Title: A SEALING STRIP AS WELL AS A PACKAGING CONTAINER INCLUDING SUCH A STRIP

Abstract: Laminated sealing strip (10) for packaging purposes, said sealing strip (10) having on its one side a first sealing layer (12) of polyethylene and on its other side a second sealing layer (13) of polyethylene. In order to impart to the sealing strip (10) heat stability enough to withstand impact of temporarily increased temperatures during a sealing operation, without wrinkling or gathering, at least one of said sealing layers (12; 13) comprises also a density-increasing polyethylene component of preferably medium density polyethylene (MDPE), high density polyethylene (HDPE) or linear medium density polyethylene (LMDPE).
A SEALING STRIP AS WELL AS A PACKAGING CONTAINER INCLUDING SUCH A STRIP

TECHNICAL FIELD

The present invention relates to a laminated sealing strip for packaging purposes, comprising a core or bulk layer and outer, liquid-tight layers of thermoplastic, preferably polyethylene.

The present invention also relates to a packaging container in which incision edges of the packaging material are covered by means of the laminated sealing strip.

BACKGROUND ART

Packaging containers for liquid foods, such as milk and juice, are produced with the aid of modern, rational filling machines which, either from a web or from prefabricated sheets of a packaging laminate, form, fill and seal the packages.

Examples of common packaging containers for milk, juice and other liquid foods are Tetra Brik, Tetra Rex and Tetra Top (all registered trademarks).

From, for example, a web of the packaging material, parallelepipedic packaging containers of the Tetra Brik type are produced in that the web is first reformed into a tube by both opposing longitudinal edges of the web being folded towards and, by thermosealing, permanently united to one another in a liquid-tight overlap joint. The tube is filled with the pertinent contents, for example milk, at the same time as the tube is divided into continuous, filled cushion-shaped packaging units by repeated flat-pressing operations and sealings of the tube in transverse sealing zones across the longitudinal direction of the tube below the level of the contents in the tube. The packaging units are separated from one another by incisions in the transverse sealing zones and are given the desired geometric configuration, usually parallelepipedic, by inward folding and fixing of the double-walled triangular corner flaps against each respective adjacent planar packaging wall or panel. The finished
packaging containers are thereafter discharged from the filling machine for further
transport and handling.

A conventional packaging container of the above-described type is produced from a
laminated packaging material comprising a rigid, but foldable, core or bulk layer of
paper or paperboard and outer, liquid-tight coatings of thermoplastic, preferably
polyethylene. For particularly oxygen gas-sensitive foods, such as for example, juice,
wine and cooking oils, the packaging material moreover includes at least one
additional layer by means of which the requisite tightness properties against oxygen
are ensured.

Examples of materials for such additional layers may be ethyl vinyl alcohol (EVOH),
polyamide (PA), polyethylene terephthalate (PET), etc., but use is preferably made of
an aluminium foil with the aid of which thermosealing by means of induction sealing
is made possible during the production of the packages.

As was intimated above, there are formed, as a result of the above-described tube
forming of the packaging material, freely exposed incision edges on both the inside
and the outside of the tube, of which at least the edge on the inside of the tube must
be protected in order to avoid the undesirable penetration of liquid into the liquid-
absorbing paper or paperboard edge (edge wicking). A liquid penetration into the
paper or paperboard layer of the packaging material results in the packaging material
losing its mechanical stability and strength, as a result of which the packaging
container becomes sloppy and inconvenient to handle and may even result in
leakage and untightness in the packaging container because of the separation of the
various layers (delamination).

The requisite edge protection may be realised in different manners and by different
means, normally with the aid of a sealing strip of the type described by way of
introduction, separately applied over the incision edge on the inside of the tube.

According to one prior art method, such a sealing strip is applied and fixed in a filling
machine along the one longitudinal edge of the packaging material web so that it has
a free strip edge projecting from the longitudinal edge. The planar packaging material
web provided with the strip is then reformed into a tube in that, as was described above, both of the longitudinal edges of the web are folded towards and permanently united to one another in an overlap seal or joint. During the tube forming operation in the filling machine, the projecting free strip edge is folded into planar abutment against the overlapping inside of the second longitudinal web edge and is fixedly sealed thereto by thermosealing in such a manner that the incision edge of the first longitudinal web edge facing towards the interior of the tube is completely covered and protected against liquid penetration (edge wicking).

Alternatively, according to another prior art method, the projecting free edge strip may be folded completely around the incision edge of the first longitudinal web edge into planar abutment against the other side (the outside) of the first longitudinal web edge, against which it is fixed prior to the reforming of the web into a tube. Both of the longitudinal edges of the web are then folded, as in the previous case, towards one another and permanently united with one another in an overlap joint by thermosealing.

Whether the sealing strip is applied using one or the other of the above-described methods, it is of course important in both cases that the entire strip application and edge covering procedure may be carried out in such a manner that the requisite protection against liquid penetration in the incision edge facing towards the inside of the packaging container is ensured as a result of the applied sealing strip. In order to achieve this, the sealing strip must thus be thermosealable to counterfacing sealing surfaces of the packaging material and an additional requirement is that the thermosealing must be capable of being carried out in an efficient and expedient manner even at the extremely high production output speeds at which today's modern filling machines operate. This requirement is particularly important in the production of so-called aseptic packaging containers in which a packed food is intended to be able to be reliably stored for extremely long storage times, without either the packaging container or the food packed in the packaging container being damaged and becoming unusable.

One prior art sealing strip that is employed in a commercial packaging container of a packaging material comprising a paper- or paperboard layer and outer liquid-tight
coatings of polyethylene, preferably low density polyethylene (LDPE) has a base layer of polyethylene terephthalate (PET) and outer, thermosealable plastic coatings of polyethylene, for example low density polyethylene (LDPE). Another prior art sealing strip for a commercial packaging material of the above-described type has a base layer of polyethylene terephthalate (PET) and outer, thermosealable plastic coatings of metallocene polyethylene (mLLDPE) which, in comparison with low density polyethylene (LDPE) displays an advantageously wider sealing window than LDPE with a lower temperature limit that lies below the corresponding limit for LDPE.

The advantage inherent in the latter sealing strip is that, as a result of its wider sealing window, it makes for a more reliable fixing of the sealing strip over a wider sealing temperature range and that it is hence less sensitive to temperature fluctuations that may occur during the normal operation of a filling machine. The lower downward sealing temperature limit moreover makes for a more rapid sealing process than the former strip and thus contributes to increased production output speeds.

While the prior art sealing strips afford an efficient and reliable protection against liquid penetration through the longitudinal incision edge on the inside of the filled packaging container when the sealing strip is applied on the packaging material during the normal operation of the filling machine, it has nevertheless proved that problems may occur when the sealing strip is exposed to excessively elevated temperatures, as is the case in connection with, for example, temporary machine stoppages for tests etc. In particular, it has proved that the freely projecting edge of the strip shows a tendency to form folds and wrinkles at such elevated exposure temperatures, whereby a subsequent downward folding of the strip edge into plantar abutment against the united second longitudinal web edge is impeded or rendered entirely impossible, with a consequential risk of liquid leakage and liquid penetration in the overlap zone between the sealing strip and the second web edge. The harmful thermal effect on the projecting strip edge may even be so severe that the projecting strip edge shows a tendency to be bent back (i.e. above 90 degrees) over the fixedly sealed strip portion, whereby a later downward folding into planar abutment against
the counterfacing sealing surface of the second web edge becomes impossible. In this case, the longitudinal incision edge on the inside of the packaging container will be completely unprotected against edge wicking within areas where the free edge strip has been folded back over itself.

There is thus a need in the art for a sealing strip which is sufficiently thermally stable to withstand the action of temporary elevated temperatures without being folded or wrinkled and with the aid of which a both efficient and expedient edge covering of the longitudinal incision edge on the inside of the packaging container will be ensured.

One object of the present invention is therefore to realise such a thermally stable sealing strip for packaging purposes.

Another object of the present invention is to realise a packaging container for liquid food in which the longitudinal incision edge of the packaging container on the inside is protected with the aid of a sealing strip according to the present invention.

These and other objects will be attained according to the present invention by means of a sealing strip of the type described by way of introduction which has been given the characterising features as set forth in appended Claim 1 and by a packaging container which has been given the characterising features as set forth in appended Claim 5.

Advantageous and preferred embodiments of the sealing strip according to the present invention have been given the characterising features as set forth in the appended subclaims.

BRIEF OUTLINE OF THE INVENTION

According to one aspect of the present invention, there will thus be realised a sealing strip for protection against liquid penetration through exposed incision edges on the inside of a packaging container for liquid food.
The sealing strip comprises a base layer of a polymer possessing gas barrier properties which, on its one side, has a first sealing layer of polyethylene and, on its other side, has a second sealing layer of polyethylene, at least one of said first and second sealing layers having an average density which is greater than or equal to the density of metallocene polyethylene (mLLDPE), i.e. greater than 0.928.

In one embodiment of the sealing strip according to the present invention, the first sealing layer has, on the one side of the base layer, a two layer structure consisting of an outer layer of a mixture of metallocene polyethylene (mLLDPE) and low density polyethylene (LDPE) and an inner layer of a mixture of low density polyethylene (LDPE) and a density-increasing polyethylene component.

According to the present invention, the second sealing layer on the other side of the base layer may also display a two layer structure consisting of an outer layer of a mixture of metallocene polyethylene (mLLDPE), low density polyethylene (LDPE) and an inner layer of a mixture of low density polyethylene (LDPE) and a density-increasing polyethylene component.

In another embodiment of the present invention, the first sealing layer has, on the one side of the base layer, a two layer structure consisting of an outer layer of a mixture of metallocene polyethylene (mLLDPE), low density polyethylene (LDPE) and a density-increasing polyethylene component, and an inner layer of a low density polyethylene (LDPE).

According to the present invention, the second sealing layer on the other side of the base layer may also display a two layer structure consisting of an outer layer of a mixture of metallocene polyethylene (mLLDPE), low density polyethylene (LDPE) and a density-increasing polyethylene component, and an inner layer of a low density polyethylene (LDPE).

Examples of density-increasing polyethylene components for use in the sealing strip according to the present invention may be any polyethylene component whatever which, in mixture with the other present polymer component or components in the two sealing layers, has a capacity to increase the average density in each respective
layer to a level which is equal to or above the density level of the same layer without
the presence of the density-increasing polyethylene component.

An optimum density-increasing polyethylene component for use in the sealing strip
according to the present invention has the ability to raise the pertinent density level to
a value that is higher than the density of metallocene polyethylene (mLLDPE) but still
lower than the density of low density polyethylene (LDPE) in order to make for a
thermosealing of a sealing strip at a sealing temperature which is at least somewhat
lower than the melting point of low density polyethylene (LDPE).

Practical examples of such density-increasing polyethylene components are medium
and high density polyethylene (MDPE and HDPE) and linear medium density polyethylene (LMDPE), either separately or in combination with each other.

The base layer in the sealing strip suitably consists of a polymer which, on the one
hand, displays superior tightness properties to gases, in particular oxygen gas, and, on the other hand, displays a sufficient thermal stability and mechanical strength to
withstand thermal and mechanical stresses to which the sealing strip is exposed on
application on a packaging material web in a filling machine.

Typical examples of usable polymers that fulfil these requirements are polyesters
(PET, PEN, PBT), biaxially oriented polyesters (BOPET, BOPEN), polyamide (PA),
oriented polyamide (OPA, BOPA), ethylene vinyl alcohol copolymer (EVOH),
biaxially oriented ethylene vinyl alcohol copolymer (BOEVOH), biaxially oriented

cyclic olefin polymers (BOCOC, BOCOP). It should be observed that these polymers
are merely examples and that it will be obvious to a person skilled in the art that other
known polymers with similar properties are also usable in conjunction with the
present invention.

According to another aspect of the present invention, there will be realised a
packaging container for liquid food, preferably a so-called aseptic packaging
container, in which free incision edges on the inside of the packaging container are
covered by a sealing strip according to the present invention applied over the incision
edge.
BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The present invention will now be described in greater detail hereinbelow, with reference to the accompanying Drawings, in which:

Fig. 1 is a schematic cross section of a sealing strip according to a first embodiment of the present invention;

Fig. 2 is a schematic cross section of a sealing strip according to a modification of the embodiment shown in Fig. 1;

Fig. 3 is a schematic cross section of a sealing strip according to a second embodiment of the present invention;

Fig. 4 is a schematic cross section of a sealing strip according to a modification of the embodiment shown in Fig. 3; and

Fig. 5 is a schematic view of a packaging material web provided with a sealing strip according to the present invention and in the process of being reformed into a tube.

DETAILED DESCRIPTION OF THE INVENTION

In the accompanying Drawings, for purposes of clarity, analogous reference numerals have been employed in all figures for the same or equivalent parts of the illustrated sealing strip, only those parts of the sealing strip essential to an understanding of the present invention having been shown. Moreover, it should be observed that the illustrated cross sections of the sealing strip are not necessarily to scale, but that the relative thickness of the illustrated material layers may deviate from the actual relationship in order further to better an understanding of the present invention.

Fig. 1 is thus a schematic cross section of a sealing strip according to a first embodiment of the present invention. The sealing strip has been given the generic
reference numeral 10 and displays a central core or base layer 11 which, on one side, has a first sealing layer 12 and, on its other side, a second sealing layer 13.

In the illustrated embodiment, the first sealing layer 12 displays a two layer structure consisting of an outer layer 12a of polyethylene, preferably a mixture of metallocene polyethylene (mLLDPE) and low density polyethylene (LDPE), and an inner layer 12b of polyethylene, preferably low density polyethylene (LDPE).

In the embodiment illustrated in Fig. 1, the second sealing layer 13 also displays a two layer structure consisting of an outer layer 13a of polyethylene, preferably a mixture of metallocene polyethylene (mLLDPE) and low density polyethylene (LDPE), and an inner layer 13b of polyethylene, preferably low density polyethylene (LDPE).

In order to impart to the sealing strip 10 sufficient thermal stability so as to withstand thermal stresses at elevated temperatures without any tendency to or risk of being folded, wrinkled or folded back, as has been described previously, at least one of the sealing layers 12 and 13 is supplemented with a density-increasing polyethylene component. In the embodiment under consideration here, it is assumed that the density-increasing polyethylene component is incorporated in the outer layer 12a of the first sealing layer 12.

Examples of usable density-increasing polyethylene components may, as was mentioned previously, be medium and high density polyethylene (MDPE and HDPE) and linear medium density polyethylene (LMDPE). The choice of density-increasing polyethylene component is not critical to the present invention, as long as the selected component is used in a sufficient quantity to ensure that the average density of the outer polyethylene layer 12a of the first sealing layer 12 is higher than the density of the same layer without the presence of the density-increasing polyethylene component. The requisite quantity of the density-increasing polyethylene component may thus readily be determined from case to case by a person skilled in the art in possession of the knowledge of the additional polyethylene component or components that are included in the pertinent layer 12a.
As was mentioned earlier, the base layer should preferably consist of a polymer which, on the one hand, displays superior tightness properties to gases, in particular oxygen gas, and, on the other hand, displays a sufficient thermal stability and mechanical strength to withstand thermal and mechanical stresses to which the sealing strip is exposed on application on a packaging material web in a filling machine.

Examples of usable polymers that fulfil these requirements are polyesters (PET, PEN, PBT), biaxially oriented polyesters (BOPET, BOPEN), polyamide (PA), oriented polyamide (OPA, BOPA), ethylene vinyl alcohol copolymer (EVOH), biaxially oriented ethylene vinyl alcohol copolymer (BOEVOH), biaxially oriented cyclic olefin polymers (BOCOC, BOCOP)

A further requirement that is placed on a well-functioning sealing strip for the purposes of the present invention is naturally that it should have integrity and superior internal cohesion between the layers included in the strip and thus not delaminate or otherwise be damaged or destroyed when it is exposed to external tensile and stretching stresses during the application on a packaging material web under the prevailing external conditions in a filling machine. In order to improve and/or ensure such integrity and internal cohesion between the layers in the sealing strip, it may therefore - in certain cases - be appropriate or even necessary to subject, for purposes of increasing bonding and adhesion, the base layer to a surface treatment by means of which adhesion to adjacent layers in the sealing strip is improved. To this end, the base layer may, prior to lamination to the remaining layers, be treated with adhesion-promoting primer or lacquer well-known to the skilled reader of this specification.

Fig. 2 is a schematic cross section of a sealing strip according to a modification of the sealing strip illustrated in Fig. 1. Like the sealing strip in Fig. 1, the sealing strip carrying the generic reference numeral 20 in Fig. 2 is a base layer 21 which, on its one side, has a first sealing layer 22 and on its other side a second sealing layer 23.

The first sealing layer 22 displays a two layer structure consisting of an outer layer 22a of polyethylene, preferably a mixture of metalloocene polyethylene (mLLDPE) and
low density polyethylene (LDPE), and an inner layer 22b of polyethylene, preferably low density polyethylene (LDPE).

The second sealing layer 23 also displays in this embodiment a two layer structure consisting of an outer layer 23a of polyethylene, preferably a mixture of metallocene polyethylene (mLLDPE) and low density polyethylene (LDPE), and an inner layer 23b of polyethylene, preferably low density polyethylene (LDPE).

In order to impart to the sealing strip 20 sufficient thermal stability so as to withstand thermal stresses at elevated temperatures without any tendency to or risk of being folded, wrinkled or folded back, as has been described previously, at least one of the sealing layers 22 and 23 is supplemented with a density-increasing polyethylene component which, in the illustrated example, is assumed to be incorporated in the inner layer 22b of the first sealing layer 22.

Examples of usable density-increasing polyethylene components may, as was mentioned previously, be medium and high density polyethylene (MDPE and HDPE), and linear medium density polyethylene (LMDPE). The choice of density-increasing polyethylene component is not critical to the present invention, as long as the selected component is used in a sufficient quantity to ensure that the average density of the inner polyethylene layer 22b of the first sealing layer 22 is higher than the density of the same layer without the presence of the density-increasing polyethylene component. The requisite quantity of the density-increasing polyethylene component may thus readily be determined from case to case by a person skilled in the art in possession of the knowledge of the additional polyethylene component or components that are included in the pertinent layer 22b.

As was mentioned earlier, the base layer 21 should preferably consist of a polymer which, on the one hand, displays superior tightness properties to gases, in particular oxygen gas, and, on the other hand, displays a sufficient thermal stability and mechanical strength to withstand thermal and mechanical stresses to which the sealing strip is exposed on application on a packaging material web in a filling machine.
Examples of usable polymers that fulfil these requirements are polyesters (PET, PEN, PBT), biaxially oriented polyesters (BOPET, BOPEN), polyamide (PA), oriented polyamide (OPA, BOPA), ethylene vinyl alcohol copolymer (EVOH), biaxially oriented ethylene vinyl alcohol copolymer (BOEVOH), biaxially oriented cyclic olefin polymers (BOCOC, BOCOP).

A further requirement that is placed on a well-functioning sealing strip for the purposes of the present invention is naturally that it should have integrity and superior internal cohesion between the layers included in the strip and thus not delaminate or otherwise be damaged or destroyed when it is exposed to external tensile and stretching stresses during the application on a packaging material web under the prevailing external conditions in a filling machine. In order to improve and/or ensure such integrity and internal cohesion between the layers in the sealing strip, it may therefore - in certain cases - be appropriate or even necessary to subject, for purposes of increasing bonding and adhesion, the base layer to a surface treatment by means of which adhesion to adjacent layers in the sealing strip is improved. To this end, the base layer may, prior to lamination to the remaining layers, be treated with adhesion-promoting primer or lacquer well-known to the skilled reader of this specification.

Fig. 3 is a schematic cross section of a sealing strip according to a first embodiment of the present invention. The sealing strip, which has been given the generic reference numeral 30, has a central base layer 31 which, on its one side, has a first sealing layer 32 and on its other side a second sealing layer 33.

In the embodiment illustrated in Fig. 3, the first sealing layer 32 displays a two layer structure consisting of an outer layer 32a of polyethylene, preferably a mixture of metallocene polyethylene (mLLDPE) and low density polyethylene (LDPE), and an inner layer 32b of polyethylene, preferably low density polyethylene (LDPE).

In the embodiment illustrated in Fig. 3, the second sealing layer 33 also displays a two layer structure consisting of an outer layer 33a of polyethylene, preferably a mixture of metallocene polyethylene (mLLDPE) and low density polyethylene
(LDPE), and an inner layer 33b of polyethylene, preferably low density polyethylene (LDPE).

In order to impart to the sealing strip 30 sufficient thermal stability so as to withstand thermal stresses at elevated temperatures without any tendency to or risk of being folded, wrinkled or folded back, as has been described previously, at least one of the sealing layers 32 and 33 is supplemented with a density-increasing polyethylene component. In the embodiment under consideration here, it is assumed that the density-increasing polyethylene component is incorporated in the outer layer 33a of the second sealing layer 33.

Examples of usable density-increasing polyethylene components may, as was mentioned previously, be medium and high density polyethylene (MDPE and HDPE), and linear medium density polyethylene (LMDPE). The choice of density-increasing polyethylene component is not critical to the present invention, as long as the selected component is used in a sufficient quantity to ensure that the average density of the outer polyethylene layer 33a of the second sealing layer 33 is higher than the density of the same layer without the presence of the density-increasing polyethylene component. The requisite quantity of the density-increasing polyethylene component may thus readily be determined from case to case by a person skilled in the art in possession of the knowledge of the additional polyethylene component or components that are included in the pertinent layer 33a.

As was mentioned earlier, the base layer should preferably consist of a polymer which, on the one hand, displays superior tightness properties to gases, in particular oxygen gas, and, on the other hand, displays a sufficient thermal stability and mechanical strength to withstand thermal and mechanical stresses to which the sealing strip is exposed on application on a packaging material web in a filling machine.

Examples of usable polymers that fulfil these requirements are polyesters (PET, PEN, PBT), biaxially oriented polyesters (BOPET, BOPEN), polyamide (PA), oriented polyamide (OPA, BOPA), ethylene vinyl alcohol copolymer (EVOH), biaxially
oriented ethylene vinyl alcohol copolymer (BOEVOH), biaxially oriented cyclic olefin polymers (BOCOC, BOCOP).

A further requirement that is placed on a well-functioning sealing strip for the purposes of the present invention is naturally that it should have integrity and superior internal cohesion between the layers included in the strip and thus not delaminate or otherwise be damaged or destroyed when it is exposed to external tensile and stretching stresses during the application on a packaging material web under the prevailing external conditions in a filling machine. In order to improve and/or ensure such integrity and internal cohesion between the layers in the sealing strip, it may therefore - in certain cases - be appropriate or even necessary to subject, for purposes of increasing bonding and adhesion, the base layer to a surface treatment by means of which adhesion to adjacent layers in the sealing strip is improved. To this end, the base layer may, prior to lamination to the remaining layers, be treated with adhesion-promoting primer or lacquer well-known to the skilled reader of this specification.

Fig. 4 is a schematic cross section of a sealing strip according to a modification of the sealing strip illustrated in Fig. 3. Like the sealing strip in Fig. 3, the sealing strip, which has been given the generic reference numeral 40 in Fig. 4, has a central base layer 41 which, on its one side, has a first sealing layer 42 and on its other side a second sealing layer 43.

The first sealing layer 42 displays a two layer structure consisting of an outer layer 42a of polyethylene, preferably a mixture of metallocene polyethylene (mLLDPE) and low density polyethylene (LDPE), and an inner layer 42b of polyethylene, preferably low density polyethylene (LDPE).

The second sealing layer 43 also displays in this embodiment a two layer structure consisting of an outer layer 43a of polyethylene, preferably a mixture of metallocene polyethylene (mLLDPE) and low density polyethylene (LDPE), and an inner layer 43b of polyethylene, preferably low density polyethylene (LDPE).
In order to impart to the sealing strip 40 sufficient thermal stability so as to withstand thermal stresses at elevated temperatures without any tendency to or risk of being folded, wrinkled or folded back, as has been described previously, at least one of the sealing layers 42 and 43 is supplemented with a density-increasing polyethylene component which, in the illustrated example, is assumed to be incorporated in the inner layer 43b of the second sealing layer 43.

Examples of usable density-increasing polyethylene components may, as was mentioned previously, be medium and high density polyethylene (MDPE and HDPE), and linear medium density polyethylene (LMDPE). The choice of density-increasing polyethylene component is not critical to the present invention, as long as the selected component is used in a sufficient quantity to ensure that the average density of the inner polyethylene layer 43b of the second sealing layer 43 is higher than the density of the same layer without the presence of the density-increasing polyethylene component. The requisite quantity of the density-increasing polyethylene component may thus readily be determined from case to case by a person skilled in the art in possession of the knowledge of the additional polyethylene component or components that are included in the pertinent layer 43b.

As was mentioned earlier, the base layer 41 should preferably consist of a polymer which, on the one hand, displays superior tightness properties to gases, in particular oxygen gas, and, on the other hand, displays a sufficient thermal stability and mechanical strength to withstand thermal and mechanical stresses to which the sealing strip is exposed on application on a packaging material web in a filling machine.

Examples of usable polymers that fulfil these requirements are polyesters (PET, PEN, PBT), biaxially oriented polyesters (BOPET, BOPEN), polyamide (PA), oriented polyamide (OPA, BOPA), ethylene vinyl alcohol copolymer (EVOH), biaxially oriented ethylene vinyl alcohol copolymer (BOEVOH), biaxially oriented cyclic olefin polymers (BOCOC, BOCOP).

A further requirement that is placed on a well-functioning sealing strip for the purposes of the present invention is naturally that it should have integrity and
superior internal cohesion between the layers included in the strip and thus not
delaminate or otherwise be damaged or destroyed when it is exposed to external
tensile and stretching stresses during the application on a packaging material web
under the prevailing external conditions in a filling machine. In order to improve
and/or ensure such integrity and internal cohesion between the layers in the sealing
strip, it may therefore - in certain cases - be appropriate or even necessary to
subject, for purposes of increasing bonding and adhesion, the base layer to a surface
treatment by means of which adhesion to adjacent layers in the sealing strip is
improved. To this end, the base layer may, prior to lamination to the remaining
layers, be treated with adhesion-promoting primer or lacquer well-known to the
skilled reader of this specification.

Fig. 5 schematically illustrates a phase in which a packaging material web of paper
with outer, liquid-tight coatings of polyethylene, for example low density polyethylene
(LDPE) or a mixture of low density polyethylene (LDPE) and metallocene
polyethylene (mLLDPE) is reformed in a filling machine into a tube in the production
of liquid-tight, preferably aseptic packaging containers. More precisely, Fig. 5 shows
that moment at which both of the longitudinal edges of the packaging material web
are, after application of a sealing strip according to the present invention on one
longitudinal edge of the web (the inside of the tube), folded towards on another and
permanently united to one another in an overlap joint.

The sealing strip in Fig. 5 may be any one whatever of the previously described
sealing strips according to the present invention and, for the purposes of clarity, in
the illustrated example the relevant sealing strip has been given the same reference
numeral as the sealing strip 10 in Fig. 1.

As shown in Fig. 5, the sealing strip 10 is applied on and sealed to the one
longitudinal edge (the right-hand edge in the figure) of the web so that the sealing
strip 10, in this stage of the tube formation, has a strip edge 10' freely projecting over
the first web edge and which, after the sealing of both of the longitudinal web edges,
is intended to urge against and, in planar abutment, be sealed to the inside of the
overlapping second longitudinal web edge in order to cover completely and protect
the inwardly facing liquid-wicking incision edge of paper or paperboard against liquid penetration (edge wicking).
INDUSTRIAL APPLICATION

A sealing strip according to the present invention is intended to be employed as protection against liquid penetration in liquid-wicking incision edges on the inside of conventional packaging containers for liquid foods such as, for example, milk, juice, cooking oils or wine etc. In particular, The sealing strip is intended to be employed as protection against such liquid penetration in conventional, well-known packaging containers of the Tetra Brik, Tetra Wedge, Tetra Prisma types (all registered trademarks), which all share the common feature that they are produced by packing and filling machines which, from a web of packaging material of plastic coated paper or paperboard, form, fill and seal aseptic packages in a continuous production process at extremely high production output speeds, such as from 15,000 and up to 20,000 packages per hour and even more.

While the present invention has been described above with reference to specific embodiments and applications, it is naturally not restricted exclusively to these illustrated and described embodiments. It will be obvious to a person skilled in the art, in the possession of the knowledge of the present invention, that numerous modifications, alterations and variations are possible without departing from the scope of the inventive concept as this is defined in the appended Claims. For example, a sealing strip according to the invention may display first and second sealing layers in which the density-increasing polymer component is simultaneously present, even though the density-increasing polyethylene component in the described and illustrated embodiments is only present in one of the two outer sealing layers.
WHAT IS CLAIMED IS:

1. A laminated sealing strip (10; 20; 30; 40) for packaging purposes, comprising a base layer (11; 21; 31; 41) which, on its one side, has a first sealing layer (12; 22; 32; 42) of polyethylene and, on its other side, has a second sealing layer (13; 23; 33; 43) of polyethylene, characterised in that at least one of said sealing layers (12; 22; 32; 42 and 13; 23; 33; 43) includes a density-increasing polyethylene component in a sufficient quantity to impart to the relevant sealing layer or layers an average density which is higher than the density of corresponding layers without the presence of the density-increasing polyethylene component.

2. The sealing strip as claimed in Claim 1, characterised in that the first sealing layer (12; 22; 32; 42) on the one side of the base layer (11; 21; 31; 41) displays a two layer structure consisting of an outer layer (12a; 22a; 32a; 42a) of polyethylene and an inner layer (12b; 22b; 32b; 42b) of polyethylene; and that the density-increasing polyethylene component is present in the outer layer (12a) of the first sealing layer (12).

3. The sealing strip as claimed in Claim 1, characterised in that the first sealing layer (12; 22; 32; 42) on the one side of the base layer (11; 21; 31; 41) displays a two layer structure consisting of an outer layer (12a; 22a; 32a; 42a) of polyethylene and an inner layer (12b; 22b; 32b; 42b) of polyethylene; and that the density-increasing polyethylene component is present in the inner layer (22b) of the first sealing layer (22).

4. The sealing strip as claimed in Claim 1, characterised in that the second sealing layer (13; 23; 33; 43) on the other side of the base layer (11; 21; 31; 41) displays a two layer structure consisting of an outer layer (13a; 23a; 33a; 43a) of polyethylene and an inner layer (13b; 23b; 33b; 43b) of polyethylene; and that the density-increasing polyethylene component is present in the outer layer (33a) of the second sealing layer (33).

5. The sealing strip as claimed in Claim 1, characterised in that the second sealing layer (13; 23; 33; 43) on the other side of the base layer (11; 21; 31; 41) displays a two layer structure consisting of an outer layer (13a; 23a; 33a; 43a) of polyethylene and an inner layer (13b; 23b; 33b; 42b) of polyethylene;
and that the density-increasing polyethylene component is present in the inner layer (43b) of the second sealing layer (43).

6. The sealing strip as claimed in any of Claims 2 to 5, characterised in that the outer layer (12a; 22a; 32a; 42a) of the first sealing layer (12; 22; 32; 42) includes a mixture of metallocene polyethylene (mLLDPE) and low density polyethylene (LDPE).

7. The sealing strip as claimed in any of Claims 2 to 6, characterised in that the outer layer (12b; 22b; 32b; 42b) of the second sealing layer (13; 23; 33; 43) includes a mixture of metallocene polyethylene (mLLDPE) and low density polyethylene (LDPE).

8. The sealing strip as claimed in any of Claims 2 to 7, characterised in that the inner layer (12b; 22b; 32b; 42b) of the first sealing layer (12; 22; 32; 42) includes a low density polyethylene (LDPE).

9. The sealing strip as claimed in any of Claims 2 to 8, characterised in that the inner layer (13b; 23b; 33b; 43b) of the second sealing layer (13; 23; 33; 43) includes a low density polyethylene (LDPE).

10. The sealing strip as claimed in any of the preceding Claims characterised in that the density-increasing polyethylene component is selected from among medium and high density polyethylene (MDPE and HDPE), and linear medium density polyethylene (LMDPE).

11. The sealing strip as claimed in any of the preceding Claims, characterised in that the base layer (11; 21; 31; 41) consists of a polymer possessing superior tightness properties against gases, in particular oxygen gas.

12. The sealing strip as claimed in any of the preceding Claims, characterised in that the base layer (11; 21; 31; 41) consists of a polymer selected from among polyethylene terephthalate (PET), biaxially oriented polyethylene terephthalate (BOPET), polyethylene naphthlate (PEN), oriented polyethylene naphthlate (BOPEN), polyethylenebutyl terephthalate (PBT), oriented polyethylenebutyl terephthalate, polyamide (PA), oriented polyamide (OPA, BOPA), ethylene vinyl alcohol copolymer (EVOH), biaxially oriented ethylene vinyl alcohol copolymer (BOEVOH) and biaxially oriented cyclic olefin polymers (BOCOC, BOCOP).
13. The sealing strip as claimed in any of the preceding Claims, characterised in that the base layer (11; 21; 31; 41) is, for purposes of promoting adhesion, surface treated on both sides with a primer, lacquer or the like.

14. The sealing strip as claimed in any of the preceding Claims characterised in that it has a mirror-symmetric laminate composition on both sides of the base layer (11; 21; 31; 41).

15. Use of a sealing strip as claimed in any of the preceding Claims for protection against liquid penetration in exposed longitudinal incision edges on the inside of a packaging container of plastic-coated paper or paperboard material for liquid foods.

16. A packaging container of plastic-coated paper or paperboard material for liquid foods, of the type which has longitudinal incision edges on its inside, characterised in that the longitudinal incision edge is completely covered over and protected against liquid penetration or edge wicking by a sealing strip as claimed in any of Claims 1 to 14 applied over the incision edge.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
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)

IPC: B32B, B65D

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

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>WO 9826994 A1 (TETRA LAVAL HOLDINGS &amp; FINANCE s.A.), 25 June 1998 (25.06.1998), see sealing layers (23,24) in figure 2</td>
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Further documents are listed in the continuation of Box C.

Date of the actual completion of the international search: 4 December 2006
Date of mailing of the international search report: 06-12-2006

Johanna Brolund/ELY
Authorized officer
Telephone No. +46 8 782 25 00
International patent classification (IPC)

B65B 51/04 (2006.01)
B32B 37/26 (2006.01)
B65D 65/40 (2006.01)
B32B 27/32 (2006.01)

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The password is HYEPRIFUBU.

Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.
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