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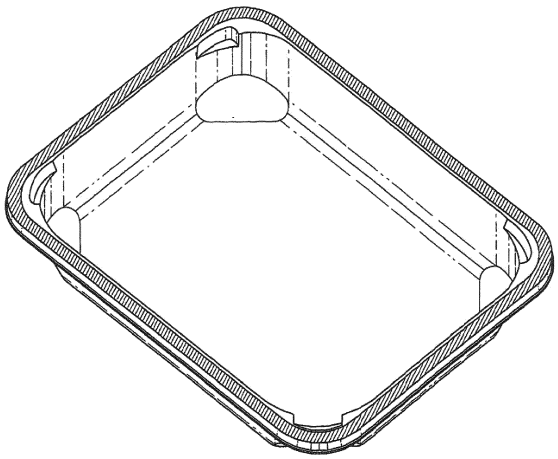
(54) SEALABLE CONTAINER, SEALED CONTAINER AND PROCESSES FOR MAKING THEREOF

(57) The present application relates to a sealable container comprising a base and a continuous side wall extending substantially perpendicular to the base with a peripheral flange formed along the upper edge of the continuous side wall, wherein the base and the continuous side wall consist essentially of PET, wherein a layer of adhesive is located on an upper surface of the peripheral flange such that a lidding film may be sealed to the peripheral flange to create a sealed space between the base, continuous side wall and lidding film. The present application further relates to a process for making said sealed container.

Figure 3



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Description

[0001] This invention relates to containers suitable for use in the packaging, storage, transportation and/or display of a product, such as a fresh food product or a medical product, and to processes for making such containers.

[0002] It is known to use plastic containers to package, store, transport and display fresh food. These containers may be sealed with a lidding film to protect the food within the container from the surrounding environment. Additionally, the atmosphere within such containers may be modified to enhance the shelf life and/or appearance of the fresh food within the container.

[0003] Clear plastic containers may be made of polethylene terephthalate (PET). The use of PET provides a high clarity product that enables a user to view readily the contents of the container. (Recycled PET may also be used, offering environmental and, sometimes, economical benefits.) However, as explained above, it is desirable to seal clear plastic containers with a lidding film, but it is difficult to attach a lidding film to PET and the sealing of a lidding film to PET is particularly sensitive to contamination.

[0004] A known solution to the problem outlined above is making the containers from PET coated with a layer of polyethylene (PE) and an intermediate layer of ethylene vinyl acetate (EVA). The PE provides a surface that a lidding film readily attaches to, thereby facilitating the production of sealed containers. Typically the PET is substantially thicker than the EVA and PE layers, and the PET/EVA/PE product may be produced by co-extrusion, lamination, extrusion coating or any other suitable technique. Although the PET/EVA/PE product produces high clarity containers, EVA and PE have different refractive indices to PET and so the PET/EVA/PE product is of a slightly lower clarity than a non-coated PET product. Additionally, use of EVA and PE incurs extra costs for two key reasons; firstly because the laminate or co-extruded layer has an intrinsic cost and secondly because, as outlined below, the internal re-processing of factory trays and "skeletal waste" is prejudiced by the presence of EVA and PE in an otherwise pure PET stream. Therefore, in comparison to a PET product, the PET/EVA/PE product is of poorer clarity, more expensive, less recyclable and less user-friendly in the manufacturing plant.

[0005] There are also environmental consequences of using a PET/EVA/PE product. During the manufacture of PET/EVA/PE containers by thermo-forming, multiple containers are formed from large and often continuous sheets of PET/EVA/PE material and individual containers are cut from these large sheets. Waste material is formed from those parts of the large sheets that are not used in the individual containers. This waste material, known as "skeletal waste", contains a mixture of PET, EVA and PE, which when recycled forms a cloudy product that cannot be used to form clear plastic containers. Since clear plastic containers are more desirable than opaque plastic containers the waste is uneconomical to recycle.

[0006] An alternative route for the manufacture of food trays as described above is by means of injection moulding. Then there is no skeletal waste as described above for thermo-forming, but there is also no easy and cost-effective way to apply the layer of PE to the tray that will facilitate easy sealing to a top-film.

[0007] Accordingly, it is an object of the present invention to provide containers that overcome some or all of the problems described above.

[0008] According to a first aspect of the invention, there is provided a sealable container comprising a base and a continuous side wall extending substantially perpendicular to the base with a peripheral flange formed along the upper, in use, edge of the continuous side wall, wherein a layer of adhesive is located on an upper, in use, surface of the peripheral flange such that a lidding film may be sealed to the peripheral flange to create a sealed space between the base, continuous side wall and lidding film. The layer of adhesive located on the upper surface of the peripheral flange does not extend onto the vertical surfaces of the continuous side wall and does not extend onto the base.

[0009] The term "adhesive" is used herein to indicate any material that enables the adhesion of the lidding film to the peripheral flange. The adhesive may be a traditional adhesive, it may be a PE or PE co-polymer based material, or indeed any other suitable material as discretely applied to the peripheral flange.

[0010] As explained above, clear plastic containers are more desirable than opaque plastic containers and therefore the base and the continuous side wall may be clear. A suitable material for making the clear base and the clear continuous side wall is PET, therefore, the base and the continuous side wall may consist essentially of PET, optionally recycled PET.

[0011] Adhesives suitable for use in the present invention include adhesives based on a polymeric substrate, such as a hot-melt adhesive. The thickness of the layer of adhesive can vary. The inventors have found that a thickness of from 20 μm to 100 μm is effective, and a thickness of 50 μm is most effective.

[0012] Sealable containers according to the present invention may be sealed to produce sealed containers. Therefore, according to a second aspect of the present invention sealed containers are provided with a lidding film sealed to a sealable container as described above.

[0013] The atmosphere within the sealed container may be modified to enhance the shelf life and/or appearance of products packaged within the sealed container. Modified atmosphere packaging (MAP) may contain increased levels of oxygen or other gases. For example to package red meat, the modified atmosphere may contain increased levels of oxygen, such as from 25% to 90% of oxygen, preferably 80% oxygen. Alternatively, MAP may contain increased levels

of carbon dioxide, as used to package poultry. These are examples only; there are a wide range of commercially available gas mixtures used across a wide range of foods and non-foods. There are also significant commercial volumes of controlled atmosphere packages where the gas mixture inside a sealed pack is initially air, but where the product consumes and also generates gases such that the atmosphere becomes modified by means of carefully designed and targeted film material and container material choices. This is known as controlled atmosphere packaging (CAP). A reliable and effective seal between lidding film and sealable container, capable of being effective despite contamination on the seal face, is key to MAP and CAP being effective.

[0014] Lidding films suitable for use in making sealed containers according to the present invention may comprise polypropylene (PP) and/or PE. These materials may act as a seal layer in a multi-layer film, that may be formed by co-extrusion or lamination. The other layers in a multi-layer structure may be chosen to impart particular properties, such as strength, resilience, gas and/or water vapour barrier properties, shrinking characteristic and UV screening. The thickness of the seal layer of the lidding film can vary. The inventors have found that a seal layer thickness of from 15 μm to 50 μm is effective, and a thickness of 20 μm is most effective. The overall thickness of the lidding film is typically from 20 μm to 60 μm.

[0015] According to a third aspect of the present invention, there is provided a process for making a sealable container as described above, wherein the process comprises:

a) providing a container comprising a base and a continuous side wall upstanding from the base with a peripheral flange formed along the upper edge of the continuous side wall; and
b) applying a layer of adhesive to an upper surface of the peripheral flange to produce a sealable container.

[0016] The container may be corona or plasma treated between steps a) and b) to improve adhesion of the adhesive to the peripheral flange.

[0017] The layer of adhesive may be applied to the upper surface of the peripheral flange by a roller, such as a silicone roller or a heated chrome roller. Alternatively, the layer of adhesive may be applied by spray coating, by a hot melt gun or by a printing technique.

[0018] The inventors have found that supporting the container during the application of the layer of adhesive helps transfer an even thickness of the adhesive to the peripheral flange. In particular, the inventors have found that supporting the peripheral flange is helpful in producing a superior sealable container.

[0019] The process for making a sealable container according to the present invention may be operated as a continuous process. For example, the containers may be supplied continuously to a production line for continuous application of the layer of adhesive. The process for making a sealable container according to the present invention may also be operated as a batch process. Alternatively, the process for making a sealable container according to the present invention may be operated as a combination of continuous and batch process steps.

[0020] For example, the containers may be supplied by a batch process step and application of the layer of adhesive may operate as a continuous process step.

[0021] According to a fourth aspect of the present invention, there is provided a process for making a sealed container as described above, wherein the process comprises:

a) providing a sealable container prepared according to the process for making a sealable container described above;
b) applying a layer of lidding film to the peripheral flange of the sealable container; and
c) applying pressure to the peripheral flange to seal the lidding film to the sealable container.

[0022] The pressure is used to fuse the lidding film to the layer of adhesive applied to the peripheral flange and thereby seal the container. Preferably heat is applied simultaneously with pressure.

[0023] The pressure applied to the peripheral flange and the time for which the pressure is applied can vary. The inventors have found that a pressure of from 30 psi to 180 psi and a period of time of from 0.5 seconds to 5 seconds is effective, and a pressure of 110 psi and a period of time of 1 second is most effective.

[0024] The heat applied to the peripheral flange can also vary. The inventors have found that a temperature of from 105 °C to 170 °C is effective, and a temperature of 150 °C is most effective.

[0025] Pressure alone or pressure and heat may be applied to the peripheral flange by any process suitable for sealing the lidding film to the sealable container. Typically a sealing shoe matching the shape of the peripheral flange is used to seal the lidding film to the sealable container.

[0026] As with the process for making a sealable container, the process for making a sealed container according to the present invention may be operated as a continuous process. For example the sealable containers may be supplied to a production line for provision of a layer of lidding film and application of heat to the peripheral flange. The process for making a sealed container according to the present invention may be operated as a batch process. Alternatively, the process for making a sealed container according to the present invention may be operated as a combination of continuous

and batch process steps.

[0027] The process for making a sealed container may be carried out after the sealable container has been made and a product placed within the sealable container or the process for making the sealed container may be carried out separately from the process for making the sealable container.

[0028] The invention will be further described with reference to the drawings and figures, in which:

figure 1 is a cross sectional view of a prior art tray;
figure 2 is a flow diagram of a typical prior art thermo-forming process;
figure 3 shows a perspective view of a tray according to the invention;
figure 4 is a cross sectional view of a tray according to the invention;
figure 5 is a flow diagram of a thermo-forming process according to the invention;
figure 6 is a schematic partial view of a flange of a prior art tray;
figures 7A to 7E are schematic partial views of trays according to the invention;
figures 8A, 8B and 8C are schematic top, side and front views of a tray according to the invention, including a modified denest feature;
figure 9A is a schematic view of a prior art tray nested into a similar tray; and
figure 9B is a schematic view of a tray according to the invention and including a modified denest feature, nested into a similar tray.

[0029] Figure 1 shows a cross sectional view of a prior art container 1' comprising a base 2' with ribs 6', side walls 3' with a peripheral flange 4'. The container 1' is made of PET and has a thickness of for example 400-500 μm. The surface of the container is coated with PE film with a thickness of for example 30 to 50 μm. Typically, the tray comprises 1 grams of PE (i.e. 5.8%w/w) and 16.8 grams of PET (i.e. 94.2% w/w).

[0030] Figure 2 is a simplified illustration of a thermo-forming process for the manufacture of PET/PE containers in which PET in the form of flakes and pellet are introduced into the system to produce the trays. The flakes and pellets are melted into sheets which are coated with a film of PE. The sheets are then moulded into trays. About 6% PET/PE waste is obtained from the extrusion of the trays.

[0031] At this stage, the extruded trays are attached to each other by a web 7 which is cut out to produce individual trays with a return flange. This separation process produces about 40% web waste. Finally about 2% tray waste is produced in the act of trimming the trays at the end of the process. Extrusion waste, web waste and tray waste are contaminated with PE and cannot be recycled to produce clear products. Based on the production of 100,000,000 trays, this represents a total of about 888 tons of waste per annum (i.e. 148 ton p.a. extrusion waste, 705 ton p.a. web waste and 35 ton p.a. tray waste).

[0032] Figure 3 shows a sealable container 1 according to the invention comprising a base 2 and a continuous side wall 3 upstanding from the base 1. A peripheral flange 4 is formed along the upper edge of the continuous side wall 3. A layer of adhesive 5 is located on an upper surface of the peripheral flange 4 such that a lidding film (not shown) may be sealed to the flange. A sealed space can thereby be created between the base 1, continuous side wall 3 and lidding film.

[0033] Figure 4 shows a cross sectional view of a sealable container 1 according to the invention comprising a base 2 and a continuous side wall 3 upstanding from the base 1. The container is preferably made of PET and has a thickness of for example 400-500 μm. A peripheral flange 4 is formed along the upper edge of the continuous side wall 3 and may comprise a return flange. The container is not coated with a PE film as in figure 2, but instead an adhesive film 5 is applied onto an upper surface of the peripheral flange 4 such that a lidding film may be sealed to the flange. The thickness of the adhesive film is preferably approximately 50 μm. Ribs 6 are located in the base 2 to strengthen the base of the tray.

[0034] Figure 5 is a simplified illustration of a thermo-forming process for the manufacture of PET containers according to the present invention in which PET in the form of flakes and pellet are introduced into the system to produce the trays. The flakes and pellets are first melted into sheets of pure PET. A process according to the present invention therefore produces waste after PET extrusion which can be recycled to produce clear product, since the waste is substantially free from adhesive or PE. Trays are then formed in the PET sheet, and then subsequently, the adhesive is applied onto the flange using an adhesive applicator 8 and the trays are trimmed and separated. The web waste is also substantially free of adhesive and can be recycled into the process. At the end the production line, tray waste is produced that comprises PET and adhesive. Thus, the claimed process produces substantially less waste contaminated by adhesive or PE and is consequently more cost-effective since it enables the production of clear products from the aggreated recycled waste. Again, using the example of the production of 100,000,000 trays, we can predict the same 888 tons of aggregated waste, but only 35 tons is affected with PE/adhesive. This can be re-admitted to the extrusion process without the existing penalties on clarity, or at worst, segregated and used for products (for example coloured products) where clarity is unimportant.

[0035] As explained above, it is difficult to attach a lidding film to PET surfaces and a solution proposed in the past was to coat the whole upper surface of the container with a layer of PE and an intermediate layer of EVA, since PE

provides a surface that a lidding film readily attaches to. However, the resulting trays were heavier and less recyclable than PET trays due to the presence of the additional layers.

[0036] In the container of the present invention, a layer of adhesive is located on an upper surface of the peripheral flange such that, at a later stage, when required, a lidding film may be sealed to the peripheral flange to create a sealed space between the base, continuous side wall and lidding film. Thus, no changes are made to the top sealing film (which can be a conventional lidding film as used in the industry) and only the container is modified. Other solutions would require expensive and complex modifications of the lid and/or the tray. The resulting container has a better recyclability and trays that are up to 3% lighter than prior art trays may be obtained.

[0037] A further advantage of the present invention is that the layer of adhesive located on the upper surface of the flange provides means for visually identifying the presence of a seal layer prior to seal, because the adhesive surface is visually different from the PET surface. In addition, post seal, the layer of adhesive provides means for visually checking the integrity of the seal by forming a adhesive "band" that is visible through the lidding film.

[0038] When the trays are nested into one another, they are often difficult to separate because of the blocking properties of PET (i.e. the propensity of PET surfaces to stick to other PET surfaces). Figure 6 is a schematic view of a corner of a known tray design. Due to tray design, the flange is wider at the corners than along the sides of the tray. In known trays, this additional area can be utilised to create a denesting feature to aid the separation of nested trays. This is achieved by forming a recess into the tray, this recess sits onto the upper flange of the nested tray. The recess location is alternated in a sequence so it does not match the tray it is nesting against.

[0039] In the present invention, the upper surface of the peripheral flange is coated with an adhesive. Some adhesives have a low tack at room temperature; however as the temperature increases, the tack level also increases. The result of this would be the locking together (or partial gluing together) of trays as the underside of the denesting recess of a (top) tray contacts the upper flange of its nested (bottom) tray.

[0040] To address this issue, the tray of the present invention may comprise at least one denesting recess located in a denesting area, whereby the denesting area is relieved relative to the upper surface of the flange, i.e. set lower than the flange level by a distance of preferably 1 mm. The relieved area extends partially (for example as crescents adjacent the corners of the tray) or completely (i.e. both adjacent the corners of the tray and along the sides of the tray) along the inner periphery of the flange so that when the adhesive material is applied to the tray, the upper surface of the relieved area is not coated. For example, in figures 7A, 7B and 7C, the relieved area is located at the corners of the tray in the shape of a crescent and the denesting recess is located in the relieved area. In figures 7D, 7E and 7F (and also in figures 8A, 8B and 8C) the relieved area extends along the whole inner periphery of the flange so that the tray comprises an outer peripheral flange coated with adhesive and an inner peripheral flange, devoid of adhesive.

[0041] The denesting recesses are located in the relieved area so that when the adhesive material is applied to the tray, the upper surface of the denesting recess and the area surrounding the recess is not coated. As such the possibility of locking together the trays is eliminated. The height of the step can be altered to adjust the separation gap between the trays. A typical gap is in the region of 7 mm.

[0042] In these embodiments, the distance between the upper surface of the relieved area and the base of the tray is shorter than the distance between the upper surface of the flange and the base. Preferably, the distance between the upper surface of the flange and the upper surface of the relieved area is approximately 1mm. Preferably, the width of the relieved area is approximately 1 mm. As can be seen in figures 9A and 9B, the distance between the adhesive coated flange of a bottom tray and the adjacent wall of a top tray can be typically increased by approximately 1 mm (e.g. 0.84 mm for standard trays and 1.71 for trays according to the present invention). The relieved area is therefore advantageous in that it prevents a first tray of the present invention to stick to second nested tray due to the distance created between the adhesive of the upper surface of the flange of the first tray and the adjacent wall of the second tray.

Examples

[0043] LINPAC rfresh R2-45 meat trays were prepared and tested to demonstrate the suitability of the invention for the packaging of fresh meat using a MAP system.

[0044] The trays were manufactured from a 500 μm thick monolayer of amorphous PET sheet. The formed trays were coated with an adhesive (reference BAM 2041) supplied by Beardow and Adams (Adhesives) Ltd. The adhesive was applied to the flange of the tray using a Diemme Fin model SC4 roller glue spreading machine. The adhesive was melted against a chrome roller with a temperature of 177 °C and applied to the tray flange via a silicone rubber roller with a temperature of 125 °C. The coating equipment had a line speed of 10 m/min and the trays were coated in batches of four using an aluminium carrier designed to support the flange of each tray as they passed under the coating roller. The equipment was adjusted to apply the adhesive uniformly on the flange with coating thicknesses of 50 μm, 60 μm, 80 μm and 90 μm. The remainder of the tray surfaces were free from adhesive contamination.

[0045] The trays were sealed using a 35 μm thick commercially available lidding film. This was supplied by LINPAC Packaging Limited (reference THB 267110). The trays were filled with an atmosphere of 80% oxygen and 20% carbon

dioxide gas using a World Class Packaging model T200 tray sealing machine. A variety of sealing conditions were used with seal times of from 1 to 3 seconds, seal pressures of from 30 psi to 180 psi, and sealing bar temperatures of from 130 °C to 170 °C.

[0046] The trays were stored for 10 days at 4 °C to simulate the packaging supply chain. The residual oxygen was then measured using a HiTec MAP 4050 gas analyser. No significant loss of oxygen concentration was noted indicating that the packs were leak free. Leak tests were conducted at room temperature using a Lippke 4000 Package Test System. Leak test pressure was 50 mBar with a settling period of 30 seconds and a leak detection time of 30 seconds. The packs were again shown to be leak free as the observed pressure drop was <2 mBar. Burst tests were conducted using the Lippke 4000 Package Test System. The rate of pressure increase was 5 mBar/second. The failure mode was failure of the top web film showing that the adhesive bond between the tray and the top web was good.

Trial Number	Adhesive thickness	Seal Temp (degC)	Seal Time (sec)	Seal Pressure (psi)	Average Leak (mBar)	Average Burst (mBar)
1	50	130	1	110	n/a	216
2	50	130	3	110	n/a	225
3	50	170	1	110	n/a	175
4	50	170	3	110	n/a	126
6	50	130	3	110	4.5	230
7	90	130	3	110	2.9	274
8	50	130	1	65	n/a	233
9	50	130	1	110	n/a	247
10	50	150	1	65	n/a	159
11	50	150	1	110	n/a	186
12	50	170	1	65	n/a	175
13	50	170	1	110	n/a	207
14	50	130	1	110	1.7	260
15	60	130	1	110	2.1	315
16	80	130	1	110	2.1	270

Specific Embodiments

[0047]

1. A sealable container comprising a base and a continuous side wall extending substantially perpendicular to the base with a peripheral flange formed along the upper, in use, edge of the continuous side wall, wherein a layer of adhesive is located on an upper, in use, surface of the peripheral flange such that a lidding film may be sealed to the peripheral flange to create a sealed space between the base, continuous side wall and lidding film.

2. A sealable container according to embodiment 1, wherein the base and the continuous side wall are clear.

3. A sealable container according to embodiment 2, wherein the base and the continuous side wall consist essentially of polyethylene terephthalate (PET), optionally the base and the continuous side wall consist essentially of recycled PET.

4. A sealable container according to embodiment 1, 2 or 3, wherein the adhesive is an adhesive based on a polymeric substrate or a polyethylene(PE) or PE co-polymer based material.

5. A sealable container according to any preceding embodiment, wherein the thickness of the layer of adhesive is from 20 μm to 100 μm, preferably 50 μm.

6. A sealable container according to any preceding embodiment, further comprising at least one denesting recess, free of adhesive, adjacent a corner of the container.

7. A sealable container according to any preceding embodiment, further comprising a denesting area, free of adhesive, which extends partially or completely along the inner periphery of the flange.

8. A sealable container according to embodiment 7, wherein the distance between the upper surface of the denesting area and the base of the tray is shorter than the distance between the upper surface of the flange and the base.

9. A sealable container according to embodiment 7 or 8, wherein the at least one recess is located in the denesting area.

10. A sealed container comprising a sealable container according to any of embodiments 1 to 9 and a lidding film sealed thereto.

11. A sealed container according to embodiment 10, wherein the atmosphere within the sealed container has been modified or controlled.

12. A sealed container according to embodiment 11, wherein the modified atmosphere contains increased levels of oxygen or carbon dioxide.

13. A sealed container according to any of embodiments 10 to 12, wherein the lidding film is a multi-layer film comprising a seal layer and the seal layer comprises polypropylene (PP) and/or PE.

14. A sealed container according to embodiment 13, wherein the thickness of the seal layer is from 15 μm to 50 μm, preferably 20 μm.

15. A sealed container according to any of embodiments 10 to 14, wherein the thickness of the lidding film is from 20 μm to 60 μm.

16. A process for making a sealable container according to any of embodiments 1 to 9, wherein the process comprises:

a) providing a container comprising a base and a continuous side wall upstanding from the base with a peripheral flange formed along the upper, in use, edge of the continuous side wall; and
b) applying a layer of adhesive to an upper, in use, surface of the peripheral flange to produce a sealable container.

17. A process according to embodiment 16, wherein the container is corona treated or plasma treated between steps a) and b).

18. A process according to embodiment 16 or 17, wherein the layer of adhesive is applied to an upper surface of the peripheral flange by a roller, by spray coating, by a hot melt gun or by a printing technique.

19. A process according to embodiment 18, wherein the roller is a silicone roller or a heated chrome roller.

20. A process according to any of embodiments 16 to 19, wherein the peripheral flange is supported during the application of the layer of adhesive.

21. A process according to any of embodiments 16 to 20, wherein the process is a continuous process.

22. A process for making a sealed container according to any of embodiments 10 to 15, wherein the process comprises:

a) providing a sealable container prepared according to any of claims 16 to 21;
b) applying a layer of lidding film to the peripheral flange of the sealable container; and
c) applying pressure to the peripheral flange to seal the lidding film to the sealable container.

23. A process according to embodiment 22, wherein pressure is applied to the peripheral flange at a pressure of from 30 psi to 180 psi for a period of time of from 0.5 seconds to 5 seconds, preferably 110 psi for 1 second.

24. A process according to embodiment 22 or 23, wherein heat is applied simultaneously with pressure.

25. A process according to embodiment 24, wherein heat is applied to the peripheral flange at a temperature of from 105 °C to 170 °C, preferably at a temperature of 150 °C.

26. A process according to any of embodiments 22 to 25, wherein a sealing shoe matching the shape of the peripheral flange is used to seal the lidding film to the sealable container.

27. A process according to any of embodiments 22 to 26, wherein the process is a continuous process.

Claims

1. A sealable container comprising:

   a base and a continuous side wall extending substantially perpendicular to the base with a peripheral flange formed along the upper, in use, edge of the continuous side wall,
   wherein the base and the continuous side wall consist essentially of polyethylene terephthalate (PET),
   characterised in that a layer of adhesive is located on an upper, in use, surface of the peripheral flange such that a lidding film may be sealed to the peripheral flange to create a sealed space between the base, continuous side wall and lidding film.

2. A sealable container according to claim 1, wherein the base and the continuous side wall are made of a monolayer of PET.

3. A sealable container according to claim 1 or 2, wherein PET is amorphous PET.

4. A sealable container according to any preceding claim, wherein PET is recycled PET.

5. A sealable container according to any preceding claim, wherein the adhesive is an adhesive based on a polymeric substrate or a polyethylene(PE) or PE co-polymer based material.

6. A sealable container according to any preceding claim, wherein the thickness of the layer of adhesive is from 20 μm to 100 μm, preferably 50 μm.

7. A sealable container according to any preceding claim, further comprising at least one denesting recess, free of adhesive, adjacent a corner of the container.

8. A sealable container according to any preceding claim, further comprising a denesting area, free of adhesive, which extends partially or completely along the inner periphery of the flange.

9. A sealable container according to claim 8, wherein the distance between the upper surface of the denesting area and the base of the tray is shorter than the distance between the upper surface of the flange and the base.

10. A sealable container according to claim 8 or 9, wherein the at least one recess is located in the denesting area.

11. A sealed container comprising a sealable container according to any of claims 1 to 10 and a lidding film sealed thereto.

12. A sealed container according to claim 11, wherein the atmosphere within the sealed container has been modified or controlled.

13. A sealed container according to claim 12, wherein the modified atmosphere contains increased levels of oxygen or carbon dioxide.

14. A sealed container according to any of claims 11 to 13, wherein the lidding film is a multi-layer film comprising a seal layer and the seal layer comprises polypropylene (PP) and/or PE.

15. A sealed container according to claim 14, wherein the thickness of the seal layer is from 15 μm to 50 μm, preferably

20 μm.

16. A sealed container according to any of claims 11 to 15, wherein the thickness of the lidding film is from 20 μm to 60 μm.

17. A process for making a sealable container according to any of claims 1 to 10, wherein the process comprises:

a) providing a container comprising a base and a continuous side wall upstanding from the base with a peripheral flange formed along the upper, in use, edge of the continuous side wall, wherein the base and continuous side wall consists essentially of PET; and
b) applying a layer of adhesive to an upper, in use, surface of the peripheral flange to produce a sealable container.

18. A process according to claim 17, wherein the container is corona treated or plasma treated between steps a) and b).

19. A process according to claim 17 or 18, wherein the layer of adhesive is applied to an upper surface of the peripheral flange by a roller, by spray coating, by a hot melt gun or by a printing technique.

20. A process according to claim 19, wherein the roller is a silicone roller or a heated chrome roller.

21. A process according to any of claims 17 to 20, wherein the peripheral flange is supported during the application of the layer of adhesive.

22. A process according to any of claims 17 to 21, wherein the process is a continuous process.

23. A process for making a sealed container according to any of claims 11 to 16, wherein the process comprises:

a) providing a sealable container prepared according to any of claims 17 to 22;
b) applying a layer of lidding film to the peripheral flange of the sealable container; and
c) applying pressure to the peripheral flange to seal the lidding film to the sealable container.

24. A process according to claim 23, wherein pressure is applied to the peripheral flange at a pressure of from 30 psi to 180 psi for a period of time of from 0.5 seconds to 5 seconds, preferably 110 psi for 1 second.

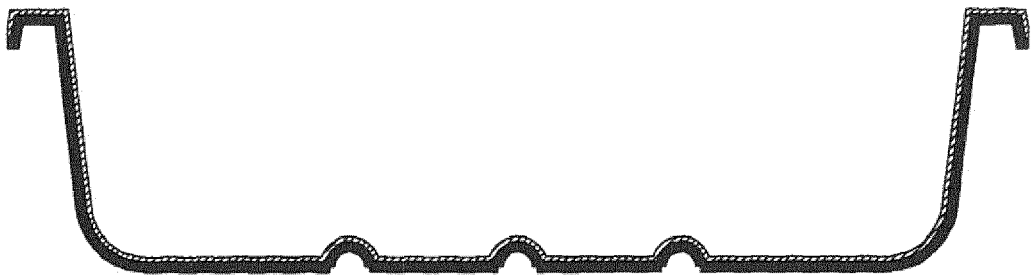
25. A process according to claim 23 or 24, wherein heat is applied simultaneously with pressure.

26. A process according to claim 25, wherein heat is applied to the peripheral flange at a temperature of from 105 °C to 170 °C, preferably at a temperature of 150 °C.

27. A process according to any of claims 23 to 26, wherein a sealing shoe matching the shape of the peripheral flange is used to seal the lidding film to the sealable container.

28. A process according to any of claims 23 to 27, wherein the process is a continuous process.

Figure 1



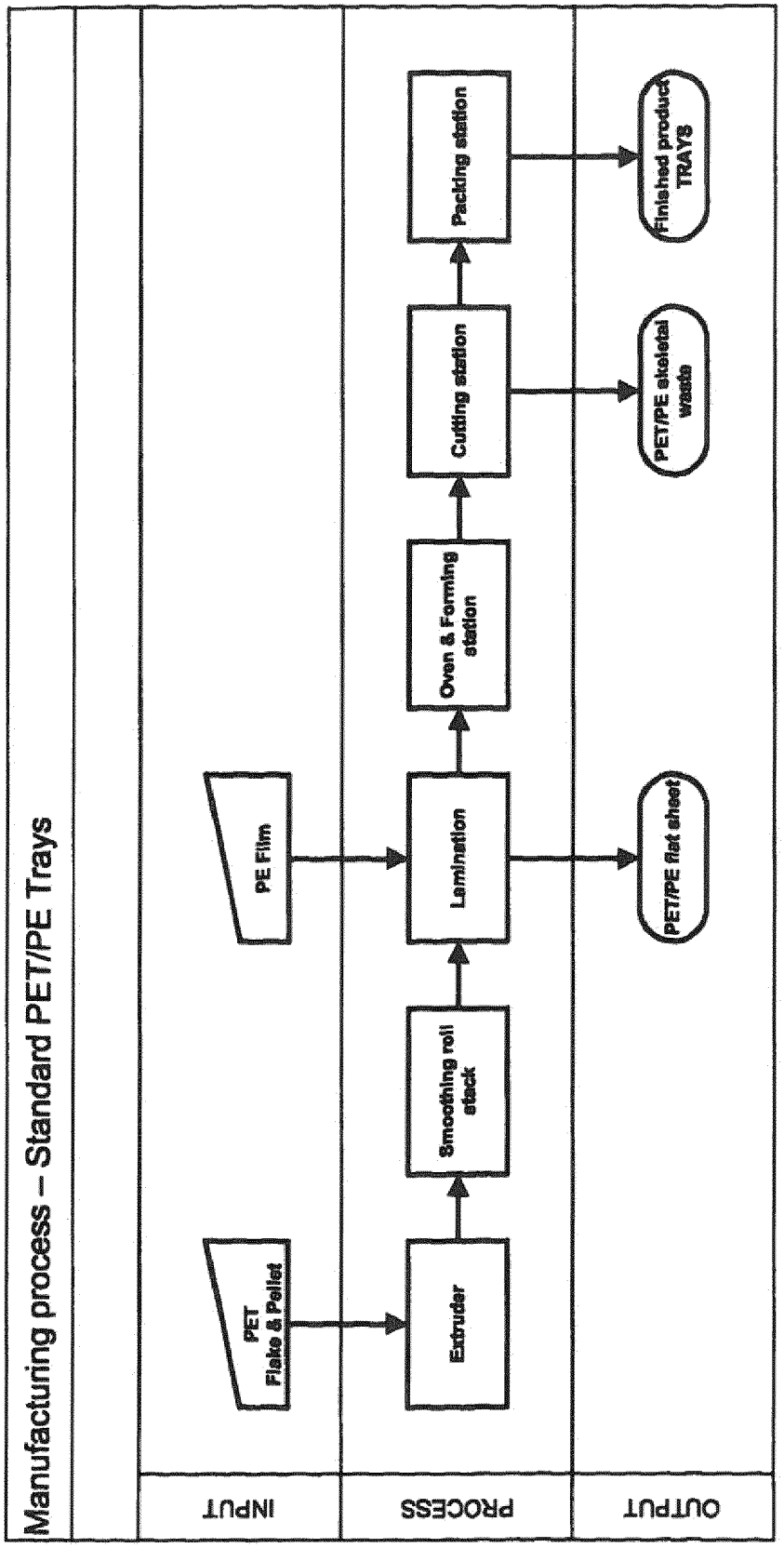

Manufacturing process – Standard PET/PE Trays
INPUT
PROCESS
OUTPUT
PET Flake & Pellet
PE Film
Extruder
Smoothing roll stack
Lamination
Oven & Forming station
Cutting station
Packing station
PET/PE flat sheet
PET/PE skeletal waste
Finished product TRAYS

Figure 2

Figure 3

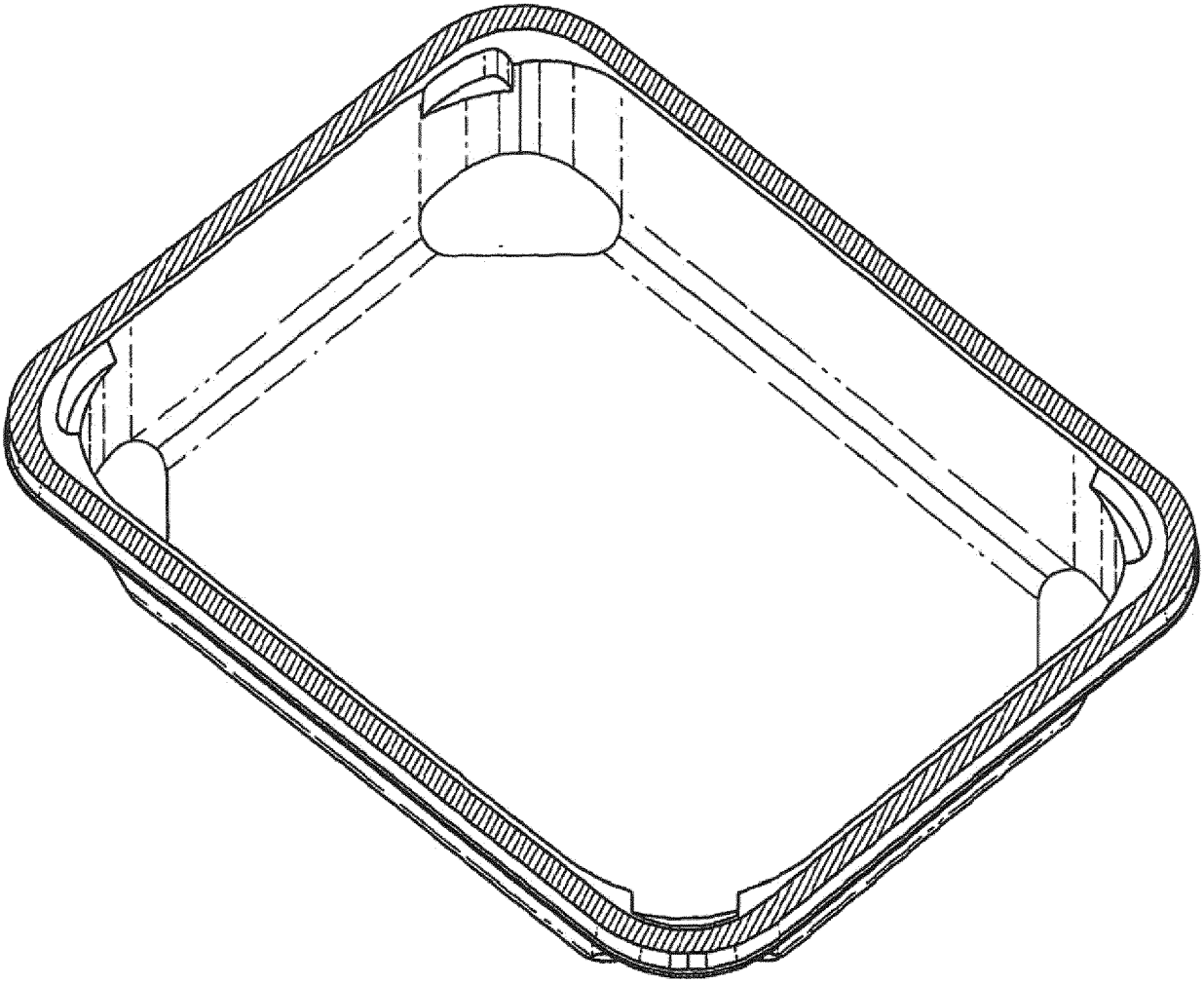
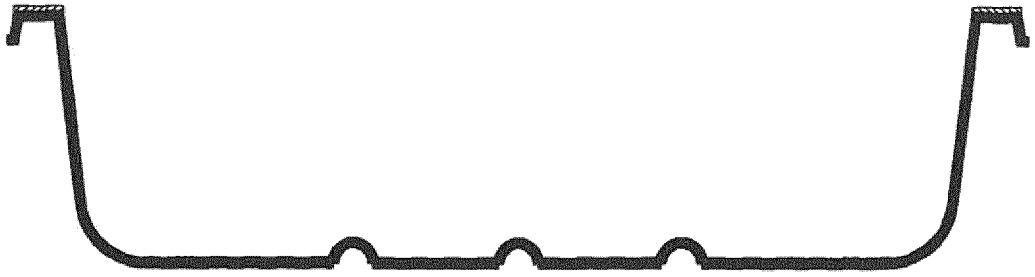


Figure 4



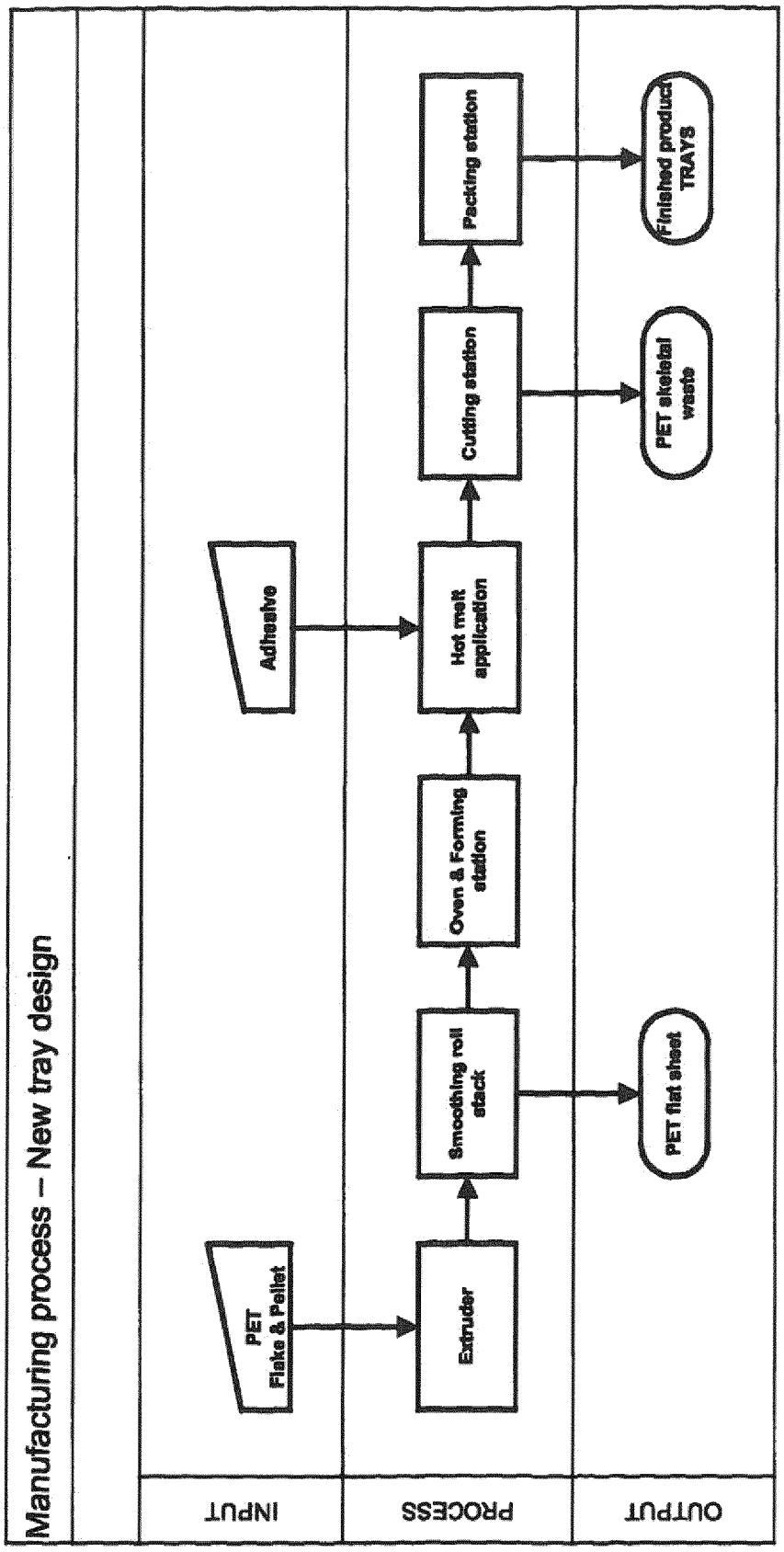

Manufacturing process – New tray design
INPUT
PROCESS
OUTPUT
PET Flake & Pellet
Extruder
Smoothing roll stack
PET flat sheet
Oven & Forming station
Adhesive
Hot melt application
Cutting station
PET skeletal waste
Packing station
Finished product TRAYS

Figure 5

Figure 6

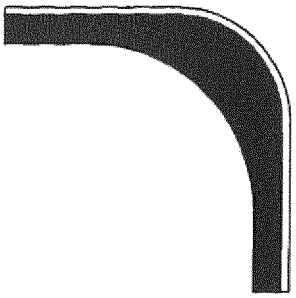


Figure 7

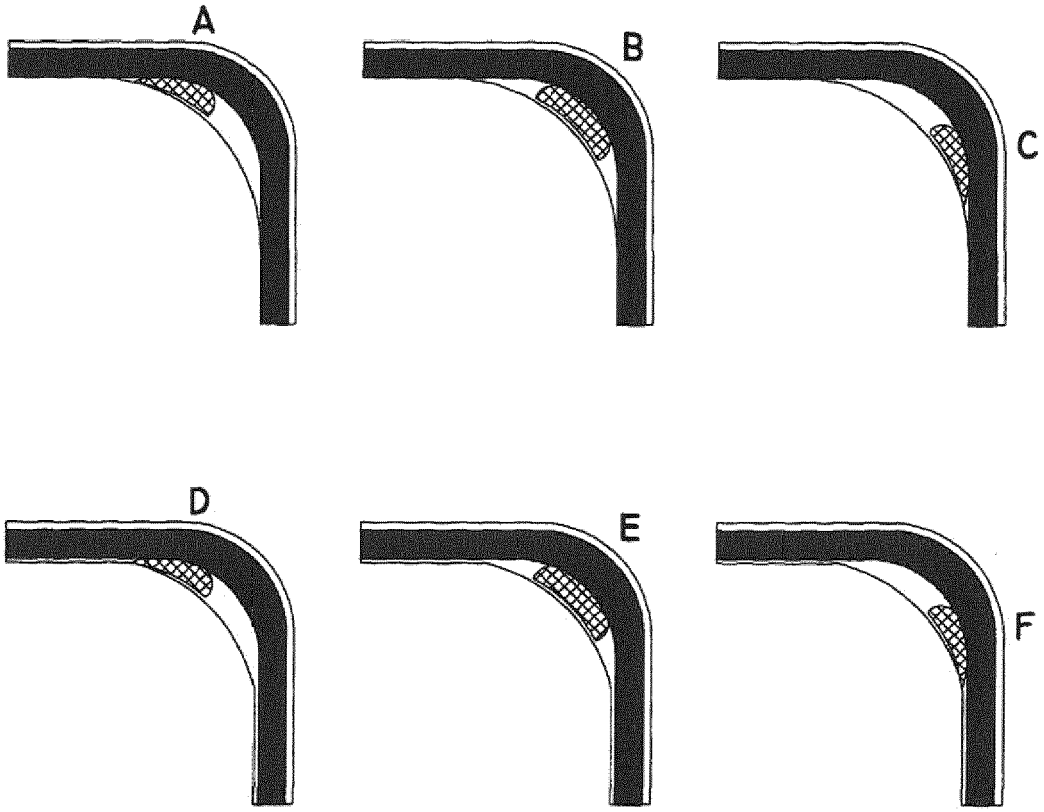


Figure 8A

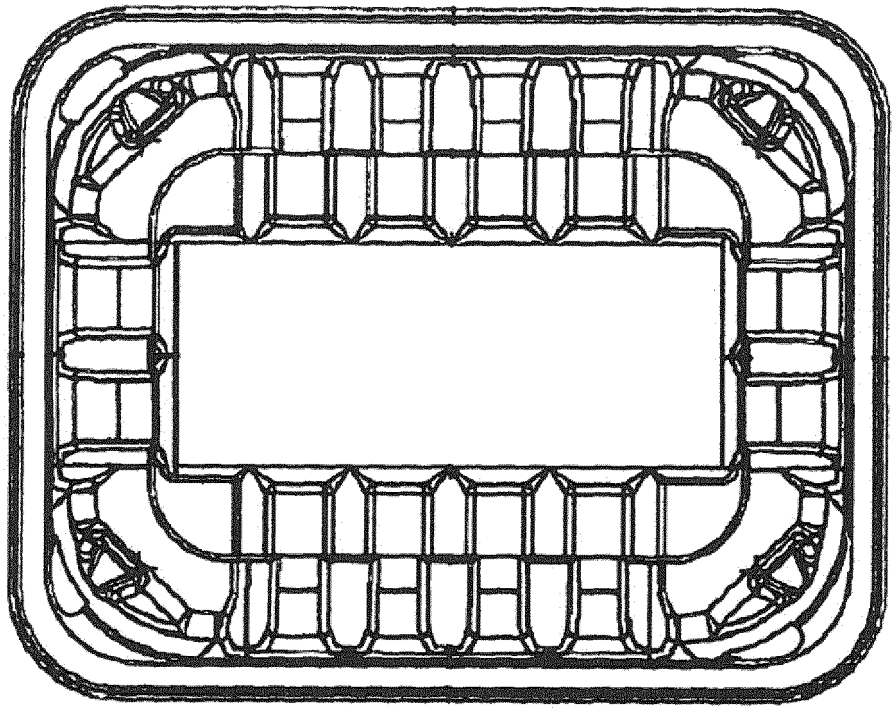


Figure 8B

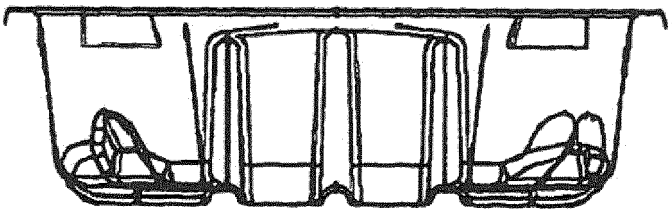


Figure 8C

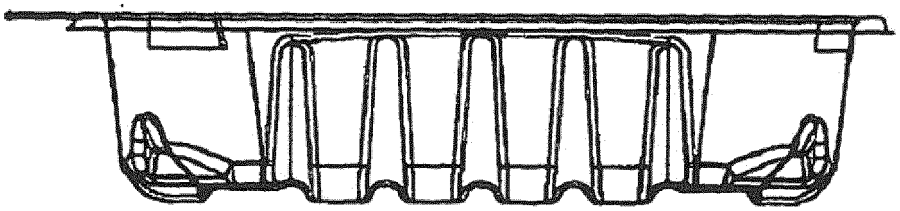
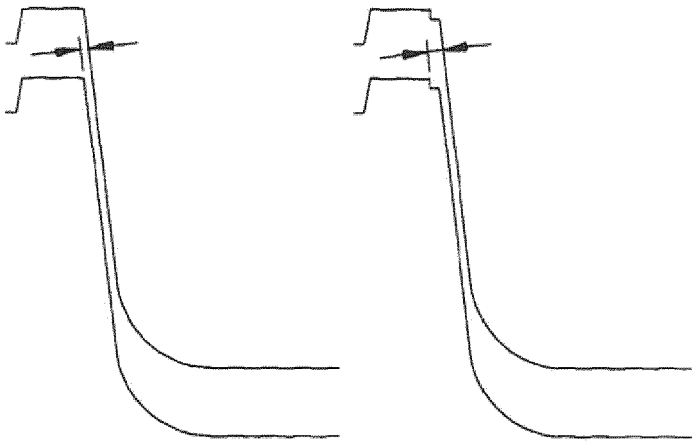


Figure 9A

Figure 9B



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EUROPEAN SEARCH REPORT

Application Number
EP 16 17 4861

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2009/121834 A1 (BASF SE [DE]; BEYERS CORNELIS PETRUS [DE]; KIRSCH STEFAN [CN]; LICHT U) 8 October 2009 (2009-10-08)	1-6, 11-17, 19,23, 24,26	INV. B65D21/02 B65D77/20 B65D81/20
Y	* page 10, line 2 - page 17, line 3 *	7-10	ADD. B65B51/02 B65B51/10
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Y	* page 3, line 79 - page 4, line 94 * * figures 1, 2, 3, 6 *	7-10	
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A	WO 99/28123 A1 (CRYOVAC INC [US]; MUELLER WALTER B [US]) 10 June 1999 (1999-06-10) * page 11, line 3 - page 12, line 9 * * page 15, line 17 - page 16, line 10 * * page 17, lines 16-18 * * figures 1-4 *	1,11-13, 17,23	TECHNICAL FIELDS SEARCHED (IPC) B65D B65B
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-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 May 2017	Piolat, Olivier

CATEGORY OF CITED DOCUMENTS

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L : document cited for other reasons

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EUROPEAN SEARCH REPORT

Application Number
EP 16 17 4861

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 21 44 653 A1 (GUNDERMANN UNIONPACK) 15 March 1973 (1973-03-15) * page 2, paragraph 4 - page 6, paragraph 1 * * figure 1 *	1,11,17, 23	
Y	JP 63 117730 U (??) 29 July 1988 (1988-07-29) * figures 5-7 *	7-10	
Y	WO 01/05666 A1 (GLUD & MARSTRAND AS [DK]; KARLSSON BENGT ROLAND [SE]) 25 January 2001 (2001-01-25) * page 5, line 27 - page 7, line 11 * * figures 1-4 *	7-10	
Y	US 6 149 006 A (BRAUNER ARNE H [US] ET AL) 21 November 2000 (2000-11-21) * column 3, line 16 - column 5, line 65 * * figures 1-3 *	7	
A	EP 0 614 823 A1 (DOLCIARIA ZAGHIS SRL [IT]) 14 September 1994 (1994-09-14) * column 2, lines 8-56 * * figures 1-6 *	7-10	TECHNICAL FIELDS SEARCHED (IPC)
A	DE 202 19 469 U1 (RIEBER GMBH & CO KG [DE]) 13 March 2003 (2003-03-13) * page 6, line 18 - page 10, line 27 * * figures 1-5 *	7-10	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 May 2017	Piolat, Olivier

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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& : member of the same patent family, corresponding document

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Application Number
EP 16 17 4861

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 16 17 4861

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-6, 11-17, 19, 23, 24, 26

   Sealable container

   ---

2. claims: 7-10

   Nestable container

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 17 4861

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