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(54) **METHOD OF MANUFACTURING AND FILLING A PACKAGE**

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(57) **ABSTRACT**

A method of manufacturing and filling a package includes: a) providing a thermoformed tub defining a product receiving space, filling the product receiving space with a nutritional product, and sealing a membrane across an open mouth of the tub to seal the product therein; b) providing a carton sleeve having a peripheral wall; and c) inserting the tub into the sleeve such that at least the sidewalls of the tub are enclosed by the sleeve, whereby the sleeve supports the tub. The carton blank can be erected separately from the tub and a mandrel may be used to ensure manufacturing tolerance. For recycling, the sleeve and tub can be separated and disposed of as required.

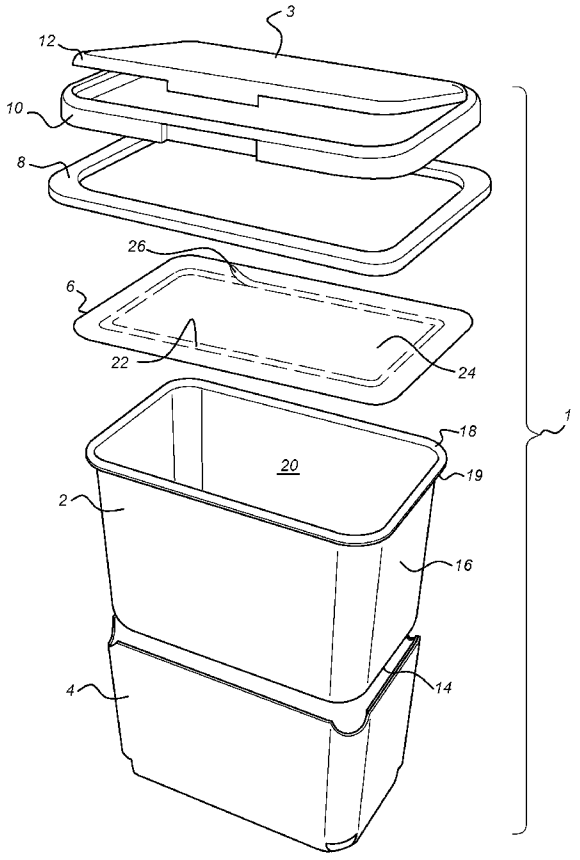


Fig. 1

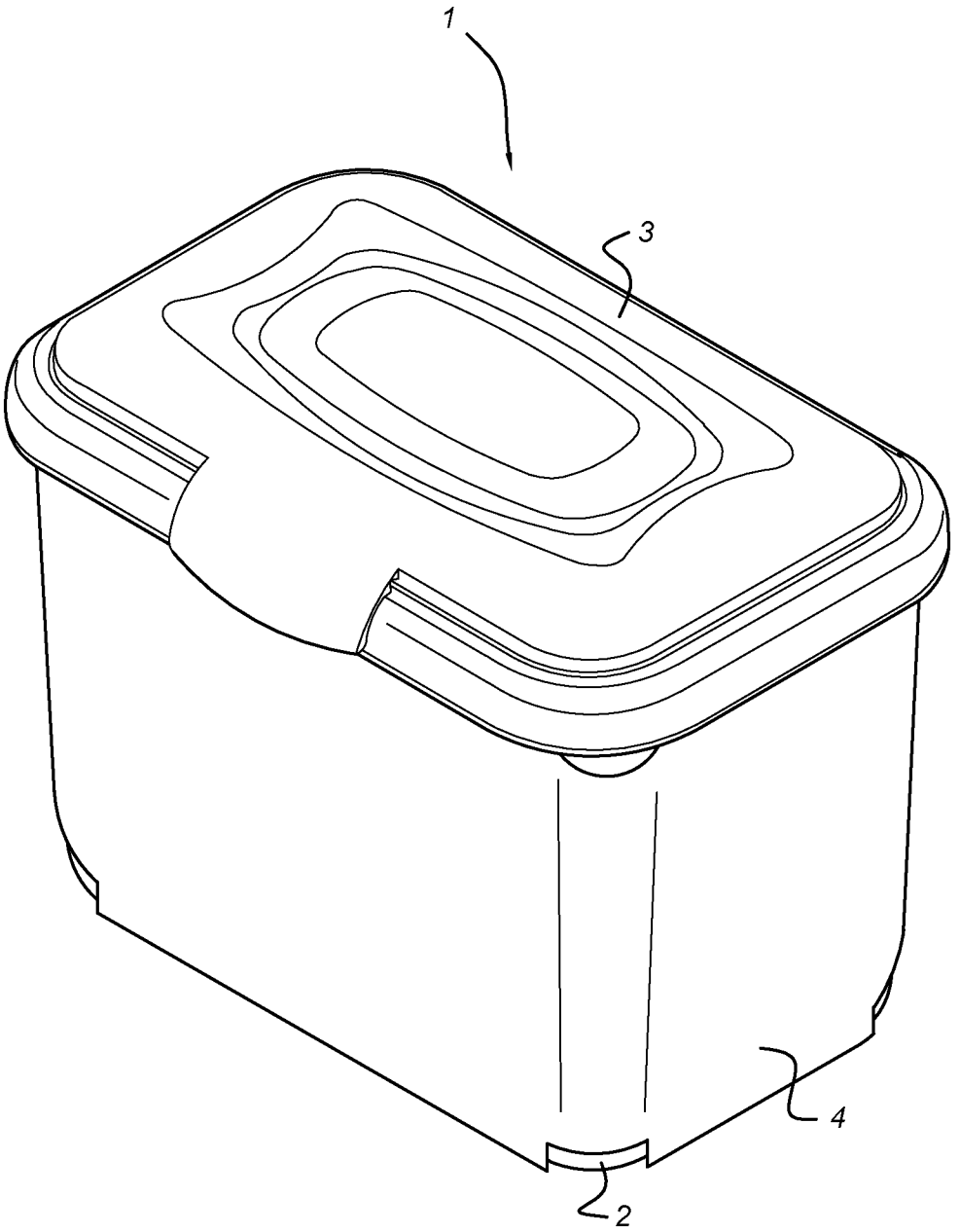


Fig. 2

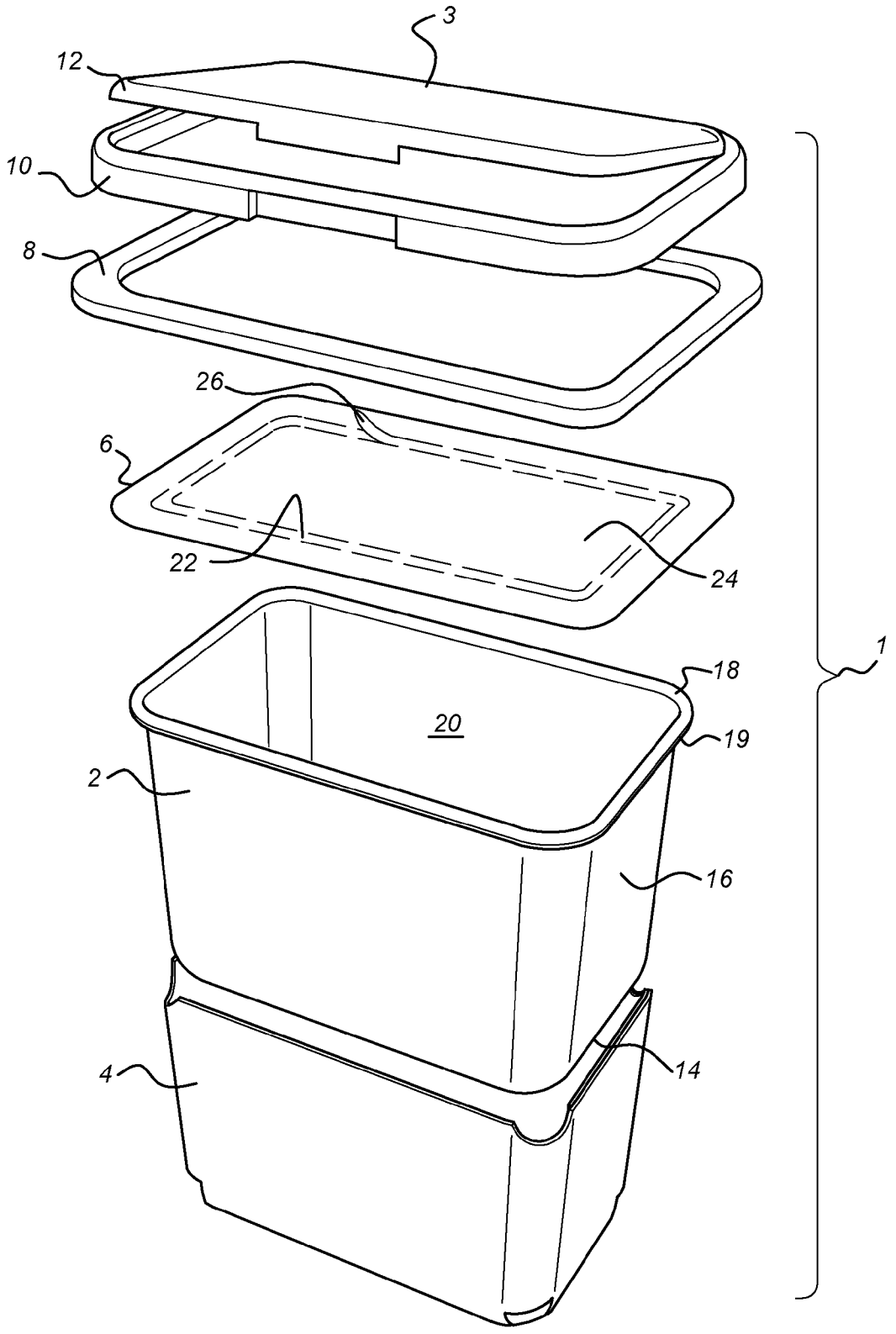


Fig. 3

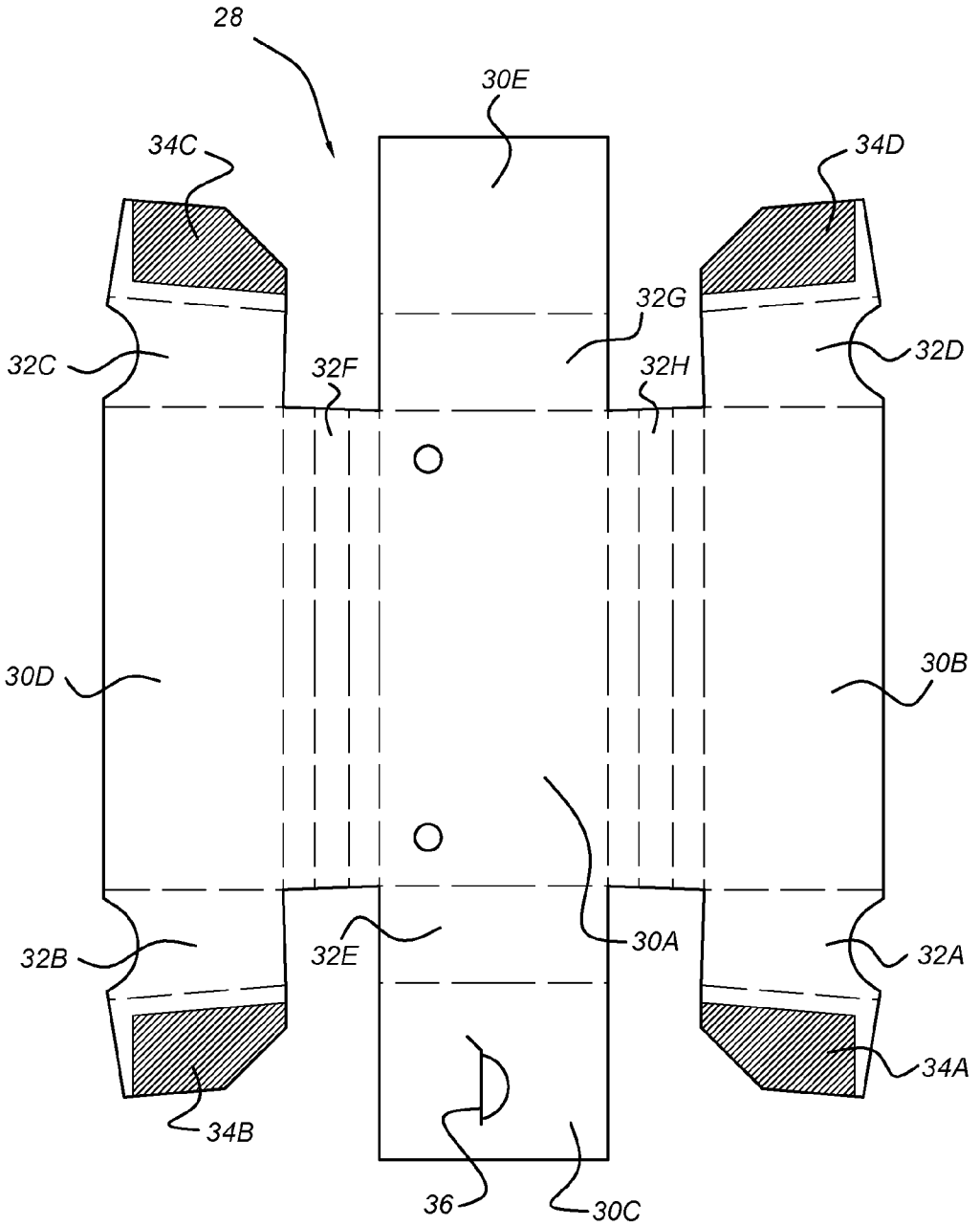
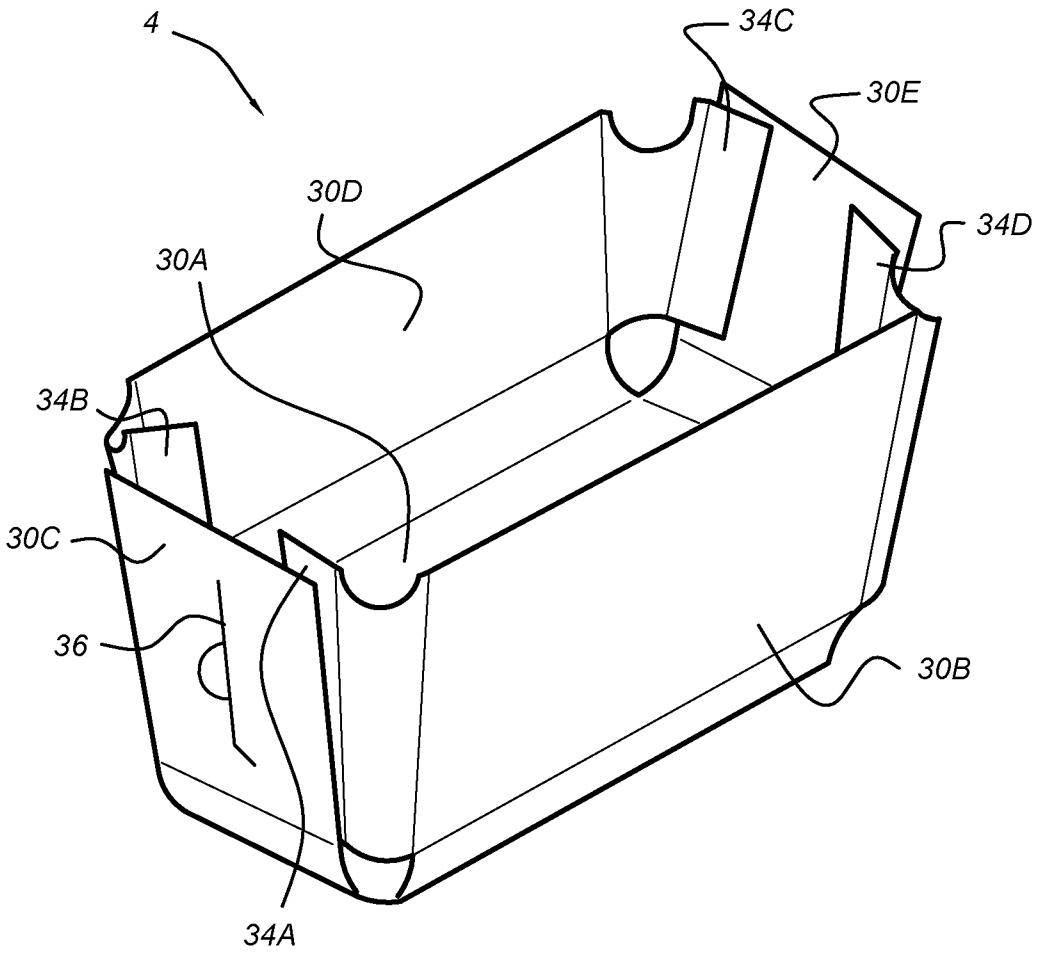

28
30E
34C
34D
32G
32C
32F
32H
32D
30D
30B
32B
32E
30A
32A
34A
34B
36
30C

Fig. 4



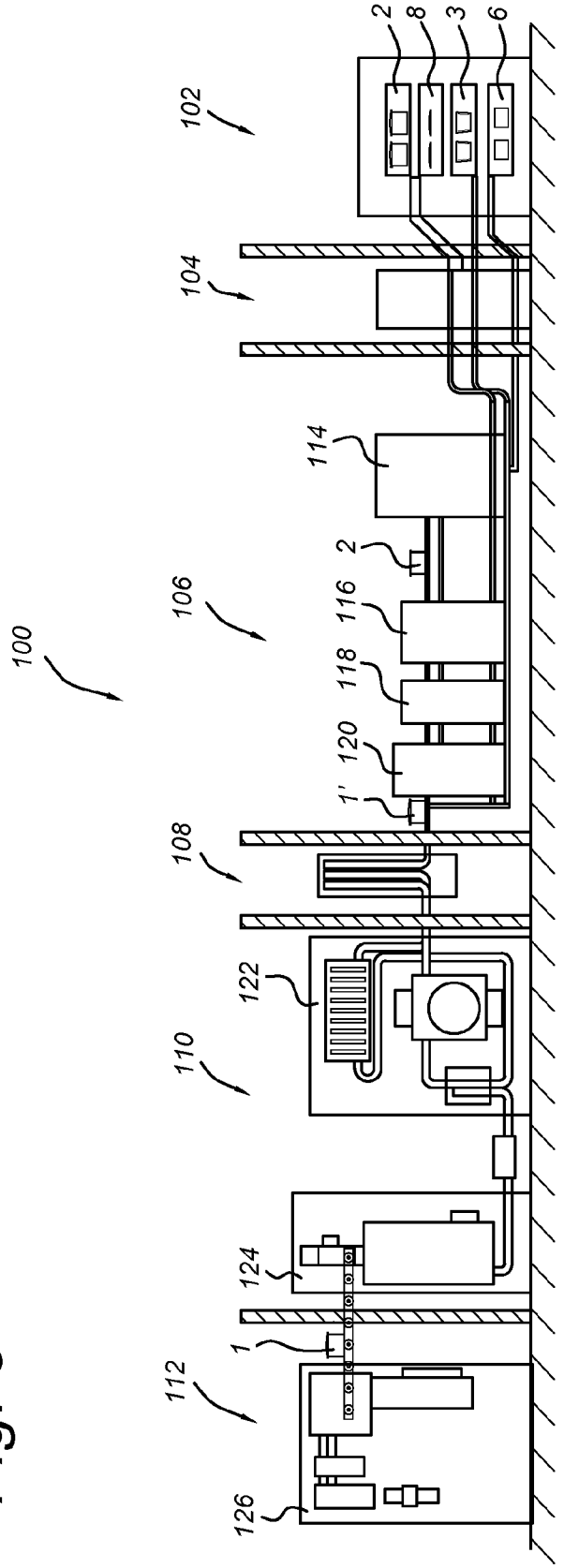


Fig. 5

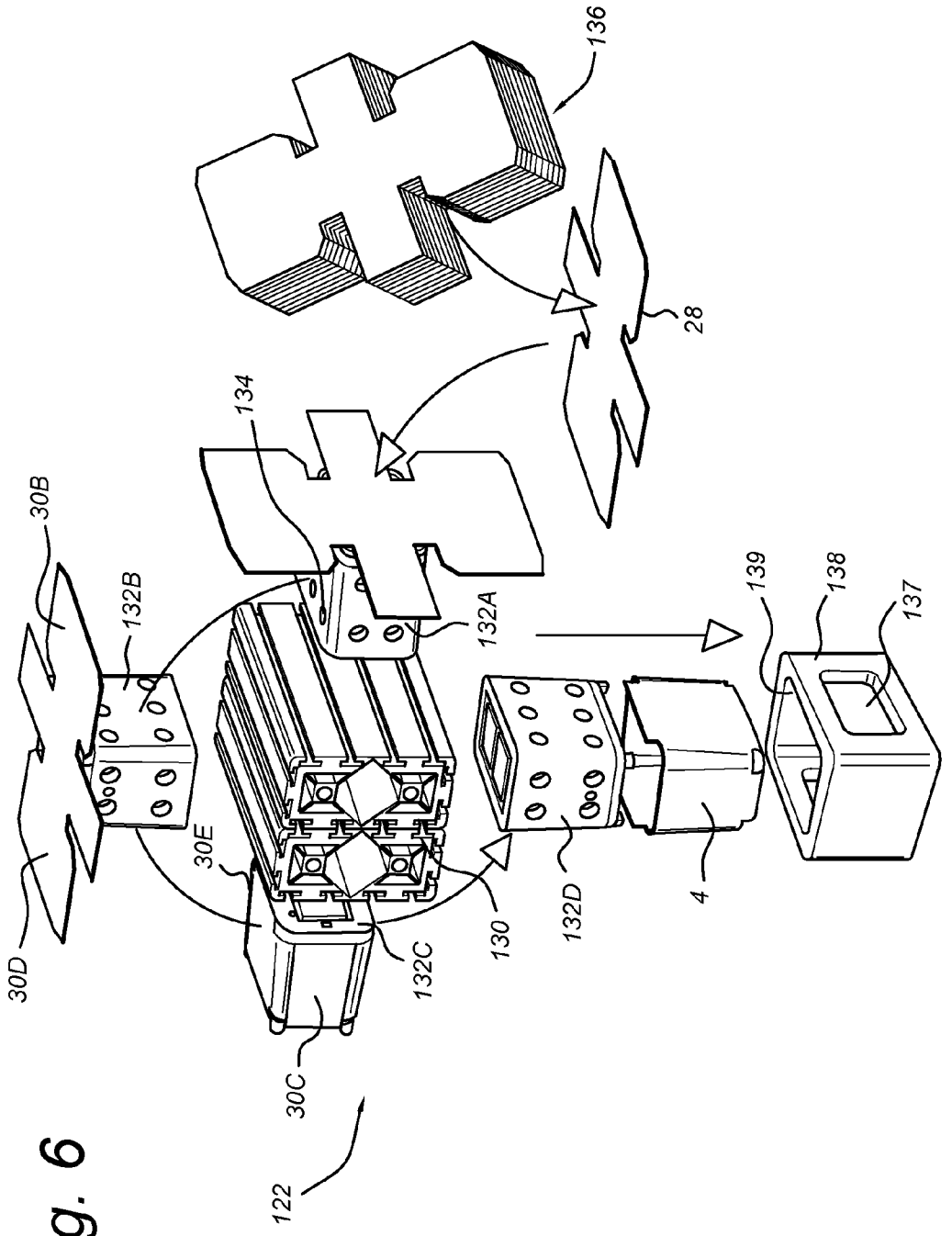

136
28
134
30B
132B
132A
139
138
137
30E
30D
132C
130
132D
4
30C
122

Fig. 6

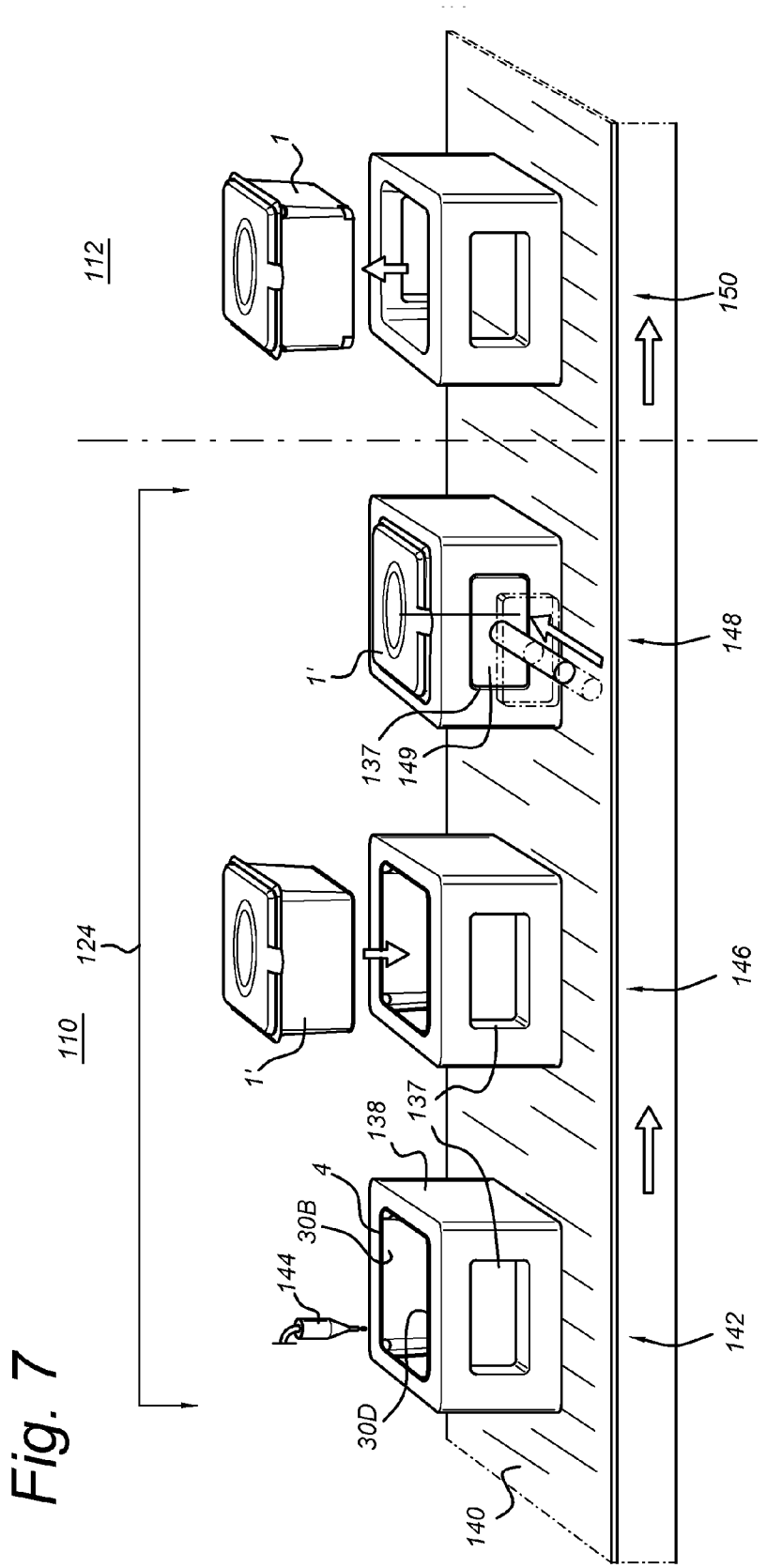


Fig. 7

METHOD OF MANUFACTURING AND FILLING A PACKAGE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to the manufacturing of packages and in particular to the manufacturing of packages for powdered nutritional products such as infant nutrition or milk formula. The invention also relates to such a package.

[0003] 2. Description of the Related Art

[0004] Powdered material, such as infant milk formula, has been sold in various forms of package for many years. Metal cans were initially the preferred container as they were relatively easy and cheap to produce and could be sealed for long term storage. The seal comprised an aluminium foil across the mouth of the container that was removed on first use. As a single container would be used for an extended period, the containers were provided with re-closable plastic lids which gripped over the outer rim of the metal can. A measuring scoop was frequently included with the container, either packaged separately or within the can itself. Such cans are however relatively heavy and expensive to produce.

[0005] More recently, alternative packaging forms have become available which improve on the existing cans. These include laminate container bodies and plastic hinged lid and rim structures, which may be glued to the container body. One such package is described in US 2008041861, having a seal for initially closing the package and a space between the seal and an upper edge of the container for partially receiving the scoop prior to use. The container part may consist of a laminate of carton, metal foil and plastic material. A further similar package is shown in WO2010071424. A disadvantage of composite packages is that they may be difficult to recycle. Proposals for multi-component packages have been made that allow disassembly for separate recycling but until the present, suitable manufacturing processes capable of achieving such packages have been absent.

[0006] In the light of these requirements, it would be desirable to provide a package capable of being assembled in a manufacturing process that can be disassembled for recycling purposes. It would also be desirable to provide a method by which such a package could be manufactured.

BRIEF SUMMARY OF THE INVENTION

[0007] According to the invention, there is provided a method of manufacturing and filling a package, the method comprising:

[0008] a) providing a thermoformed tub defining a product receiving space, filling the product receiving space with a nutritional product, and sealing a membrane across an open mouth of the tub to seal the product therein;

[0009] b) providing a carton sleeve having a peripheral wall; and

[0010] c) inserting the tub into the sleeve such that at least the sidewalls of the tub are enclosed by the sleeve, whereby the sleeve supports the tub.

[0011] As a result of the disclosed method, the carton sleeve can be manufactured separately from the tub and joined after filling and sealing. The composite package can benefit from improved strength and the carton sleeve can be easily printed. Because the sleeve is added at a late stage in the production cycle, the sleeve design or language may be changed, even after the tub has been filled. It is noted that previous manufacturing processes have wrapped carton sleeves directly around a tub. Such processes may require a mandrel to be inserted into the tub for support and cannot therefore be carried out once the tub has been filled. For recycling, the sleeve and tub can be separated and disposed of as required.

[0012] In a preferred embodiment of the method, step a) may further comprise fitting a lower rim to an upper edge of the tub. This rim may advantageously assist in strengthening the otherwise relatively thin thermoformed tub. The lower rim is preferably adhered or welded on top of the membrane seal although it is not excluded that it may be connected to the upper edge of the tub directly before applying the membrane. The lower rim is preferably formed of the same class of material as the tub such that both may be recycled together. According to an important aspect of the invention, the step of applying the lower rim may further comprise centering the tub with respect to the lower rim prior to connection. In this manner, the lower rim may subsequently serve as a guide for further operations on the tub. As mentioned above and hereinafter, the tolerance between the tub and the sleeve is important and any variation in their relative dimensions should not be exacerbated by lack of alignment of the components.

[0013] In a further preferred embodiment of the invention, step a) further comprises fitting a lid assembly to the tub, the lid assembly comprising an upper rim and a recloseable lid. The upper rim is preferably circumferential, defining an access opening and the lid can be hingedly attached to the upper rim for closing the access opening. This allows the tub to be opened by a user by removal of the membrane seal and subsequently opened and resealed using the lid to close the access opening.

[0014] In a most preferred embodiment, the upper rim and the lower rim are mechanically connected together in an interference fit. The lower rim thus has the function of strengthening the upper edge of the tub allowing the upper rim and lid to be effectively connected thereto.

[0015] Of significant importance, for nutritional products and especially for infant nutrition, all elements of the package that come into contact with the product must be manufactured according to strict norms. This requires certain manufacturing steps to be carried out in a high-care environment. Additional components such as scoops and the lid or closure must also be manufactured according to the same standards if they are to come into contact with the product. According to one important aspect of the invention, step a) may take place in a high-care zone. In this context, it is understood that all of the individual actions included in step a) should take place within this high-care zone. Thus the package is filled and sealed and all element surfaces coming into contact with the nutritional product are only exposed to the high-care zone. For the purpose of the present invention, high-care is intended to denote that the environment is at an overpressure with respect to atmospheric pressure, preferably an overpressure of between 5 Pa and 50 Pa, more preferably an overpressure of between 5 Pa and 30 Pa, most preferably between 5 Pa and 20 Pa. The temperature in the high-care zone is preferably kept between 18° C. and 25° C., more preferably between 19° C. and 23° C. and the relative humidity is preferably controlled between 20% RH and 80% RH, more preferably between 30% RH and 60% RH, most preferably between 35% RH and 50% RH. Also, the atmosphere within the high-care environment is preferably filtered to remove particulates, such as with a HEPA (High-efficiency particulate absorption) filter includ-

ing a H10 filter or higher according to EN 1822:2009. Preferably, all components entering into contact with the product are cleaned by sterile, ionized air jet and checked with a vision system for imperfections or foreign bodies. Furthermore, the package is filled in a low-oxygen atmosphere. This may include flushing with nitrogen or carbon dioxide before and during the filling procedure and prior to applying the membrane. Nevertheless, the skilled person will understood that other criteria may be applied to this zone if required e.g. by local regulations.

[0016] Preferably, a scoop is provided within the package and may be located above the membrane seal prior to use. It is also conceivable that a scoop is integrally formed with the lid construction and separated at first use. In either case, the scoop is preferably also included within the package in step a) and may therefore also be handled exclusively in the high-care zone.

[0017] A further important point in defining the actions carried out in the high-care zone is to specify that the steps b) and c) take place outside the high-care zone. These actions may thus be characterised as ones that may not be permitted within the high-care zone. In particular, carton handling may be associated with considerable process debris and should be kept separate from the actions taking place in step a). For the purpose of the present invention, low-care is intended to denote that the environment thereof is kept at ambient conditions. This includes ambient pressure, meaning no overpressure situation is created. Furthermore, the temperature in the low-care zone is preferably less strictly controlled compared to the high-care conditions, meaning that the temperature in the low-care can be between 12° C. and 30° C., more preferably 15° C. and 26° C. Particulate filtration may be installed in the low-care area or installed for flow of air into the low-care zone but HEPA filtration is preferably not implemented to save costs

[0018] Most preferably step c) further comprises gluing the tub to the sleeve. It will be understood that the gluing performed in step c) is distinct from the gluing performed in step b). The former is a construction step in erecting the carton blank, the latter is an assembly step in joining the tub to the sleeve. Nevertheless, this additional gluing procedure may further strengthen the connection of the blank to itself. Preferably the connection between the tub and the sleeve can easily be broken to allow for disassembly on recycling of the package after use. The glue is preferably a hot-melt adhesive and is applied at locations on the inner surface of the carton sleeve.

[0019] According to a still further aspect of the invention, the tub is a pre-formed, size-stabilised tub of thermoplastic material. By manufacturing the tub in advance, better process control may be achievable whereby the tub to tub variation may be kept to a minimum. This is extremely important in ensuring a good fit with the sleeve. In the present context, pre-formed is understood to require that the tub has been formed at least 24 hours and preferably at least 48 hours prior to filling. This allows for residual stresses within the tub, due to the thermoforming process, to be relaxed. Step a) may also include a size determining step, in which critical dimensions of the tub are established and oversized and undersized tubs are rejected. In general, the absolute tolerance of a thermoformed item is closely related to its largest dimension and is also related to the amount of stretching that it has undergone during the thermoforming process. For a tub having a relatively large cross-sectional area, the absolute tolerance may be high. In the present case, the tub may have a largest dimension of more than 10 cm and preferably more than 15 cm. A relative tolerance of 1%, which is very slight for plastic forming processes, may already lead to absolute variations in length dimension of more than 1 mm.

[0020] The invention is particularly applicable to thin-walled tubs and in particular to tubs defining a single compartment. Such tubs may be relatively inexpensive due to the use of minimal amounts of plastics. Additional strength is provided by the carton sleeve. Preferably, the tub has a wall thickness of about 0.10 mm to 0.50 mm, preferably between 0.15 and 0.40 mm. It will be understood by the skilled person that, due to the thermoforming process, the wall thickness may not be uniform over the whole tub. In particular, the upper edge of the tub may form a flange having greater thickness and stiffness. The tub may be manufactured of any appropriate material capable of being thermoformed. A most suitable material is polypropylene. However, other polymer materials such as polyethylene terephthalate (PET) or polyethylene (PE) can be used as well. Multi layer materials may also be used, subject to the requirements of recycling. Most preferably, the tub comprises a multi-layer laminate including a central barrier layer having reduced oxygen transmission, such as EVOH or the like.

[0021] As indicated above, the strength of the package may be achieved by the combined strengths of the tub and the sleeve. The sleeve thus also has a structural function in addition to providing a printable surface. Preferably, the carton blank has a weight of between 50 g/m^2 and 400 g/m^2, preferably from 100 g/m^2 to 300 g/m^2. In general, the carton blank material has greater weight and thickness than the sidewalls of the tub. It may have a wall thickness of between 0.10 mm to 0.50 mm and may even have a wall thickness of 0.6 mm. The carton blank material may have a thickness that is at least twice the wall thickness of the sidewalls.

[0022] According to the invention, the tub and the sleeve support each other in order to provide a wall structure that is stronger than would be the case for each of the elements when taken alone. In one embodiment, this may be achieved by providing an interference fit between the sidewalls of the tub and the carton sleeve. This interference fit may prevent them from sliding out of each other during normal use and can also ensure that the sidewalls of the tub are adequately supported. It will be understood that the weight of the powder contents can assist in pressing the sidewalls into contact with the sleeve. In one embodiment, the interference fit may be provided without additional adhesive or the like. This eases the separation of these two parts of the package upon disposal and decreases the amount of time for manufacturing as the process step of adding adhesive can be omitted. It will however be appreciated that in other embodiments, adhesive of some form may be desirable e.g. to increase the composite strength of the package. Other mechanical connection between the tub and the sleeve may also be provided.

[0023] The interference fit may be achieved in various ways. In a preferred embodiment, the tub and the outer sleeve are manufactured to high tolerances, guaranteeing the required fit. This may be achieved when the sleeve has a sleeve base and the sidewalls and the sleeve are slightly tapered whereby a depth of the tub is such that it achieves the interference fit before the base of the tub engages the sleeve base. It will be understood that the sleeve base may be either open or at least partially closed. In particular it may be desirable that the sleeve base supports the underside of the tub

base. The taper of the outer sleeve and/or tub may be between 1° and 7°, preferably around 3°.

[0024] Alternatively or additionally, the interference fit may be achieved by slightly oversizing the tub relatively to the sleeve, i.e. that the tub is marginally larger than the sleeve. Upon insertion of the tub, the upstanding sidewalls of the tub will be deformed to fit into the sleeve and upon relaxation, the sidewalls of the tub will exert a force on the peripheral wall of the sleeve, causing the interference fit.

[0025] Additionally, the fit may further require that a top edge of the sleeve is at a distance different from the top edge of the tub. In order for the sleeve to adequately support the tub, the top edge of the sleeve does not necessarily have to coincide with the top edge of the tub. When a relatively small distance is maintained between the top edges, the tolerances of the respective heights of the tub and the sleeve can be accommodated such that the support of the sleeve to the tub can be optimized. This distance may be at most 5.0 mm, preferably 2 mm, more preferably 1 mm, whereby the sidewalls are supported up to the top edge, without the tub actually being suspended from its top edge.

[0026] The sleeve may be manufactured prior to insertion of the tub by any suitable method that ensures the required strength of this component. According to one important embodiment of the invention, improved tolerance between the sleeve and the tub may be achieved by providing in step b) a blank having a plurality of panels, folding the panels around a mandrel, and gluing the panels to each other to produce the sleeve. The mandrel thus assures that the sleeve is produced to the highest manufacturing tolerance. The gluing step ensures that the sleeve retains its configuration on removal from the mandrel. This is important, since any difference in size between these components can lead to the sleeve either being stretched and broken or being too loose around the tub. In this context, configuration is understood to mean its final dimensions and is not intended to exclude the fact that the sleeve could be bent, folded or flattened between steps b) and c).

[0027] In order to benefit from the combined strengths of the tub and the sleeve, both components must fit well together. In order to achieve a good fit, the mandrel preferably has external dimensions that correspond to the largest nominal external dimensions of the tub. For a tub having absolute variations in length, width and depth of around 1 to 1.5 mm, this can lead to a maximum tolerance between the tub and the sleeve of around 1.5 mm.

[0028] As indicated above, the tub and the sleeve may have tapered sidewalls. By providing such a taper, assembly of the components together in step c) is facilitated and improved centering of the tub and sleeve is achieved. Preferably, the blank has the shape of a cross defining a base and four side panels. The side panels may be provided with lobes or tabs that engage with each other and may be glued or otherwise adhered together. Once the sleeve has been formed, it may be stored for later use in step c) or may immediately be integrated into a package. Preferably the method comprises the provision of a puck for supporting the sleeve during step c). The puck may be a solid member or a frame or jig, having an opening sized to fit and support the sleeve. The puck is thus able to exert a counter pressure against the tub on its insertion into the sleeve. The puck may advantageously also be used for transporting the sleeve from step b) to step c) in an automated process and may be provided with indexing and identification provisions. According to a particularly advantageous embodiment, the puck is arranged to allow pressure to be exerted on the sleeve to move it into engagement with the peripheral walls of the tub. The puck may be provided with active regions that move to cause such engagement or may be provided with openings through which pressure plates may be introduced. Pressure may be applied at regions at which glue has been applied in order to cause adhesion at these points. Preferably, pressure is applied at a centre of the side panels of the sleeve, close to an upper edge thereof.

[0029] The membrane used to seal across the open mouth of the tub may be any conventional membrane of foil or plastic film or the like. Preferably, the membrane comprises a weakened tear line defining an opening region, and a pull tab for removing the membrane prior to use. The membrane may seal to an inside surface of the sidewalls. Most preferably however, the tub comprises an outwardly extending flange at the top edge to which flange the membrane is connected.

[0030] The invention also relates to a package manufactured according to any of the methods as described above. The resulting package may be easy to produce and dispose of. Other advantages will be apparent on the basis of the further description below.

[0031] The invention is particularly applicable to infant formula and most preferably the package is filled with powdered infant milk formula.

[0032] According to a still further aspect of the invention, the process is particularly applicable to wide access packages of the type wherein the tub is rectangular and has an access opening with a minimum dimension of at least 70 mm, more preferably around 100 mm and an area of at least 100 cm^2. In this context, rectangular is understood to include square and does not exclude the presence of rounded corners. The volume of the package may be between 0.8 litre and 3 litres, preferably around 1.5 litres. Such wide access packages are particularly susceptible to the problems of wall strength.

[0033] According to another aspect of the invention there is also disclosed a method of manufacturing a package for a powdered material, comprising:

[0034] providing a tub for receiving the powdered material, the tub having a base and sidewalls extending to a top edge;

[0035] providing a lid assembly, comprising a peripheral rim defining a wide access opening, and a lid, hingedly attached to the rim for reclosing the access opening;

[0036] filling the tub with the powdered material;

[0037] sliding the tub into a sleeve, such that at least the sidewalls of the tub are enclosed by the sleeve, whereby the sleeve supports the tub and the tub and sleeve form a container for the powdered material;

[0038] providing a membrane for separating the powdered material from the environment, the membrane having an opening region and a peripheral region, separated from each other by a line of weakness;

[0039] sealing the membrane to the sidewalls of the tub; and

[0040] connecting the peripheral rim of the lid assembly over the top edge of the tub.

[0041] In this context, container is intended to denote the combination of the tub and the sleeve that holds the powdered product. The tub is slid into the sleeve to form the container and to give support to the relatively thin tub. Most preferably, the tub is formed by thermoforming although it will be understood that blow moulding may also be applied. The manufacturing steps may be in the sequence as described above, although first sliding the tub into the sleeve and then filling the

tub is another possibility. However, filling the tub with the powdered material prior to sliding into the sleeve is preferred, since the product provides additional support to the peripheral wall of the tub. Additionally, the contents of the tub exert an outward force to the sleeve, thereby promoting an interference fit between the tub and the sleeve. In addition, the membrane can be provided over the top edge of the tub before sliding the tub into the sleeve to give extra support to the tub.

[0042] According to an embodiment, the method comprises connecting the peripheral rim of the lid assembly over the top edge with a mechanical connection, i.e. form fitting.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043] The features and advantages of the invention will be further appreciated upon reference to the following drawings of a number of exemplary embodiments, in which:

[0044] FIG. **1** shows a package manufactured according to the present invention;

[0045] FIG. **2** shows the package of FIG. **1** in partly exploded perspective view;

[0046] FIG. **3** shows a plan view of a blank for forming the sleeve shown in FIG. **2**;

[0047] FIG. **4** shows in perspective view the blank of FIG. **3** in partially erected position;

[0048] FIG. **5** shows a schematic view of a production line for carrying out the method according to the invention;

[0049] FIG. **6** shows part of the blank erecting station of FIG. **5**; and

[0050] FIG. **7** shows a schematic view of the insertion station of FIG. **5**.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0051] FIG. **1** shows in perspective view a package **1** manufactured according to the present invention. The package **1** is in its completed state and includes a tub **2**, enclosed by a sleeve **4**, and a lid assembly **3**.

[0052] FIG. **2** shows a partially exploded view of the package **1** showing in further detail the component parts of the package **1**, including the tub **2**, the sleeve **4**, a membrane **6**, a lower rim **8**, an upper rim **10** and a lid **12**. The tub **2** is thermoformed of a laminate of inner and outer relatively thin polypropylene material layers and an intermediate EVOH barrier layer. It includes a base **14** and a peripheral wall **16** defining a product containing space **20**. The peripheral wall **16** extends to an upper edge **18** having an outwardly directed flange **19**. The sleeve **4** is formed of carton. Lower rim **8** is formed as a flat annular ring of a similar dimension to the outwardly directed flange **19**. The lower rim **8** is injection moulded of polypropylene, although it will be understood that other appropriate materials could also be employed. The upper rim **10** and lid **12** form the lid assembly **3** and are also formed of injection moulded polypropylene. The upper rim **10** is designed to mechanically engage with the lower rim **8** in an interference fit including snap connectors, not shown. The seal **6** includes a tear line **22** defining an opening region **24** and includes a pull tab **26**.

[0053] FIG. **3** shows a plan view of a blank **28** used to form the sleeve **4**. The blank material is PE coated, high-quality card of 300 g/cm^2. The blank **28** defines a number of panels **30**A-E, corner sections **32** A-H and gluing tabs **34** A-D. Each of the gluing tabs **34** A-D is provided with heat seal adhesive **35**. The heat seal adhesive is an otherwise conventional varnish that is pre-applied by offset printing during production of the blank **28**. Panel **30**C is provided with a breakaway zone **36**, which allows the sleeve **4** to be broken and separated from the tub **2** after use.

[0054] FIG. **4** shows a perspective view of the sleeve **4** in partially assembled state. As can be seen, panel **30**A forms a base of the sleeve **4**, while sidepanels **30**B and **30**D form elongate sides. End panels **30**C and **30**E are folded upwards to form ends and overlie the gluing tabs **34** A, B and **34**C, D respectively.

[0055] FIG. **5** shows a schematic view of a production line **100** for carrying out the method according to the invention. The production line **100** is divided into a number of zones, defined as a first low-care zone **102**, a first transition zone **104**, a high-care zone **106**, a second transition zone **108**, a second low-care zone **110** and a third low-care zone **112**. The tub **2**, lower rim, **8**, lid assembly **3** and membrane **6** are all delivered via the first low-care zone **102**, through the first transition zone **104**, to the high-care zone **106**. It is noted that the tubs **2** are pre-formed, size-stabilised thermoformed tubs that have been formed at least 48 hours previously. In the high-care zone, the tub **2** is first filled with milk powder at filling station **114**. Subsequently, at sealing station **116**, membrane **6** is applied to close the product containing space **20** and hermetically seal the milk powder within the tub **2**. At welding station **118**, the tub **2** is centred and lower rim **108** is applied over the membrane **6** onto the outwardly directed flange **19** at the upper edge **18** of the peripheral wall **16** and subsequently welded into position. Thereafter, the semi-finished package **1'** proceeds to lidding station **120**, where the lid assembly **3** is applied onto the lower rim **108** and clicked into position. At this point, all of the components that enter into contact with the milk powder are enclosed within the semi-finished package **1'**. This can now proceed from the high-care zone **106** into the second transition zone **108**, where a number of semi-finished packages l'can be buffered. It will be understood that only the processes relevant to the present invention have been described at this point and that many other further operations may take place within the high-care zone **106**, including cleaning, inspecting, testing and the like.

[0056] Within the second low-care zone **110** is a blank erecting station **122** for forming the sleeve **4** as will be described in further detail below. Thereafter, at insertion station **124**, the semi finished package is inserted into an erected sleeve **4** and glued to form the final package **1** which passes to third low-care zone **112** for onward shipment at a shipment station **126**.

[0057] FIG. **6** shows in greater detail part of the blank erecting station **122** in partially exploded view. It comprises a central profile **130**, carrying four mandrels **132**A-D at equal angular spacing around its circumference. Each mandrel **132** has a nominal size corresponding to the size of the tubs **2** as delivered at station **102**. In use, the profile **130** is arranged to index to four rotation positions. In the illustrated position, mandrel **132**A is in the alignment position where it is presented with an aligned blank **28** from a magazine **136**. The blank **28** is retained on the mandrel **132**A by suction openings **134** as is generally conventional in carton handling machines. Mandrel **132**B is in the sidewall forming position. At this location, the side panels **30**B and **30**D are folded onto the mandrel **132**B by engaging surfaces of a manipulator (not shown) and then the gluing tabs **34**A-D are wrapped around the end of the mandrel and held into position by the suction openings **134**. Mandrel **132**C is in the heat-seal position,

where a pair of manipulators (not shown) fold the end panels **30**C and **30**E onto the glue tabs **34**A-D and apply heat and pressure to melt the adhesive **35** and complete the sleeve **4**. Mandrel **132**D is in the release position, where the sleeve **4** is released from the mandrel **132**D into a puck **138**. The puck **138** has an opening **139** sized to correspond with the dimensions of the sleeve **4** and supports it around its external periphery. The puck **138** also has apertures **137** on its lateral sides, the purpose of which will be explained below.

[0058] FIG. **7** shows a schematic view of the insertion station **124**. The puck **138** with sleeve **4** is transported on a conveyor **140** from the blank erecting station **122** in the second low-care zone **110** to a gluing position **142** where a glue dispenser **144** deposits a quantity of adhesive onto the internal surfaces of the side panels **30**B, **30**D. The adhesive is a hot-melt adhesive available as TECHNOMELT™ SUPRA **325** HT from Henkel AG and having an application temperature of between 160° C. and 190° C. The puck **138** then proceeds to receiving position **146**, where a semi finished package **1'** is lowered into the sleeve **4**. The puck **138** then proceeds to pressure position **148** where pressure plates **149** exert a lateral force through the apertures **137** against the sleeve **4** to move it into engagement with the tub **2**. The puck **138** supports the sleeve **4** during the application of pressure. From the pressure position **148**, the puck **138** proceeds on the conveyor **140** out of the insertion station **124** to the third low-care zone **112** and an extraction position **150** where the completed package **1** is removed from the puck **138** for further handling, boxing and palleting (not shown) at the shipment station **126**.

[0059] Thus, the invention has been described by reference to certain embodiments discussed above. It will be recognized that many modifications in addition to those described above may be made to the structures and techniques described herein without departing from the spirit and scope of the invention. Accordingly, although specific embodiments have been described, these are examples only and are not limiting upon the scope of the invention.

1-21. (canceled)

22. A method of manufacturing and filling a package with a nutritional product, the method comprising:

a) providing a thermoformed tub having sidewalls and a base defining a product receiving space, filling the product receiving space with the nutritional product, and sealing a membrane across an open mouth of the tub to seal the product therein;

b) providing a carton sleeve having a peripheral wall; and

c) inserting the filled and sealed tub into the sleeve such that at least the sidewalls of the tub are enclosed and supported around their periphery by the sleeve

wherein step a) takes place in a high care zone defined by a supra-atmospheric pressure and a filtered atmosphere and steps b) and c) take place outside the high care zone.

23. Method according to claim **22**, wherein step a) further comprises fitting a lower rim to an upper edge of the tub.

24. Method according to claim **22**, wherein step a) further comprises fitting a lid assembly to the tub, the lid assembly comprising an upper rim and a recloseable lid.

25. Method according to claim **24**, wherein step a) further comprises fitting a lower rim to an upper edge of the tub, and the upper rim and the lower rim are mechanically connected together in an interference fit.

26. Method according to claim **22**, wherein filling the product receiving space with the nutritional product takes place in a low oxygen atmosphere.

27. Method according to claim **22**, wherein step c) further comprises gluing the tub to the sleeve.

28. Method according to claim **22**, wherein the tub is a pre-formed, size-stabilised tub of thermoplastic material.

29. Method according to claim **22**, wherein the tub has a wall thickness of between 0.10 mm and 0.50 mm, preferably between 0.15 mm and 0.40 mm.

30. Method according to claim **22**, wherein the carton blank has a weight of between 50 g/m^2 and 400 g/m^2, preferably from 100 g/m^2 to 300 g/m^2.

31. Method according to claim **22**, wherein step b) comprises providing a carton blank having a plurality of panels, folding the panels around a mandrel, and gluing the panels to each other to produce the sleeve.

32. Method according to claim **31**, wherein the mandrel has external dimensions that correspond to external dimensions of the tub to a tolerance of less than 2 mm, preferably less than 1 mm.

33. Method according to claim **22**, wherein the tub and the sleeve have tapered sidewalls, with a taper of between 1° and 7°, preferably around 3°.

34. Method according to claim **22**, further comprising a puck for transporting the sleeve from step b) to step c) and for supporting the sleeve during step c).

35. Method according to claim **34**, wherein step c) comprises applying a lateral displacement to panels of the sleeve to bring them into engagement with the sidewalls of the tub.

36. Method according to claim **35**, wherein the lateral displacement is applied through openings in the puck.

37. Method according to claim **22**, wherein the membrane comprises a weakened tear line defining an opening region, and a pull tab.

38. Package manufactured according to the method of claim **22**.

39. Package according to claim **38**, wherein the nutritional product comprises powdered infant milk formula.

40. Package according to claim **38**, wherein the tub is generally rectangular and has a capacity of between 800 ml and 3000 ml.

41. Method according to claim **23**, wherein step a) further comprises fitting a lid assembly to the tub, the lid assembly comprising an upper rim and a recloseable lid.

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