

**SEALED PACKAGE FOR POURABLE FOOD PRODUCTS AND
PACKAGING MATERIAL FOR PRODUCING SEALED PACKAGES FOR
POURABLE FOOD PRODUCTS**

5 TECHNICAL FIELD

The present invention relates to a sealed package for pourable food products.

The present invention also relates to a sheet packaging material for producing sealed packages for pourable food products.

10 BACKGROUND ART

As is known, many liquid or pourable food products, such as fruit juice, UHT (ultra-high-temperature treated) milk, wine, tomato sauce, etc., are sold in packages made of sterilized packaging material.

A typical example is the parallelepiped-shaped package for liquid or
15 pourable food products known as Tetra Brik Aseptic (registered trademark), which is made by creasing and sealing laminated strip packaging material. The packaging material has a multilayer structure comprising a base layer, e.g. of paper, covered on both sides with layers of heat-seal plastic material, e.g. polyethylene. In the case of aseptic packages for long-storage products, such as UHT milk, the packaging
20 material also comprises a layer of oxygen-barrier material, e.g. an aluminium foil, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material forming the inner face of the package eventually contacting the food product.

Packages of this sort are normally produced on fully automatic packaging
25 machines, on which a continuous tube is formed from the web-fed packaging material; the web of packaging material is sterilized on the packaging machine, e.g. by applying a chemical sterilizing agent, such as a hydrogen peroxide solution, which, once sterilization is completed, is removed from the surfaces of the

packaging material, e.g. evaporated by heating; the web so sterilized is then maintained in a closed, sterile environment, and is folded and sealed longitudinally to form a tube, which is fed vertically.

In order to complete the forming operations, the tube is filled with the
5 sterilized or sterile-processed food product, and is sealed and subsequently cut along equally spaced cross sections.

More precisely, the tube is sealed longitudinally and transversally to its own axis.

Pillow packs are so obtained, which have a longitudinal seal and a pair of
10 top and bottom transversal seals.

Alternatively, the packaging material may be cut into blanks, which are formed into packages on forming spindles, and the packages are then filled with the food product and sealed. One example of this type of package is the so-called "gable-top" package known by the trade name Tetra Rex (registered trademark).

15 A package is known which comprises:

- a rectangular bottom panel which is crossed by a bottom transversal seal;
- a rectangular top panel, which is crossed by a top transversal seal;
- a rear panel which extends between corresponding first edges of top and bottom panels;
- 20 - a front panel which is opposite to the rear panel and extends between corresponding second edges, opposite to first edges, of top and bottom panels; and
- a pair of lateral panels interposed between bottom and top panels, and between rear and front panels.

A longitudinal seal extends perpendicularly between the transversal seals
25 and along the centerline of the rear panel.

In greater detail, rear and front panels are parallel to one another, lateral panels are parallel to one another, and lateral panels are orthogonal to both rear and front panels.

Furthermore, the top panel is slanted with respect to the bottom panel and is descending proceeding from the relative first edge to the relative second edge.

In other words, the distance between first edges of bottom and top panels is greater than the distance between second edges of such bottom and top panels.

5 As a consequence, the height of the rear panel is greater than the height of the front panel.

The top panel also comprises:

- a first area which accommodates an opening device and is bounded, on opposite sides, by the second edge and the transversal seal; and
- 10 - a second area which is bounded, on opposite sides, by the first edge and the transversal seal.

More precisely, the opening device substantially comprises a frame fitted to the first area of the top panel and a cap which is releasably coupled with the frame, so as to free a pouring opening of the food product, when unscrewed.

15 The above type of package is known under the name Tetra Brik Edge (Registered Trademark). Its main characteristic is the slanted top panel, which brings two advantages: an angled top panel which improves the pourability, and a transversal seal, crossing the top panel, being offset towards the rear panel, leaving a greater area for placing a cap.

20 Such a known package could be uncomfortable to pick up, especially when it stands between several other similar packages on the shelf, or in a secondary package such as a cardboard box.

Furthermore, in correspondence with other carton packages, the reduced circulation of air between the packages, as a consequence of being tightly packed, 25 could cause the formation of moisture onto such packages, especially if packed in a closed environment, such as a plastic wrap or a cardboard box, and even more so when subjected to humid weather conditions.

Due to the height of an opening device and to the inclination of the top

panel, the opening device may protrude from the first area of the top panel beyond a hypothetical prolongation of the front panel as shown in Figure 1. Since consumers today want bigger caps, for an improved drinking experience and improved pouring performance, this problem will only increase. Furthermore, newly developed one-step opening caps are higher than previous two-step opening caps, and this means that the caps stick out even more outside of the front panel. A one-step opening cap is a cap that only requires one action from the user, such as unscrewing the cap, in order to prepare the package for pouring or drinking.

A group of packages is often stored and transported in boxes as shown in Figure 2a. In this condition, the front panel of a second package contacts the rear panel of a first package. Furthermore, the front panel of an initial package and the rear panel of a last package are in contact with respective inner walls of the box.

Furthermore, the opening device of the second package interferes with the rear panel of the first package and therefore exerts a pressure against this rear panel. Accordingly, there is a risk that such pressure causes the opening devices to come off from the relative packages. The opening device could also cause a dent on the adjacent package, which causes an unwanted appearance and could make a customer reject the package. The dent could in worst case also affect the integrity of the package.

Furthermore, the interference between the opening device of the second package and the rear panel of the first package tends to slightly detach the front panel of the second package from the rear panel of the first package.

Accordingly, the rear panel of the last package and the front panel of the first package are forced against the walls of the box.

As a consequence, there is a risk of damaging the packages within the box or the shrink wrap, or even to cause damage to the secondary box or shrink wrap itself.

Finally, packages with opening devices applied thereon are normally

transferred on a belt conveyor within the packaging plant.

In case that the conveyor is stopped or packages are grouped, a queue of packages with opening devices is formed. This happens relatively regularly in the packaging line.

5 In this situation, the packages are pushed against each other, and can become slightly angled or leaning with respect to the conveyor as a consequence of the interference between their opening devices and the rear panel of the adjacent package, as shown in Figure 2b.

As a result, there is the risk that one or more of the packages fall over on the
10 conveyor. This can cause a jam and the filling line must be stopped to fix the problem. It is also possible that some packages fall off the conveyor, due to this inclination, leading to waste of packaging material and product.

Furthermore, a need is felt within the industry to easily detected the fermentation of the pourable food product within the package and/or the leakage of
15 air (or another gas) into the package.

EP-A-277673 discloses a sealed package comprising a quadrilateral top wall, a quadrilateral bottom wall, front and rear sidewalls and lateral sidewalls. The top wall is not provided with an opening device.

The joint portion between each two adjacent walls of the front, rear and
20 lateral four side walls is formed with two ridgelines interconnecting the corresponding pair of corners of the top and the bottom walls.

The front wall extends between the front edges of top and bottom walls. The rear wall extends between the rear edges of top and bottom walls.

The two ridgelines are joined to each other at their upper and lower ends but
25 are spaced apart from each other between these ends. The ridgelines extend smoothly as curved inwardly of the package to form a joint wall therebetween.

WO-A-2009/030910 discloses a package comprising a top and bottom walls, a front and a rear wall. And two lateral walls.

Top wall is sloped relative to sidewalls and to bottom wall. In a first embodiment, the front edge of the top wall – which coincides with the top edge of the front sidewall – is curved.

In a second embodiment, the package comprises a recess for receiving the
5 nose of a consumer drinking directly from a spout. The recess is formed by providing a lenticular panel in the sheet packaging material from which package is formed.

DISCLOSURE OF INVENTION

It is therefore an object of the present invention to provide a sealed package
10 for food product, which reduces at least one afore-mentioned drawback connected with the known packages and preserving, at the same time, the number of panels of the known packages.

According to the present invention, there is provided a sealed package for pourable food products, as claimed in claim 1.

15 Another object of the present invention is to provide a sheet packaging material for producing sealed packages of pourable food products, as claimed in claim 13.

Another object of the present invention is to provide a method for forming a sealed package for pourable food product, as claimed in claim 22.

20 BRIEF DESCRIPTION OF THE DRAWINGS

Two preferred, non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a queue of known sealed packages which have been
25 disclosed in the introductory part of the present description;

Figure 2a shows the known sealed packages of Figure 1 when accommodated within a box;

Figure 2b shows the known packages in a queue, as they are falling off the

conveyor;

Figure 3 shows a frontal view of a first embodiment of a sealed package for pourable food product, in accordance with the teachings of the present invention;

Figure 4 shows a lateral view of the sealed package of Figure 3;

5 Figure 5 shows a perspective view of the sealed package of Figures 3 and 4;

Figure 6 shows a top plan view of a basic unit of a sheet packaging material by which to produce one package of the type shown in Figures 3 to 5;

Figure 7 shows a queue of sealed packages of the type shown in Figures 3 to 5;

10 Figure 8 shows a perspective view of a second embodiment of a sealed package for pourable food product;

Figures 9 and 10 show a frontal and back view of the sealed package of Figure 8;

Figure 11 shows a top plan view of a basic unit of sheet packaging material by which to produce one package of the type shown in Figures 7 to 10; and

Figure 12 shows a queue of sealed packages of the type shown in Figures 8 to 10.

BEST MODE FOR CARRYING OUT THE INVENTION

Number 1 in Figure 3 indicates as a whole a sealed package for pourable food products, which is made of multilayer sheet packaging material 2 (Figure 6) and may be fitted with a reclosable opening device 3 (shown in Figure 7) preferably made of a plastic material.

Opening device 3 is applied to package 1 by conventional fastening systems, such as adhesives, or by microflame, electric-current-induction, ultrasound, laser, or other heat-sealing techniques.

With reference to Figure 3, package 1 comprises:

- a quadrilateral (in the example shown, rectangular or square) top panel

5;

- a quadrilateral (in this case, rectangular or square) bottom panel 6, which is opposite to top panel 5;

- a flat rear panel 7, which extends between top panel 5 and bottom panel 6;

- a front panel 8, which extends between top panel 5 and bottom panel 6,
5 and is opposite to rear panel 7; and

- two lateral panels 9 opposite to each other, and which extend between top panel 5 and bottom panel 6, and between rear and front panels 7, 8.

Lateral panels 9 extend each from front panel 8 to rear panel 7.

Front panel 8 and rear panel 7 are adjacent to both lateral panels 9.

10 Bottom panel 6 comprises two horizontal edges 10, 11 parallel to one another, and two horizontal edges 12 interposed between and orthogonal to edges 10, 11. Edges 12 are parallel to one another.

Panel 5 comprises two horizontal edges 15, 16 opposite to each other and parallel to one another. More precisely, horizontal edges 15, 16 are parallel to and
15 arranged over edges 10, 11 respectively.

Edges 15, 16 are rectilinear.

Panel 5 also comprises two edges 17, which extend between edges 15, 16 and are parallel to one another.

Edges 17 are arranged over respective edges 12.

20 In particular, the distance between edges 11, 16 is greater than the distance between edges 10, 15.

In other words, the height of rear panel 7 is greater than front panel 8.

Edges 10, 11 and 12 define a plane; top panel 5 is slanted with respect to such a plane, and is descending, proceeding from edge 16 to edge 15.

25 The rear panel 7 extends between edges 11, 16 and comprises two vertical edges 18a, 18b, which are parallel to one another and extend between edges 11, 16.

Front panel 8 extends between edges 10, 15 and comprises two edges 19, 20, which extend between edges 10, 15.

Each lateral panel 9 is bounded by edge 12, 17, by a relative edge 18a; 18b, and by a relative edge 19; 20.

Edges 19, 20 are the only edges which extend between edges 10, 15.

Edges 19, 20 are distinct and separate from each other, i.e. they do not have
5 any common point.

Edge 19 bounds both front panel 8 and one lateral wall 9.

Edge 20 bounds both front panel 8 and the other lateral wall 9.

Edges 10, 15 define a theoretical plane P, which is perpendicular to bottom panel 6, parallel to rear panel 7 and arranged, when package 1 is standing on the
10 bottom panel 6, vertically.

Package 1 also comprises a top transversal sealing 21 and a bottom transversal sealing (not shown), which extends across respective top and bottom panels 5, 6.

Sealing band 21 divides top panel 5 into two portions 22, 23, one (22) of
15 which, adjacent to front panel 8 and bounded by edge 15, defines an area for the potential application of opening device 3, while the other portion (23), adjacent to rear panel 7 and bounded by edge 16, comprises along the centerline, an end portion of a flat longitudinal sealing band 24 of package 1. More specifically, sealing band 24 extends perpendicularly between sealing band 21 and bottom
20 sealing band, and substantially along the centerline of rear panel 7.

Sealing band 21 extends beyond top panel 5 of package 1 into respective flat, substantially triangular lateral portions 26 of packaging material folded coplanar with and onto respective lateral panels 9 as of top panel 5.

Sealing band 21 also forms, lengthwise, a flat top tab 30 projecting from
25 portions 22, 23 and from lateral portions 26 and folded onto portions 23 and onto portions 26 along a bend line formed at the base of tab 30.

Advantageously, edges 19, 20 extend on the opposite side of plane P with respect to panel 7; the whole front panel 8 extends on the opposite side of plane P

with respect to panel 7; and panels 9 are concave.

In greater detail, edges 19, 20 comprise, proceeding from edge 15 towards edge 10:

- respective portions 40, 41 which extend at increasing distances from plane P; and
- respective portions 42, 43 which extend at decreasing distance from plane P.

In other words, edges 19, 20 extend outside of plane P with reference to panel 7.

Distances between edges 19, 20 and plane P are measured orthogonally to such plane P.

Portions 40, 42 join to one another at point Q while portions 41, 43 join to one another at point R (Figure 3).

In other words, each edge 19, 20 comprises, proceeding from edge 15 to edge 10, a relative portion 40, 41 which extends at increasing distances from plane P and a relative portion 42, 43 which extend at decreasing distances from such plane P.

Portions 40, 41 converge towards one another, i.e. have a decreasing distance from each other, from edge 15 to a segment S, which connects points Q, R. Segment S is, in the embodiment shown, horizontal, and is arranged on the opposite side of edges 10, 15 relative to rear panel 7.

Points Q, R are arranged at the same distance from edge 10 and at the same distance from edge 15.

The distance of points Q, R, i.e. the length of segment S, is within +/- 5% of the half of the distance between edges 10, 15.

Alternatively, the distance of points Q, R, i.e. the length of segment S, is within +/- 5% of the average of the distance between edges 10, 15 and the distance between edges 11, 16.

Portions 42, 43 converge towards one another, i.e. have a decreasing distance from each other, from edge 10 towards segment S.

In other words, portions 40, 41 extend at increasing distances from plane P and at decreasing distances from one another, proceeding from edge 15 to segment
5 S. Differently, portions 42, 43 extend at decreasing distance from plane P and at increasing distances from one another, proceeding from segment S to edge 10.

In this way, edges 19, 20 are arranged at the narrowest distance from one another at points Q, R.

As a consequence of the shape of edges 19, 20, lateral panels 9 are not flat
10 but are defined by relative concave surfaces which at first converge towards one another and then diverge from one another, proceeding from relative edges 17 to relative edges 12.

Portions 40, 41, 42, 43 are, in the embodiment shown, curvilinear.

More precisely, edges 19, 20 are shaped, in the embodiment shown, as
15 parabolic arcs.

Panel 8 is convex.

The maximum distance of panel 8 from plane P is reached at the mid-section of package 1, i.e. at a plane orthogonal of plane P and having the same distance from edges 15, 10.

20 Bottom panel 6 coincides with the projection of top panel 5 on a plane orthogonal to an axis D (Figures 4 and 5). More precisely, axis D joins the center points of panels 5, 6. Center points of panels 5, 6 coincide with respective intersection points of the diagonals of panels 5, 6.

Furthermore, the inclination angle of panel 5 relative to the plane defined by
25 edges 10, 11 ranges between 15 and 20 degrees. In particular, such an inclination angle is 17 degrees.

Front panel 8 is symmetrical with respect to a curvilinear axis C which joins the middle-point of edge 15, the middle-point of segment S and the middle-point of

edge 10. Axis C lies on and follows the front panel 8.

Axis C extends at increasing distance from plane P, proceeding from edge 15 to segment S; and extends at decreasing distances from plane P proceeding from segment S to edge 15.

5 Axis C has a similar conformation of edges 19, 20. In the embodiment shown, axis C is, therefore, shaped as a parabolic arc, although other curvatures are possible.

 All sections of package 1 parallel to a plane U (Figure 4) parallel to bottom panel 6, between edges 10 and 15, have the same perimeter or circumference, since
10 the package 1 is formed from a cylindrical tube with constant diameter.

 In top panel 5, the package 1 may have a removable portion (not shown in Figure 6) that, in use, can be detached from packaging material 2 by an opening device 3 to free a pour opening by which to pour the food product from package 1.

 Opening device 3 substantially comprises a frame 51 applied onto portion
15 22 of top panel 5, and a cap 52 screwed onto a neck defined by frame 51 (Figure 7).

 Packaging material 2 from which package 1 is made has a multilayer structure comprising a base layer, e.g. of paper, for stiffness, and a number of lamination layers covering both sides of base layer.

 In the example shown, the lamination layers comprise a first layer of
20 oxygen-barrier material, e.g. an aluminum foil, and a number of second layers of heat-seal plastic material covering both sides of both base layer and first layer. In other words, such solution comprises, in succession and from the side eventually forming the inside of package 1, a layer of heat-seal plastic material, a layer of barrier material, another layer of heat-seal plastic material, base layer, and another
25 layer of heat-seal plastic material.

 The inner layer of heat-seal plastic material contacting the food product, in use, may, for example, be made of strong, in particular, high-stretch, metallocene-catalyzed, low-linear-density (LLD) polyethylene.

Normally, layers of heat-seal plastic material are laminated on the base layer in a melted state, with successive cooling.

As a possible alternative, at least the inner layers of plastic material may be provided as prefabricated films, which are laminated on the base layer; this
5 technique allows reducing any risk of formation of holes or cracks at or around the removable portion during the forming operations for producing sealed package 1.

The letter M in Figure 6 indicates a basic unit of packaging material 2, by which to produce package 1, and which may be a precut blank, or a portion of a web of packaging material comprising a succession of units M.

10 In the first case, basic unit M is folded on a known crease spindle (not shown), is filled with the food product, and is sealed at the top and bottom to form package 1. In the second case, the web of packaging material 2, comprising a succession of basic units M, is:

- folded into a cylinder to form a vertical tube having constant
15 circumference;
- filled continuously with the food product; and
- sealed transversely and cut into basic units M, which are then folded to form respective packages 1.

Basic unit M has a crease pattern 60, i.e. a number of crease lines defining
20 respective fold lines, along which packaging material 2 is folded to form the finished package 1.

It is important to mention that the term crease lines is used in the present description lines along which basic unit M is folded to form a relative package 1, 1'. In particular, decorative lines are not crease line in the meaning of the present
25 description.

Crease pattern 60 substantially comprises:

- a transversal crease line 63 for forming edges 10, 11, 12 of finished package 1;

- a piecewise transversal crease line 67 for forming edges 15, 16, 17 of finished package 1;
 - a pair of transversal crease lines 61, 62 for allowing the folding of top seal 21 and of the bottom seal;
 - 5 - a pair of longitudinal crease lines 65, 66a having respective main portions 86, 87 adapted to form respective edges 18a, 18b of finished package 1;
 - a pair of longitudinal crease lines 68, 69 which are separated from and aligned to one another and comprise respectively inner end points 100, 101;
 - a pair of longitudinal crease lines 70, 71 which are separated from and
10 aligned to one another, are parallel to respective crease lines 68, 69, and comprise respectively inner end points 102, 103;
 - a pair of crease lines 120, 121 for forming respectively edges 19, 20 of finished package 1; and
 - an edge area 60 to be sealed on an opposite edge 64 of basic unit M to
15 form a cylinder.
- Crease lines 63, 61, 62 are parallel to each other and orthogonal to crease lines 65, 66a.
- In particular, crease line 63 comprises a first segment 80 which extends between an edge 64 of crease pattern 60 and crease line 65;
- 20 - a second segment 81 which extends between crease line 65 and end point 100 of crease line 68;
 - a third segment 82 which extends between end point 100 of line 68 and a top end point 102 of crease line 70;
 - a fourth segment 83 which extends between end point 102 of line 70 and
25 crease line 66a; and
 - a fifth segment 84 which extends between crease line 66a and an edge area 66b.

Crease line 67 comprises:

- a first segment 90 parallel to first segment 80 of line 63 and which extends between edge 64 and crease line 65;
- a second segment 91 slanted with respect to second segment 81 of line 63 and which extends between crease line 65 and end point 101 of crease line 69;
- 5 - a third segment 92 parallel to third segment 82 of line 63 and which extends between end point 101 and end point 103 of crease line 71;
- a fourth segment 93 slanted with respect to third segment 83 of line 63 and which extends between end point 103 of crease line 71 and crease line 66a; and
- a fifth segment 94, which extends between crease line 66a and edge area
- 10 66b.

Furthermore, crease pattern 60 comprises:

- two pairs of crease lines 110, 111 and 112, 113 adapted to form respective top flaps 26 of finished package 1; and
- two pairs of crease lines 114, 115 and 116, 117 adapted to form bottom
- 15 flaps (not shown in Figures 3 to 5) of finished package 1.

More precisely, the bottom flaps are folded onto panel 6 of finished package 1.

Crease line 110 (112; 115; 117) extends between end point 101 (103; 100; 102) and the midpoint of a segment of crease line 61 (61; 62; 62) interposed

20 between crease lines 65, 69 (66a, 71; 65, 68; 66a, 70). Crease line 111 (113; 114; 116) extends between intersection point of crease lines 65, 67 (66a, 67; 65, 63; 66a, 63) and the midpoint of the segment of crease line 61 (61; 62; 62) interposed between crease line 65, 69 (66a, 71; 65, 68; 66a, 70).

End points 100, 101 are joined by a theoretical reference segment 105

25 (shown in a dotted-line in Figure 6 but not present on basic unit M) and end points 102, 103 are joined by a theoretical reference segments 106 (shown in a dotted-line in Figure 6 but not present on basic unit M).

Advantageously, crease lines 120, 121 extend within an area 123,

rectangular in the embodiment shown, bounded by segment 82 of crease line 63, segment 92 of crease line 67 and by theoretical reference segments 105, 106.

In greater detail, crease lines 120, 121 comprise relative first ends which coincide with end points 100, 102, and second ends 124, 125, opposite to first ends, which are at a certain distance from relative end points 101, 103 of crease lines 69, 71.

Crease line 120 is the only crease line which originates from one (100) of end points 100, 101 and extends towards the other one (101) of end points 100, 101.

In the very same way, crease line 121 is the only crease line which originates from one (102) of end points 102, 103 and extends towards the other one (103) of end points 102, 103.

Crease lines 120, 121 are distinct and separate from each other, i.e. they do not have common points.

Crease lines 120, 121 at first converge towards one another and then diverge from one another, proceeding from end points 100, 102 of crease lines 68, 70 towards relative second ends 124, 125.

Crease lines 120, 121 extend at first at increasing distances from relative theoretical reference segments 105, 106 and then at decreasing distances from relative theoretical reference segments 105, 106, proceeding from end points 100, 102 of crease lines 68, 70 towards relative second ends 124, 125.

Crease lines 120, 121 extend also symmetrically with respect to an axis B, which joins the middle-points of segments 82, 92. Axis B is, in the embodiment shown, vertical.

Basic unit M has a constant width measured orthogonally to axis B. In this way, it could form a tube of packaging material from which packages 1, 1' are obtained after their folding.

Crease lines 120, 121 are curvilinear. More precisely, crease lines 120, 121 are, in the embodiment shown, shaped as parabolic arcs.

Number 1' in Figures 8 to 10 and 12 indicates a second embodiment of a sealed package in accordance with the present invention; sealed packages 1, 1' being similar to each other, the following description is limited to the differences between them, and using the same references, where possible, for identical or
5 corresponding parts.

Scaled package 1' differs from sealed package 1 in that edges 18a', 18b' extend on the opposite side of a theoretical reference plane T' defined by edges 11, 16, relative to panel 8; and in that the whole panel 7' extends, on the opposite side of plane T', relative to panel 8 (Figure 12).

10 Panel 7' is, in particular, convex.

Edges 18a', 18b' are the only edges which extend between edges 11, 16.

Edges 18a', 18b' are distinct and separate from each other, i.e. they do not have any common point.

Edge 18a' bounds both rear wall 7 and one lateral wall 9.

15 Edge 18b' bounds both rear wall 7 and one lateral wall 9.

Plane T' is, in the embodiment shown, parallel to plane P.

In greater detail, edges 18a', 18b' comprise, proceeding from edge 16 towards edge 11 (Figure 10):

- respective portions 45', 46' which extend at increasing distance from plane
20 T' and converge to one another, i.e. have a decreasing distance from one another; and

- respective portions 47', 48' which extend at decreasing distance from plane T' and diverge from one another, i.e. have an increasing distance from one another.

25 The distance between edges 18a', 18b' and plane T' are measured orthogonally to such plane T'.

Portions 45', 47' and 46', 48' join to one another respectively at points W', Z' which are joined by a theoretical reference segment V'.

Segment V' is, in the embodiment shown, horizontal, is arranged on the opposite side of edges 11, 16 relative to panel 8, and is parallel and staggered relative to edges 11, 16.

Portions 45', 46', 47', 48' are, in the embodiment shown, curvilinear.

5 More precisely, edges 18a', 18b' are shaped, in the embodiment shown, as parabolic arcs. Other curvatures or shapes are possible of edges 18a', 18b'.

Rear panel 7' is symmetrical with respect to a curvilinear axis A' which joins the middle-point of edge 16, the middle-point of segment V' and the middle-point of edge 11.

10 Axis A' extends at increasing distances from plane T', proceeding from edge 16 to segment V'; and extends at decreasing distance from plane T', proceeding from segment V' to edge 16.

Axis A' has a similar conformation of edges 18a', 18b', and is, therefore,
15 shaped as a parabolic arc in the embodiment shown.

The maximum distance of panel 7' from plane T' is reached at the mid-section of package 1', i.e. at a plane orthogonal of plane T' and having the same distance from edges 16, 11.

Package 1' also differs from package 1 in that opening device 3'
20 substantially comprises a frame 51' which straddles edge 15 and comprises two fastening portions 53a', 53b' at a predetermined angle to each other (Figure 8). Cap 52' is releasably fitted to a neck portion of frame 51'.

More precisely, portion 53a' is applied onto portion 22 of top panel 5 while portion 53b' is applied onto an area of front panel 8 adjacent to edge 15.

25 Letter M' in Figure 11 indicates a second embodiment of a basic unit of packaging material 2', by which to produce package 1'; the basic units of packaging material 2, 2' for making the two different package embodiments 1, 1' are similar to each other, the following description is limited to the differences

between them, and using the same references, where possible, for identical or corresponding parts.

Basic unit of packaging material 2' differs from basic unit of packaging material 2 in that crease pattern 60' does not comprise crease line 65. Furthermore,
 5 crease pattern 60' comprises, instead of crease line 65,:

- a segment 186' which extends from an end point 187' of segment 80 on the opposite side of crease line 67 and orthogonally to segment 80; and
- a segment 191' which extends from an end point 188' of segment 90 on the opposite side of crease line 63 and orthogonally to segment 90.

10 End point 187' is in common between segments 80, 186' as well as end point 188' is in common between segments 90, 191'.

Furthermore basic unit of packaging material 2' differs from basic unit of packaging material 2 in that it does not comprise crease line 66a.

Crease pattern 60' comprises, instead of crease line 66a:

- 15
- a segment 192' which extends from an end point 189' of segment 84 on the opposite side of crease line 67 and orthogonally to segment 84;
 - a segment 193' which extends from an end point 190' of segment 93 on the opposite side of crease line 63 and orthogonally to segment 94.

End point 189' is in common between segments 84, 192' and end point 190' is in common between segments 94, 193'.

End points 187', 188' are joined by a theoretical reference segment 180' (shown in a dotted-line in Figure 11 but not present on basic unit M) and end points 189', 190' are joined by a theoretical reference segment 181' (shown in a dotted-line in Figure 11).

25 Crease pattern 60' finally comprises:

- a crease line 182' which extends between end points 187', 188', and is adapted to define edge 18a' of finished package 1'; and
- a crease line 183' which extends between end points 189', 190' and is

adapted to define edge 18b' of finished package 1'.

More precisely, crease line 182' originates from end point 187' and extends towards end point 188'. Differently, crease line 183' originates from end point 189' and extends towards end point 190'.

- 5 In greater detail, crease lines 182', 183' comprise relative first ends which coincide respectively with end points 187', 189'; and second ends which are at a certain distance from relative end points 188', 190'.

Advantageously, crease line 182' extends within an area 184' bounded by segments 80, 90, by a segment 85 of edge 64 interposed between segments 80, 90, and by theoretical reference segment 180'; and crease line 183' extends within an area 185' bounded by segments 84, 94, by a segment 88 along edge area 66b, and by theoretical reference segment 181'; crease line 182' is the only crease line which originates from one (187') of end points 187', 188' and extends towards the other one (188) of end points 187', 188'.

- 15 In the very same way, crease line 183' is the only crease line which originates from one (189') of end points 189', 190' and extends towards the other one (190) of end points 189', 190'.

Crease lines 182', 183' are distinct from each other, i.e. they do not have common points.

- 20 Areas 184', 185' are, in the embodiment shown, rectangular.

In greater detail, crease line 182' (183') at first converge towards segment 85 (88) and then diverge from such segment 85 (88), proceeding from end points 188' (190') towards end points 187' (189').

- Crease line 182' (183') extends at first at increasing distances from theoretical reference segment 180' (181') and then at decreasing distance from theoretical reference segment 180' (181'), proceeding from end points 188' (190') towards end points 187' (189').

Crease lines 182', 183' are curvilinear and, in the embodiment shown,

shaped as parabolic arcs.

As a consequence, crease pattern 60' comprises a first region and a second region adapted to define rear panel 7' of finished package 1', once that blank M' has been folded along segments 90, 94 and crease lines 181', 182', and edge 85 has
5 been sealed to edge area 66b.

In particular, the first region is bounded by segments 80, 85, 90 and by crease line 182' while the second region is bounded by segments 84, 94, 88 and by crease line 183'.

Points Q, RE

10 The advantages of package 1, 1' and sheet packaging material 2, 2' and of the method of forming package 1, 1' according to the present invention will be clear from the above description.

In particular, package 1, 1' is easy to grip, in particular when it stands between several other similar packages 1, 1'.

15 As a matter of fact, when several packages 1, 1' are placed side-by-side, such as on a retailer shelf, the waist of the packages, caused by the central narrowing of the front panels 8 (and rear panels 7' if applicable), makes it easier to insert a finger on each side and pick out an individual package 1, 1'.

The presence of such a gap is due to the fact that front panel 8 extends on
20 the opposite side of plane P with respect to rear panel 7, 7',

Furthermore, due to the fact that each package 1, 1' is not in full contact with adjacent packages 1, 1', air is allowed to circulate between such packages 1, 1', so reducing the moisture surrounding packages 1, 1'.

As a result, packages 1, 1' are conserved in a particularly hygienic
25 environment.

Furthermore, even when they are provided with an opening device 3, 3' which protrudes beyond rear panel 7, packages 1, 1' are prevented from being damaged when stored and/or transported in a plurality of rows within a box or when

conveyed in a packaging plant.

As a consequence, when packages 1, 1' are arranged in rows, for example within a box to be stored and/or transported, even if front panel 8 of a second package 1, 1' contacts rear panel 7 of a first package 1, 1', cap 52, 52' of opening
5 device 3, 3' of second package 1, 1' is substantially prevented from interfering with rear panel 7, 7' of first package 1, 1' (Figures 7 and 12).

Accordingly, the pressure exerted by cap 52, 52' of opening device 3, 3' against rear panel 7, 7' of a first package 1, 1' is dramatically reduced. As a consequence, also the risk that the cap 52, 52' of the opening device 3, 3' comes off
10 as a result of the above-mentioned pressure is dramatically reduced.

Furthermore, rear panels 7, 7' of packages 1, 1' which contact the inner wall of the box are substantially prevented to exert a pressure against such inner wall.

Accordingly, also the risk of damaging packages 1, 1' within box is dramatically reduced.

15 In case that packages 1, 1' with opening device 3, 3' applied thereon form a queue on a conveyor, packages 1, 1' are substantially prevented from leaning with respect to one another.

In this way, even if a queue is particularly long, there is no risk that some packages 1, 1' fall over onto the conveyor.

20 Due to the fact that panels 9 are concave, package 1, 1' is particularly advantageous.

As a matter of fact, panels 9 create a space between packages 2 place side by side with respective panels 9 arranged side by side. This is effective in preventing mildew in shrink-wrapped multipack and/or in very difficult ambient
25 conditions.

Furthermore, thanks to the presence of panels 9, it is much easier to detect if the pourable product has been fermented. In such a case, an internal pressure will press out panels 9 easily, making detection with available apparatus easily

conducted. Furthermore, panels 9 could lose their concavity if air (or another gas) leaks into package 1, 1', through an untight sealing, or a micro-crack. In this case, this leakage may be easily detected and the package 1, 1' may be so discarded. In both the above cases, concave panels 9 create a small vacuum pressure inside
5 package 1, 1', which is used for the above visualizations.

Finally, if edges 18a, 18b are curved, they work like an arch-type reinforcement and are, therefore, able to contrast a force exerted from an adjacent package 1'.

Package 1' reaches all the above-identified advantages, even when it is
10 fitted with an opening device 3' which extends a considerable distance outside of front panel 8.

As a matter of fact, not only front panel 8 of package 1' extends on the opposite side of plane P with respect to rear panel 7', but also rear panel 7' of package 1' extends on the opposite side of plane T' with respect to front panel 8.

15 In this way, as shown in Figure 12, the gap available for cap 52' of opening device 3' substantially equals the sum of:

- the distance between segment S and plane P of relative package 1';
- and
- the distance between segment V' and plane T' of following package
20 1'.

It is important to mention that all the above-mentioned advantages are reached by the present invention without changing the quadrangular shape of package 1, 1', i.e. by a package 1, 1' which has two quadrangular bottom and top panel 6, 5 and four panels – front panel 8, rear panel 7, 7' and two panels 9 –
25 interposed therebetween.

Clearly, changes may be made to packaging material 2, 2' and the package 1, 1' as described and illustrated herein without, however, departing from the scope defined in the accompanying claims.

In particular, only the portion of front panel 8 adjacent to edge 15 could extend on the opposite side of plane P with respect to rear panel 7. In a completely analogous way, only the portion of rear panel 7' adjacent to edge 16 could extend on the opposite side of plane T' with respect front panel 8.

5 Furthermore, second ends 124, 125 may coincide with end points 101, 103. In this case, crease lines 120, 121 extend between relative end points 100, 102 and relative end points 101, 103.

In a completely analogous way, second ends of crease lines 182', 183' may coincide with end points 188', 190'.

10 Edges 18a, 18b, 19, 20 and crease lines 120, 121, 182', 183' may not be parabolic. For example, edges 18a, 18b, 19, 20 and crease lines 120, 121, 182', 183' may be shaped as a series of straight segments joined to one another and inclined with respect to one another.

 Finally, the longitudinal seal of package 1, 1' may extend along a panel
15 other than rear panel 7, 7'.

CLAIMS

- 1) A sealed package (1, 1') for pourable food products, comprising:
- a quadrilateral bottom panel (6) which comprises a first front edge (10) and a second rear edge (11) opposite to another;
 - a quadrilateral top panel (5) which is opposite to said bottom panel (6) and comprises a third front edge (15) and a fourth rear edge (16);
 - a front panel (8) which extends between said first and third edges (10, 15);
 - a rear panel (7, 7') which extends between said second and fourth edges (15, 16); and
 - two lateral panels (9) opposite to each other;
- said front panel (8) comprising a fifth and sixth edge (19, 20) which are opposite to one another and extend both between said first and third edges (10, 15);
- said rear panel (7, 7') comprising a seventh and an eighth rear edge (18a, 18b; 18a', 18b') which are opposite to one another and extend between said second and fourth edges (11, 16);
- said two lateral panels (9) being adjacent to said front and rear panels (8; 7, 7') and extend each from said front to said rear panel (8; 7, 7');
- said fifth edge (19) bounding said front panel (8) and one said lateral panel (9);
- said sixth edge (20) bounding said front panel (8) and the other said lateral panel (9);
- said seventh edge (18a; 18a') bounding said rear panel (7) and said one lateral panel (19);
- said eighth edge (18b; 18b') bounding said rear panel (7) and said other lateral panel (19);
- said fifth edge (19) and said sixth edge (20) being the only edges which extend between said first edge and third edge (10, 15);

said seventh and eighth edges (18a, 18b; 18a', 18b') being the only edges extending between said second and fourth edges (11, 16);

the distance between said first and third edges (10, 15) being smaller than the distance between said second and fourth edges (11, 16);

said top panel (5) being angled with respect to a first plane defined by said first and second edges (10, 11);

said first and third edges (10, 15) defining a second theoretical reference plane (P);

the sections of said package (1, 1') in a third plane (U) having constant perimeter; said third plane (U) being parallel to said bottom panel (6), said package (1, 1') being formed from a cylindrical tube with a constant diameter;

characterized in that at least one of said fifth and sixth front edges (19, 20) extends at least partially on the opposite side of said second theoretical plane (P) with respect to said rear panel (7, 7');

said front panel (8) comprising at least one first region which extends on the opposite side of said second theoretical plane (P) with respect to said rear panel (7, 7');

said lateral panels (9) being concave;

said fifth and sixth edges (19, 20) comprise respective first portions (40, 41) which extend at increasing distances from said second theoretical reference plane (P), proceeding from said second edge (15) towards said first edge (10).

said fifth and sixth edge (19, 20) further comprise respective second portions (42, 43) which are joined to corresponding first portions (40, 41) and originate, on the opposite side to said corresponding first portions (40, 41), from said first edge (10);

said second portions (42, 43) extending at increasing distances from said second theoretical reference plane (P), proceeding from said first edge (10) towards said first portions (40, 41);

said first and second portions (40, 41; 42, 43) join at a first and a second point (Q, R); said first and second points (Q, R) being arranged at the same distance from said first and third edges (10, 15) and being connected by a segment (S);

said first portions (40, 41) converging towards one another from said third edge (15) towards said segment (S);

said second portions (42, 43) converging towards one another from said first edge (10) towards said segment (S).

2) The sealed package as claimed in claim 1, characterized in that said first region of said front panel (8) is bounded by said third edge (15).

3) The sealed package as claimed in claim 1 or 2, characterized in that the whole said front panel (8) extends on the opposite side of said second theoretical plane (P) with respect to said rear panel (7, 7').

4) The sealed package as claimed any one of the previous claims, characterized in that said front panel (8) extends symmetrically about an axis (C); said axis (C) joining a middle point of said first edge (10), a middle point of said segment (S), and a middle point of said third edge (15).

5) The sealed package as claimed in any one of the previous claims, characterized in that said fifth and sixth edges (19, 20) are separate and distinct from each other; and/or

characterized in that said second and fourth edge (11, 16) defines a fourth reference theoretical plane (T');

said seventh and said eighth rear edges (18a, 18b; 18a', 18b') being opposite to one another and extending both between said second and fourth edges (11, 16);

at least one of said seventh and eighth edges (18a', 18b') extending at least partially on the opposite side of said fourth theoretical plane (T') with respect to said frontal panel (8).

6) The sealed package as claimed in claim 5, characterized in that said seventh and eighth edges (18a, 18b; 18a', 18b') are distinct and separate from each other.

7) The sealed package as claimed in any one of previous claims, characterized in that the angle between said first plane and said top panel (5) ranges between 15 and 20 degrees; and/or
characterized in that said rear panel (7, 7') is flat or convex.

8) A sheet packaging material (M, M') for producing a sealed package (1, 1') of a pourable food product, comprising:

- at least one first crease line (67) and one second crease line (63);
said first crease line (67) comprising a first portion (92) which is adapted to define a first front edge (15) of a top panel (5) of said finished package (1, 1');
said second crease line (63) comprising a second portion (82) which is adapted to define a second front edge (10) of a bottom panel (6) of said finished package (1, 1');

said sheet packaging material (M, M') further comprising:

- a third crease line (65, 182') which extends between respective third portions (90, 80) of said first and second crease lines (67, 63); and

- a fourth crease line (66a, 183') which extends between respective fourth portions (94, 84) respectively of said first and second crease lines (67, 63);

- said first crease line (67) further comprising a fifth portion (91) interposed between said first and respective third portion (92, 90), and a sixth portion (93) interposed between respective said first and fourth portion (92, 94);

said second crease line (63) further comprising a seventh portion (81) interposed between said second and said respective third portions (82, 80), and an eighth portion (83) interposed between said second and said respective fourth portion (82, 84);

said third and fourth crease lines (65, 182' ; 66a, 183'), and said third and fourth portions (90, 80; 94, 84) being adapted to bound a rear panel (7, 7') of said package (1, 1'), once said packaging material (M, M') has been folded along said third and fourth crease lines (65, 182'; 66a, 183'), and along said third and fourth portions (90, 80; 94, 84);

said third and fourth portion (90; 94) of said first crease line (67) being adapted to define a first rear edge (16) of said finished package (1, 1');

said third and fourth portion (80; 84) of said second crease line (63) being adapted to define a second rear edge (11) of said finished package (1, 1');

the distance between said third and between said fourth portions (90, 80; 94, 84) being greater than the distance between said first and second portion (92, 82), so that the distance between said first rear edge (16) and said second rear edge (11) is greater than the distance between said first front edge (15) and said second front edge (10) of said finished package (1);

said sheet packaging material (M, M') having a constant width measured orthogonally to an axis (B), so that it could form a tube of packaging material from which said packages (1, 1') are obtained after their folding;

said axis (B) joining a middle-point of said first portion (92) and a middle-point of said second portion (82);

characterized by comprising a fifth and a sixth crease lines (120, 121) extending, at least partially, within a first area (123) which is bounded by a first and a second reference theoretical segment (105, 106), and by said first and second portions (92, 82);

said first reference theoretical segment (105) extending between a first end (100) of said second portion (82) and a second end (101) of said first portion (92);

said second reference theoretical segment (106) extending between a third end (102), opposite to said first end (100), of said second portion (82) and a fourth end (103), opposite to said second end (101), of said first portion (92);

said fifth and sixth crease lines (120, 121) and said second and first portions (82, 92) being adapted to bound a front panel (8) of said package (1, 1'), once said packaging material (M, M') has been folded along said fifth and sixth crease lines (120, 121) and said second and first portions (82, 92);

said fifth and seventh portions (91, 81), said fifth crease line (120), and at least one part of said third crease line (65, 182') being adapted to define a first lateral concave panel (9) extending from said front panel (8) to said rear panel (7, 7') of said package (1, 1'), once said packaging material (M, M') has been folded along said fifth crease line (120), said fifth and seventh portions (91, 81) and said at least one part of said third crease line (65, 182');

said sixth and eighth portions (93, 83), said sixth crease line (121) and at least one part of said fourth crease line (66a, 183') being adapted to define a second lateral concave panel (9) extending from said front panel (8) to said rear panel (7, 7') of said package (1, 1'), once said packaging material (M, M') has

been folded along said sixth crease line (121), said sixth and eighth portions (93, 83) and said at least one part of said fourth crease line (66a, 183');

said fifth crease line (120) being the only one crease line originating from one (100) of said first and second end (100, 101) and extending towards the other one (101) of said first and second end (100, 101);

said sixth crease line (121) being the only one crease line originating from one (102) of said third and fourth end (102, 103) and extending towards the other one (103) of said third and fourth end (102, 103);

said fifth and sixth crease lines (120, 121) at first converge towards one another and then diverge from one another, proceeding from said first portion (92) towards said second portion (82).

9) The sheet packaging material as claimed in claim 8, characterized in that said third and fourth portions (80, 90; 84, 94) are each located on an opposite side of said axis (B).

10) The sheet packaging material as claimed in any one of claims 8 or 9, characterized in that said fifth and sixth crease lines (120, 121) wholly extend within said first area (123).

11) The sheet packaging material as claimed in any one of claims 8 to 10, characterized in that said fifth and sixth crease lines (120, 121) are symmetrical with respect to the axis (B), which joins a middle-point of said first portion (92) and a middle-point of said second portion (82).

12) The sheet packaging material as claimed in any one of claims 8 to 11, characterized in that:

said third crease line (182') extends, at least partially, within a second area (184') which is bounded by a third reference theoretical segment (180'), by said third portions (90, 80) and by a first edge (64) of said sheet packaging material (M');

said fourth crease line (183') extends, at least partially, within a third area (185') which is bounded by said fourth reference theoretical segment (181'), by said fourth portions (94, 84) and by a second edge, opposite to said first edge (64), of said sheet packaging material (M');

said third reference theoretical segment (180') extending between a fifth end (188') of said third portion (90) of said first crease line (67) and a sixth end (187') of said third portion (80) of said second crease line (63);

said fourth reference theoretical segment (181') extending between a seventh end (190') of a fourth portion (94) of said first crease line (67) and an eighth end (189') of said fourth portion (84) of said second crease line (63);

said third crease line (182') being the only one crease line (182') which originates from one (187') of said sixth and fifth end (187', 188') and extends towards the other one (188') of said sixth and fifth end (187', 188');

said fourth crease line (183') being the only one crease line (182') which originates from one (189') of said seventh and eighth end (189', 190') and extend towards the other one (190') of said seventh and eighth end (189', 190').