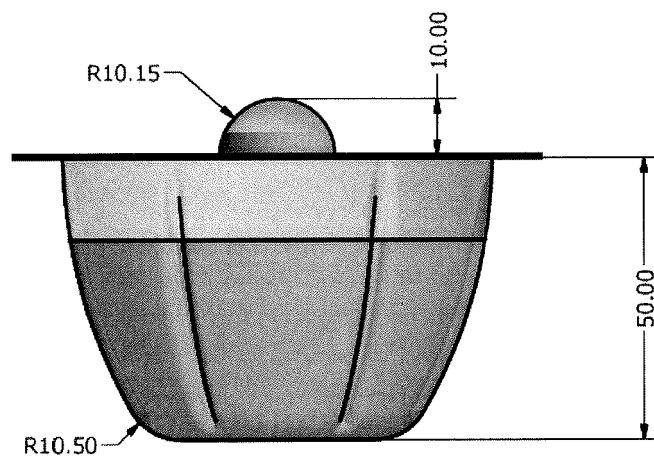


Fig. 2b



EUROPEAN SEARCH REPORT

Application Number
EP 16 17 0258

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Place of search Munich		Date of completion of the search 20 October 2016	Examiner Ngo Si Xuyen, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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20-10-2016

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