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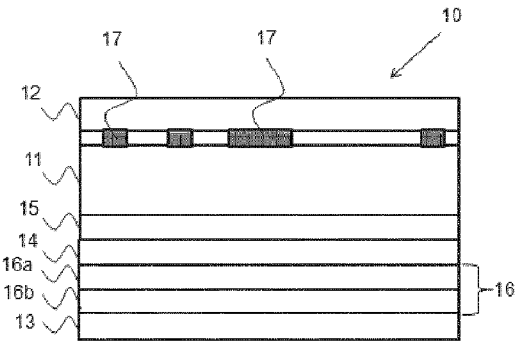
(54) Title: PACKAGING LAMINATE AND A PACKING CONTAINER THEREOF

(57) Abstract: Packaging laminate for a wedge-shaped packaging container having a filling capacity of at least 900 ml of liquid food. The packaging laminate (10) has a paper layer (11) and outer liquid-tight coatings (12;13) of polyethylene, of which the outer liquid-tight coating (13) on that side of the paper layer (11) intended to face inwards in the wedge-shaped packaging container is a pre-made film. Said pre-made film is preferably a blown film of either a linear low-density polyethylene (LLDPE) alone or a blend of a linear low-density polyethylene (LLDPE) and low-density polyethylene (LDPE) having a thickness of 18-25 µm (ASTM E252-06).

Figure 1

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Title

Packaging laminate and a packing container thereof

Technical field

The present invention relates to a packaging laminate for a packaging container of the kind that has a substantially wedge-shaped appearance and that is produced by folding and heat-sealing a web of the packaging laminate, by means of the web being shaped into a tube, with the two longitudinal edges of the web being brought together and joined to each other in a longitudinal liquid-tight sealing seam, which tube is filled with the liquid food in question and is divided into filled, contiguous packaging units by repeated transverse pressing-together and heat-sealing of the tube transversely with respect to the longitudinal direction of the tube, below the filling level of the tube, which packaging units are separated from each other, by cuts made in the transverse sealing areas, and are given the desired wedge-shaped appearance by means of at least one further folding and heat-sealing operation in which one end of the packaging unit is shaped to give a substantially rectangular, flat end wall, on which the finished wedge-shaped packaging container is intended to be placed in an upright position, which packaging laminate comprises a stiff but foldable layer of paper and outer liquid-tight coatings of polyethylene on both sides of the paper layer.

The invention further relates to a filled packaging container of the kind that has a substantially wedge-shaped appearance and that is produced by folding and heat-sealing a web of the packaging laminate, by means of the web being shaped into a tube, with the two longitudinal edges of the web being brought together and joined to each other in a longitudinal liquid-tight sealing seam, which tube is filled with the liquid food in question and is divided into filled, contiguous packaging units by repeated transverse pressing-together and heat-sealing of the tube transversely with respect to the longitudinal direction of the tube, below the filling level of the tube, which packaging units are separated from each other, by cuts made in the transverse sealing areas, and are given the desired wedge-shaped appearance by means of at least one further folding and heat-sealing operation in which one end of

the packaging unit is shaped to give a substantially rectangular, flat end wall, on which the finished wedge-shaped packaging container is intended to be placed in an upright position.

## Background of the invention

It is known to package and transport liquid food, for example juice, in consumer packages of a disposable type. A large group of these so-called disposable packages are produced from a packaging laminate which has a stiff but foldable layer of paper and outer liquid-tight coatings of polyethylene. In order to protect the packaged food against entry of oxygen, and against the damaging effect thereof, the packaging laminate is usually also provided with at least one further layer of a material having desired barrier properties against oxygen transmission. A common example of a supplementary laminate layer of this kind is an aluminium foil applied between the paper layer and one of the two outer liquid-tight polyethylene coatings.

From a web of the packaging laminate, finished packaging containers are produced by the web first of all being shaped into a tube, with the two longitudinal edges of the web being brought together and joined to each other in a longitudinal liquid-tight sealing seam. The tube is filled with the liquid food in question, e.g. juice, and is divided into contiguous pillow-shaped packaging units by repeated transverse pressing-together and heat-sealing of the tube transversely with respect to the longitudinal direction of the tube, below the liquid level of the tube. The filled pillow-shaped packing units are separated from each other, by cuts made in the transverse sealing areas, and are given the desired geometric shape by means of at least one further forming and sealing operation.

A commercially available packing container of this kind is the one which is offered for sale under the name Tetra Wedge® Aseptic (registered trademark) and which is easily recognizable from its typical wedge-shaped appearance. Another commercially available packaging container of this kind is the one which is sold under the name Tetra Brik® Aseptic and which has a parallelepipedal “brick-like” shape. While the latter type of packaging container is available on the market with a

great many volumes ranging from 100 ml up to 1500 ml, the wedge-shaped Tetra Wedge® Aseptic packages are available only with small volumes, such as 125 ml and 200 ml.

A wedge-shaped packaging container has several advantages over a parallelepipedal packaging container. Perhaps the most important advantage, purely from the point of view of economy, is the wedge-shaped packaging container's intrinsically more efficient utilization of packaging material in terms of the packaged volume of food per used surface area of packaging laminate. In other words, the packaged volume of food per used surface area of packaging laminate is greater in the wedge-shaped packaging container than in the brick-like parallelepipedal packaging container. The difference in cost-effectiveness between the two compared types of packaging is largely attributable to the fact that the wedge-shaped packing container does not have, at its top end, the double-walled triangular corner flaps that are present on the parallelepipedal packaging type and that use up a lot of material. The wedge-shaped packaging container when filled and standing in an upright position on its planar bottom wall is also more stable in this position compared with the brick-shaped parallelepipedal package type due to its relatively lower centre of gravity. Finally, the wedge-shaped packing container is at least to some extent more user-friendly than the brick-shaped one due to its narrower converging short ends around which the container can easily be manually gripped and lifted for emptying its contents.

In view of its beneficial properties as mentioned above there is a need and desire for this type of packaging to be made available also in higher packaging volumes than the packaging volumes commercially available at present. In particular, there is a need for wedge-shaped packaging containers of this kind with substantially the same large packaging volumes as are already present in connection with commercial packaging containers of the parallelepipedal type.

As has been described above, the packaging laminate in a commercially available wedge-shaped packaging container has a stiff but foldable layer of paper and outer liquid-tight coatings of polyethylene being applied through direct extrusion coating on both sides of the paper layer. To ensure that the liquid food packed in the wedge-shaped packaging container has the desired protection against entry of

oxygen, and against the adverse interactions therewith, the packaging laminate in the commercial packaging container additionally has an aluminium foil serving as an oxygen barrier between the paper layer and the outer polyethylene coating on the inside of the packaging container.

Various attempts have been made to produce a wedge-shaped packaging container with the desired larger packaging volume, such as 900 ml and higher, from a web of the same packaging laminate as the commercial ones, but none of these attempts has as yet resulted in a functional and suitable packaging container.

In some prior attempts such large wedge-shaped packaging containers were manufactured of a packaging laminate as described above, in which the extruded amount of polyethylene in the outer coating on the inside of the packaging container was increased in an attempt to increase the mechanical strength of the transverse seal at the top end of the package.

None of such prior attempts have however been successful in terms of robust packaging containers being able to withstand normal external stresses, such as vibrations and impacts, without crack formation and ruptures of the transversal sealing joint at the converging top end. It was thought that one reason for failure could be associated with the stiffness of the paper layer which after folding and sealing at the converging top end had an inherent tendency to "spring back" to the open tube shape with a circular cross section. In particular it was thought that the inside pressure of the included liquid content acting on the inner walls of the packaging container in cooperation with said inherent "spring-back" tendency of the folded and sealed paper layer made the packaging containers even weaker in such harsh, but normal handling conditions. Therefore, additional attempts were made to counteract such stiffness-dependent weakness and to manufacture wedge-shaped packaging containers of a packaging laminate using a less stiff paper layer than that used in the commercial larger-volume packaging containers. In particular wedge-shaped packaging containers were manufactured of a packaging laminate comprising a paper layer and outer liquid-tight extruded coatings of polyethylene on both sides of the paper layer, wherein the stiffness of the used paper layer was as low as the stiffness of a corresponding paper layer used in the commercial wedge-shaped packaging containers. Again, not even a decreasing stiffness of the paper

layer made it possible to manufacture the desired robust wedge-shaped packaging containers of a packaging volume far beyond the volume of today´s corresponding commercial packaging containers. Almost all of the tested packaging containers were associated with serious problems relating to integrity and leakage due to insufficient bonding strength between the extrusion-coated outer coatings of polyethylene in the transverse sealing seam at the top end of the wedge-shaped packaging container. In some cases, the bonding strength has even been so weak that the wedge-shaped packaging container was-unable to withstand the stresses of the vibrations, jolts and impacts to which it is exposed during normal transport and handling.

Object of the invention

An object of the invention is therefore to avoid the above-described disadvantages associated with the background art.

Another object is to make available a wedge-shaped packaging container which has a packaging volume of at least 900 ml and which reliably withstands the stresses of the vibrations, impacts and knocks to which the packaging container is exposed during normal transport and handling, without suffering the accompanying adhesion-related problems relating to integrity and leakage of the kind described above.

A further object is to make available a packaging laminate of the type described in the introduction for a wedge-shaped packaging container with a packaging volume of at least 900 ml.

Description of the invention

In one aspect, the invention makes available a packaging laminate for a packaging container of the kind that has a substantially wedge-shaped appearance and that is produced by folding and heat-sealing a web of the packaging laminate, by means of the web being shaped into a tube, with the two longitudinal edges of the web being brought together and joined to each other in a liquid-tight sealing seam, which tube is filled with the liquid food in question and is divided into filled,

contiguous packaging units by repeated transverse pressing-together and heat-sealing of the tube transversely with respect to the longitudinal direction of the tube, below the filling level of the tube, which packaging units are separated from each other, by cuts made in the transverse sealing areas, and are given the desired geometric wedge-shape by means of at least one further folding and heat-sealing operation in which one end of the packaging unit is shaped to give a substantially rectangular, flat bottom wall on which the finished wedge-shaped packaging container is intended to stand in an upright position, which packaging laminate comprises a stiff but foldable layer of paper and outer liquid-tight coatings of polyethylene on both sides of the paper layer . The packaging laminate is characterized in that one of the two outer liquid-tight coatings is a pre-made film.

A pre-made film will maintain a cross-sectional area in the transverse top seal of the wedge-shaped package which is larger than the one obtained with the corresponding extruded coating in the known packaging laminate. As a result of the so maintained larger cross-sectional area the internal pressure acting on the transverse top seal due to vibrations, shakings etc during transport and handling will decrease to a corresponding extent and have a lower tendency to break or damage the transverse top seal of the package.

In practice, said pre-made film is produced by either the blown-film process or the cast-film process. In the blown-film process the film is made by extruding molten polymer through a circular die and inflating the tubing to a desired diameter. In the cast-film process molten polymer is extruded through a slot die onto the surface of a chill roll or into a water bath and is subsequentially stretched into a mono- or bi-axially oriented film. The preferred choice of pre-made film is the one produced according to the blown-film process which offers the most versatility in the production of a wide range of film widths.

In one embodiment a blown film of the packaging laminate is made of linear low-density polyethylene (LLDPE) alone, in particular when the film is manufactured by means of an annular nozzle.

In another or alternative embodiment the blown film of the packaging laminate is made of a blend of low-density polyethylene (LDPE) and linear low-density polyethylene (LLDPE). This embodiment is preferred in cases where the pre-made

film is manufactured as a flat film so as to increase the output of the film. The proportion of the low-density polyethylene component, which is used as a smearing agent to decrease the friction between the melt of the blend and the inner walls of the used equipment, can be as high as 50% of the total weight of the blend. In general, the proportion of the low-density polyethylene (LDPE) component is 10-40%, such as 20-30% of the total weight of said blend. Correspondingly, the proportion of the linear low-density polyethylene (LLDPE) can be as low as 50% of the total weight of the blend. In general the proportion of the linear low-density polyethylene (LLDPE) is 60-90%, such as 70-80% of the total weight of the blend.

The thickness of said blown film in the packaging laminate can vary, provided the sufficient mechanical strength and robustness to withstand vibrations, impacts and similar stresses to which the package is exposed to during transport and handling is obtained. In general the thickness of the blown film, whether of linear low-density polyethylene (LLDPE) alone or a blend of low-density polyethylene (LDPE) and linear low-density polyethylene (LLDPE) is at least 18 µm. Even though there is no upper limit for the film thickness it is for cost and functional reasons preferred not to use a film having a thickness of above 25 µm since a film having a thickness above 25 µm does not contribute in any substantial manner to the increase of the adhesion strength. In practice the thickness of the blown film therefore is within 18-25 µm. In a preferred embodiment of the packaging laminate the blown film has a thickness of 21-24, such as 22 µm, which is a well-balanced or optimised thickness in terms of both function and costs. All given thickness values given here as well as in the following specification and claims are measured according to ASTM E252-06.

Contrary to a coating being applied through extrusion coating as used in the prior art, a pre-made film, such as the blown film of either linear low-density polyethylene (LLDPE) alone or a blend of low-density polyethylene (LDPE) and linear low-density polyethylene (LLDPE), can also be efficiently used in combination with the paper layer to impart increased stiffness to the packaging laminate through a “sandwich”-effect.

While the stiff but foldable paper layer in the known packaging laminate as described above has a stiffness value of 80 mN for a wedge-shaped packaging container with a packaging volume of 125 or 200 ml, the paper layer of the

packaging laminate according to the invention due to said "sandwich"- effect can have a corresponding stiffness value not only for small packaging volumes, but surprisingly also for substantially higher packaging volumes of up to 900 ml and even higher, such as 1000 ml. In general, the paper layer of the packaging laminate according to the invention has a stiffness within the range of 20-120 mN, such as 60-100, such as 75-85 mN. In the case the packaging laminate according to the invention is intended for a packaging container with a packaging volume of 900 ml or more, the paper layer preferably has a stiffness of 80 mN since then one and the same paper grade could be used for a wedge-shaped packaging container irrespective of its packaging volume.

The stiff but foldable paper layer in the packaging laminate according to the invention can have a multilayer structure comprising a bottom layer, a middle layer and a top layer. The top layer can also be provided with a clay coat in order to improve the printability of the packaging laminate and thereby increase the print quality of a decorated packaging laminate according to the invention. In a practical illustrative embodiment, the packaging laminate according to the invention can have a clay coat of this kind, which improves the printability, in a quantity of 20 $g/m^2$.

In a practical illustrative embodiment of a packaging laminate according to the invention for a wedge-shaped packaging container with a packaging volume of 900 ml or more, the stiff but foldable paper layer can have the following composition:

- bottom layer of 100% long fibres
- middle layer of 30% CTMP short fibres + 60% long fibres, and
- top layer of 70% short fibres + 30% bleached long fibres.

The blown film has an MD tensile strength of at least 22 $N/mm^2$, a CD tensile strength of at least 18 $N/mm^2$, an MD elongation at break of at least 250% and a CD elongation at break of at least 400% to impart increased mechanical strength and stiffness to the packaging laminate for robust wedge-shaped packaging containers having a packaging volume of up to or higher than 900 ml (all the values being determined according to ASTM D882).

In a practical embodiment of the packaging laminate for a robust packaging container with a packaging volume of 900 ml, the blown film when together with a paper layer having a stiffness of 80 mN has an MD tensile strength of 28 $N/mm^2$, a CD tensile strength of 22 $N/mm^2$, an MD elongation at break of 300% and a CD elongation at break of 500% (all the values being determined according to ASTM D882).

In one embodiment, the packaging laminate according to the invention is supplemented with at least one further layer having barrier properties against gases, especially oxygen. A preferred example of a gas barrier layer of this kind is an aluminium foil between the stiff but foldable paper layer of the packaging laminate and the blown film of linear low-density polyethylene (LLDPE) or a blend of low-density polyethylene (LDPE) and linear low-density polyethylene (LLDPE) on one side of the paper layer. An aluminium foil also has the advantage of making the packaging laminate weldable by induction heat-sealing which is a quick, safe and effective sealing technique for shaping the packaging laminate into a packaging container.

According to an embodiment of the invention, the layer serving as a gas barrier is laminated to the stiff but foldable paper layer by a lamination layer and further laminated to the outer liquid-tight coating via an adhesive layer. The adhesive layer , may comprise a layer of an adhesive polymer nearest to the gas barrier layer, and possibly a further adhesive or lamination layer of a different adhesive polymer or polyethylene, such as LDPE, nearest to the outer liquid-tight coating.

As the adhesive polymer in the adhesive layer(s), an extrusion-coatable grade of an ethylene-based copolymer modified or grafted with acrylic acid, or other adhesion-improving functional groups, may be used. According to an embodiment of the invention, the adhesive polymer may be an ethylene-acrylic acid copolymer (EAA) of medium content of acrylic acid functional groups, such as 5-6 mole-%.

The outer liquid-tight coating of polyethylene on the other side of the paper layer, in the packaging laminate according to the invention, can be an extruded coating of low-density polyethylene (LDPE) or a blend of linear low-density polyethylene (LLDPE) and low-density polyethylene (LDPE) of the same kind as in existing packaging laminates for the commercially available wedge-shaped

packaging containers with packaging volumes far below 900 ml, such as 200 ml and less. The only demand in respect of this outer coating is that it must be weldable together with said blown film of a blend of low-density polyethylene (LDPE) and linear low-density polyethylene (LLDPE).

In a second aspect, the invention makes available a wedge-shaped packaging container made from a packaging laminate comprising a stiff but foldable paper layer and outer liquid-tight coatings of polyethylene on both sides of the paper layer, which packaging container is produced by folding and heat-sealing a web of the packaging laminate, by means of the web firstly being shaped into a tube, with the two longitudinal edges of the web being brought together and joined to each other in a longitudinal liquid-tight sealing seam, which tube is filled with liquid food and is divided into filled, contiguous packaging units by repeated transverse pressing-together and heat-sealing of the tube transversely with respect to the longitudinal direction of the tube, below the filling level of the tube, which packaging units are separated from each other and are given the desired wedge-shaped appearance by means of at least one further folding and heat-sealing operation in which one end of the packaging unit is shaped to give a substantially rectangular, flat bottom wall, on which the wedge-shaped packaging container is intended to be placed in an upright position. The packaging container is characterized in that the stiff but foldable paper layer of the packaging laminate has a stiffness value of 20-120 mN (ASTM D882), and in that the outer liquid-tight coating of polyethylene, on the inside of the packaging container, is a pre-made film.

In an embodiment of the invention,said pre-made film to be used for the wedge-shaped packing container according to the invention is a blown film.

In one embodiment of the invention, the wedge-shaped packaging container has a sufficiently large internal volume to accommodate 900 ml or more of the liquid food. In this embodiment, the blown film is either a blown film of linear low-density polyethylene (LLDPE) alone or a blown film of a blend of low-density polyethylene (LDPE) and linear low-density polyethylene (LLDPE). Said blown film, whether of linear low-density polyethylene (LLDPE) alone or a blend of low-density polyethylene (LDPE) and linear low-density polyethylene (LLDPE), has an MD tensile strength of at least 22 $N/mm^2$, a CD tensile strength of at least 18 $N/mm^2$, an MD elongation at

break of at least 250% and a CD elongation at break of at least 400%, all the values being determined according to ASTM D882.

In a specific illustrative embodiment, the wedge-shaped packaging container has an internal volume of 900 ml, while at the same time the stiff but foldable paper layer has a stiffness value of 80 mN, and the blown film has an MD tensile strength of 28 N/mm$^2$, a CD tensile strength of 22 N/mm$^2$, an MD elongation at break of 300% and a CD elongation at break of 500%, all the values being determined according to ASTM D882.

In a further aspect the invention provides a method of manufacturing a packaging laminate for a wedge-shaped packing container said packaging laminate comprises a stiff but foldable paper layer and outer liquid-tight coatings of polyethylene on both sides of said paper layer, which method comprises the following steps:

a) providing a web of paper having a stiffness of 20-120 mN, preferably 60-100 mN, such as 75-85 mN, such as 80 mN,
b) applying an outer liquid-tight layer of polyethylene on one surface of the web through extrusion-coating, and
c) applying an outer liquid-tight layer of polyethylene on the other surface of the web.

The method is characterized in that the outer liquid-tight layer applied in step c) is a pre-made film.

Advantageously, said pre-made film is a blown film of either a linear low-density polyethylene (LLDPE) alone or a blown film of a blend of linear low-density polyethylene (LLDPE) and low-density polyethylene (LDPE).

The blown film to be used in the method according to the invention, whether of linear low-density polyethylene (LLDPE) alone or of a blend of linear low-density polyethylene (LLDPE) and low-density polyethylene (LDPE) has an MD tensile strength of at least 22 N/mm$^2$, a CD tensile strength of at least 18 N/mm$^2$, an MD elongation at break of at least 250% and a CD elongation at break of at least 400%.

Said blown film is applied in step c) through lamination by means of an adhesive polymer which is extruded between the paper web and the blown film.

Brief description of the figures

The invention is described in more detail below with reference to the attached drawings, in which:

Figure 1 is a schematic cross-sectional view of the packaging laminate according to one embodiment of the invention;

Figure 1A is a schematic cross-sectional view of a part of the packaging laminate in Figure 1; and

Figure 2 is a schematic side view of a packaging container known per se with a wedge-shaped appearance.

Detailed description of the figures

Figure 1 thus shows a packaging laminate according to one embodiment of the invention in a sectional view. The packaging laminate 10 has a stiff but foldable layer 11 and outer liquid-tight coatings 12 and 13 on both sides of the stiff but foldable paper layer 11. The packaging laminate 10 also has a layer 14 serving as a gas barrier between the stiff but foldable paper layer 11 and the outer liquid-tight coating 13 on one side of the stiff but foldable paper layer 11.

As will be seen from Figure 1, the layer 14 serving as a gas barrier is laminated onto the stiff but foldable paper layer 11 by a lamination layer 15 and onto the outer liquid-tight coating 13 via an adhesive layer 16 which, in the example shown, comprises a first adhesive layer 16a, nearest to the layer 14 serving as a gas barrier, and a second adhesive layer 16b, nearest to the outer liquid-tight coating 13. The packaging laminate 10 also has a printed pattern 17 of an aesthetic and/or

informative character on that surface of the stiff but foldable paper layer 11 immediately below the outer liquid-tight coating 12.

In the embodiment of the packaging laminate 10 according to the invention shown here, the outer liquid-tight coating 13 on one side of the stiff but foldable paper layer 11 is a pre-made film.

Said pre-made film (13) is in general a blown film which is made of either a linear low-density polyethylene (LLDPE) alone or a blend of a linear low-density polyethylene (LLDPE) and low-density polyethylene (LDPE). The blown film (13) has a thickness of 18-25 µm (ASTM E252-06), for example 22 µm (ASTM E252-06).

The blown film (13), whether of a linear low-density polyethylene (LLDPE) or a blend of linear low-density polyethylene (LLDPE) and low-density polyethylene (LDPE), has an MD tensile strength of at least 22 $N/mm^2$, a CD tensile strength of at least 18 $N/mm^2$, an MD elongation at break of at least 250% and a CD elongation at break of at least 400%, all the values being determined according to ASTM D882. In a further practical illustrative embodiment, said blown film (13) has an MD tensile strength of 28 $N/mm^2$, a CD tensile strength of 22 $N/mm^2$, an MD elongation at break of 300% and a CD elongation at break of 500%, all the values being determined according to ASTM D882.

The outer liquid-tight coating 12 on the other side of the stiff but foldable paper layer 11 is a polyethylene coating, preferably an extruded coating of low-density polyethylene (LDPE).

The layer 14 serving as a gas barrier is preferably an aluminium foil, which additionally has the advantageous property that it permits heat-sealing of the packaging laminate 10 by induction heat-sealing, which is a quick, safe and effective sealing technique. In the example shown, the aluminium foil 14 is on one side laminated to the stiff but foldable paper layer 11 by means of a lamination layer 15 of low-density polyethylene (LDPE) and on the other side laminated to the blown film 13 by means of a first adhesive layer of an ethylene-acrylic acid copolymer (EAA) 16a, nearest to the aluminium foil 14, and a second adhesive layer 16b of low-density polyethylene (LDPE), nearest to the blown film 13.

The stiff but foldable paper layer 11 has a stiffness value of 20-120 mN, such as 60-100 mN, such as 75-85 mN, such as 80 mN as already explained.

As is shown on an enlarged scale in Figure 1A, the stiff but foldable paper layer 11 in this embodiment has a multilayer structure comprising a bottom layer 11a, a middle layer 11b and a top layer 11c. In an illustrative example, the multilayer structure shown has the following composition: bottom layer 11a of 100% long fibres; middle layer 11b of 30% CTMP short fibres + 60% long fibres; and top layer 11c of 70% short fibres + 30% bleached long fibres.

In order to improve printability of the packaging laminate 10 the top layer 11c of the stiff but foldable paper layer 11 preferably is provided a printable coat 11d on its surface. Such a coat 11d can, but need not be a clay coat which is applied in a quantity of 20 g/m$^2$.

From a web of the packaging laminate 10, filled packaging containers 20 are produced with the wedge-shaped appearance shown schematically in Figure 2. The web is first formed into a tube, with the two longitudinal edges of the web being brought together and joined to each other in a longitudinal liquid-tight sealing seam. According to the invention, the web is formed in such a way that the outer liquid-tight coating 13 of the blown film of the packaging laminate 10 faces towards the interior of the formed tube. The tube is filled with the liquid food in question, e.g. juice, and is divided into contiguous pillow-shaped packaging units by repeated transverse pressing-together and heat-sealing of the tube transversely with respect to the longitudinal direction of the tube, below the liquid level of the tube. The filled pillow-shaped packaging units are separated from each other, by cuts made in the transverse sealing areas, and are given the desired wedge-shaped appearance by means of at least one further folding and heat-sealing operation in which one end of the packaging unit is shaped to give a substantially rectangular, flat bottom wall 21, on which the finished packaging container 20 is intended to stand in an upright position.

From the web of the packaging laminate 10 according to the invention it is possible, as has already been mentioned, to produce wedge-shaped packaging containers that have a sufficiently large internal volume to be able to be filled with liquid food in volumes that are considerably greater than the volumes that have

hitherto been able to be filled into corresponding wedge-shaped packaging containers on the market. While commercially available wedge-shaped packaging containers only hold up to 200 ml of liquid food, a wedge-shaped packaging container made from the packaging laminate according to the invention can accommodate large volumes such as 900 ml or even greater, e.g. 1000 ml.

Example

A wedge-shaped packing container having a filling volume of 900 ml was manufactured of a packaging laminate of the following specific composition:

- outer liquid-tight coating 12 of low-density polyethylene (LDPE), 12 g/m2
- printed pattern 17 of aesthetical character, water-based printing ink
- paper layer* 11 having a stiffness of 80 mN
- lamination layer 15 of low-density polyethylene (LDPE), 20 g/m2
- aluminium foil 14, 6.3 µm
- first adhesive layer 16a, of a medium acid EAA copolymer
- second adhesive layer 16b of low-density polyethylene (LDPE), 10 g/m2
- blown (mono extruded) film 13, 22 µm, of a blend (20:80) of low-density polyethylene** (LDPE) and linear low-density polyethylene*** (LLDPE)

*) the paper layer 11 was of a multilayer structure comprising a clay coat, 20 g/m2, a top layer of 70% short fibers and 30% bleached long fibers, a middle layer of 30% CTMP short fibers and 60% long fibers, and a bottom layer of 100% long fibers

**) LDPE Braskem EB861 (co-polymer) with MFI of 0.7 g/10 min (230 C; 2.16 kg) and density of 0.921 g/cm3

***) LLDPE Dowlex 2045 with MFI of 1.0 g/10 min (190 C; 2.16 kg) and density of 0.920 g/cm3

A lot of filled sealed wedge-shaped packing containers were exposed to external stresses (impact, vibrations, shakings etc) far beyond conditions to which packing containers for liquid food are exposed during normal transport and handling. Evaluation of the so stressed samples was undoubtedly clear. All of the tested samples were essentially intact, without any tendency to leak.

Industrial applicability

The packaging laminate according to the invention can be used for a wedge-shaped packaging container for liquid food, and it can be used especially for a wedge-shaped packaging container of the type having a filling volume of 900 ml or more.

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Patent Claims

1. Packaging laminate for a packaging container (20) of the kind that has a substantially wedge-shaped appearance and that is produced by folding and heat-sealing a web of the packaging laminate (10), by means of the web being shaped into a tube, with the longitudinal edges of the web being brought together and joined to each other in a longitudinal liquid-tight sealing seam, which tube is filled with the liquid food in question and is divided into filled, contiguous packaging units by repeated transverse pressing-together and heat-sealing of the tube transversely with respect to the longitudinal direction of the tube, below the liquid level of the tube, which packaging units are separated from each other, by cuts made in the transverse sealing areas, and are given the desired wedge-shaped appearance by means of at least one further folding and heat-sealing operation in which one end of the packaging unit is shaped to give a substantially rectangular, flat bottom wall, on which the finished wedge-shaped packaging container is intended to be placed in an upright position, which packaging laminate (10) comprises a stiff but foldable layer (11) of paper and outer liquid-tight coatings (12;13) of polyethylene on both sides of the paper layer (11), characterized in that the outer liquid-tight coating (13) of polyethylene, on that side of the paper layer (11) intended to face inwards when the web of packaging laminate (10) is shaped into a tube, is a pre-made film.
2. Packaging laminate according to Claim 1, characterized in that the pre-made film (13) is a blown film.
3. Packaging laminate according to Claim 1 or 2, characterized in that the pre-made film (13) is made of a linear low-density polyethylene (LLDPE) alone.
4. Packaging laminate according to Claim 1 or 2, characterized in that the pre-made film is made of a blend of a low-density polyethylene (LDPE) and a linear low-density polyethylene (LLDPE).
5. Packaging laminate according to any of the preceding Claims 1-4, characterized in that it has a layer (14) serving as a gas barrier between the stiff but foldable paper layer (11) and said pre-made film (13).
6. Packaging laminate according to Claim 5, characterized in that said layer (14) serving as a gas barrier is an aluminium foil.

7. Packaging laminate according to any of Claims 1- 4, characterized in that the pre-made film (13) has a thickness of 18 - 25 µm (ASTM E252-06).
8. Packaging laminate according to Claim 7, characterized in that the pre-made film (13) has a thickness of 21-24 µm (ASTM E252-06).
9. Packaging laminate according to Claim 7 or 8, characterized in that the pre-made film (13) has an MD tensile strength of at least 22 N/mm$^2$, a CD tensile strength of at least 18 N/mm$^2$, an MD elongation at break of at least 250% and a CD elongation at break of at least 400% (ASTM D882).
10. Packaging laminate according to Claim 1, characterized in that the paper layer (11) has a multilayer structure.
11. Packaging laminate according to Claim 10, characterized in that the paper layer (11) has a stiffness value of 20-120, such as 60-100, such as 75-85.
12. Packaging laminate according to Claim 10 or 11, characterized in that the paper layer (11) comprises a bottom layer (11a), a middle layer (11b) and a top layer (11c).
13. Packaging laminate according to Claim 12, characterized in that the top layer (11c) has a clay coat (11d).
14. Packaging laminate according to Claim 12 or 13, characterized in that the bottom layer (11a) comprises 100% long fibres, the middle layer (11b) comprises 30% CTMP short fibres + 60% long fibres, and the top layer (11c) comprises 70% short fibres + 30% bleached long fibres.
15. Packaging container having a substantially wedge-shaped appearance and being manufactured by folding and heat-sealing a web of a packaging laminate (10) comprising a stiff but foldable layer (11) of paper and outer liquid-tight coatings (12;13) of polyethylene on both sides of the paper layer (11), characterized in that the paper layer (11) has a stiffness value of between 20-120 mN, such as 60-100 mN, such as 75-85 mN, and in that the outer liquid-tight coating (13) of the packaging laminate (10), on the inside of the wedge-shaped packaging container (20), is a pre-made film.
16. Packaging container according to Claim 15, characterized in that said pre-made film (13) is a blown film.
17. Packaging container according to Claim 15 or 16, characterized in that the wedge-shaped packaging container (20) has a sufficiently large internal packaging volume to accommodate at least 900 ml of liquid food.

Figure 1

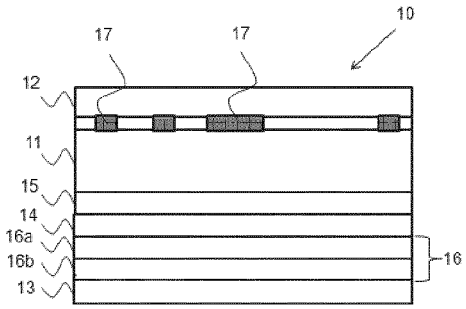



Figure 1A

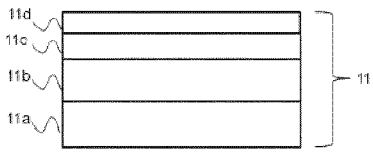
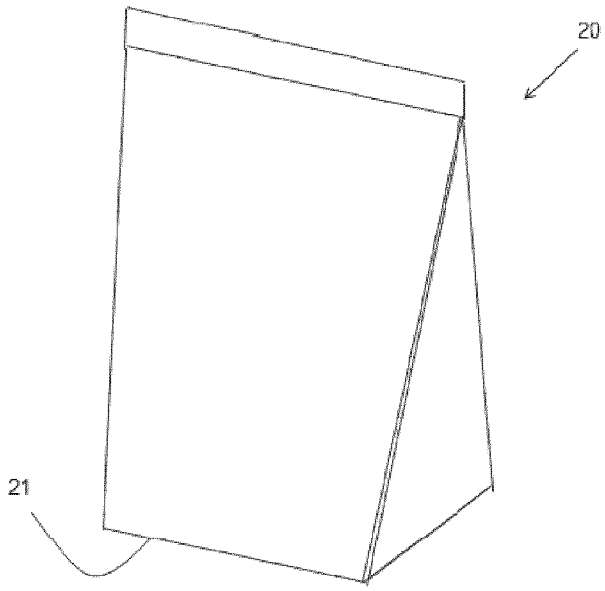


Figure 2



# INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/067899

A. CLASSIFICATION OF SUBJECT MATTER
INV. B32B15/085 B32B15/20 B32B27/10 B32B27/32 B32B29/00
B65D75/00 B65D77/00
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B32B B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 24 April 2014 | 02/05/2014 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Kanetakis, Ioannis |

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International application No
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| A | US 2004/055918 A1 (BENEDETTI PAOLO [IT] ET AL) 25 March 2004 (2004-03-25)<br>paragraph [0027]<br>----- | 1,15 |

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