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(56) Fremdragne publikationer:

EP-A1- 0 865 915
DE-A1- 2 144 023
GB-A- 917 458
GB-A- 1 389 287
JP-A- H06 286 059

Food packaging container

Area of the invention

The invention relates to an inherently stable container according to the preamble of Claim 1.

State of the art

Recyclable trays for packaging food are known from the prior art. A current trend is to use raw materials from the food industry, also known as biopolymers, to produce the trays. Starch from grains or potatoes in particular, as well as sugar cane, is often used for this purpose. Aside from their undisputed environmental compatibility, these raw materials have the disadvantage that their heat resistance and melting tendency cannot compete with the same properties as other materials from the non-food sector. Most biopolymers are therefore not suitable for temperature-resistant food packaging. These substances have also fallen into disrepute for causing food shortages, as starch for biopolymer applications is often promoted by the state.

GB 1 389 287 relates to a lining material for cardboard boxes or an outer packaging material. An intermediate layer is bonded to outer layers with an adhesive on both sides. The lining material thus comprises three layers and a package even comprises four layers, namely the three layers of the lining material and the cardboard layer. The outer layers are paper plies. The intermediate layer can be a barrier layer from a coated cellulose ply. The coating is an aqueous copolymer with a vinylidene chloride percentage. Compared to conventional liner material, which has wax as an intermediate layer, this material is more heat-resistant when heat-sealed. The wax intermediate layer can also be damaged when folded. However, the lining material is not suitable for direct contact with food, as the outer layers are made of paper and the barrier layer is arranged between the outer layers. The paper would soften if it were to come into contact with food. The lining material is not intended to possess dimensional stability and may therefore only be used as wrapping material. In addition, packaging with cardboard is very expensive, as it consists of four layers.

DE 2 144 023 describes a carrier layer made of cellulosic hydrate fibres, which can be connected with layers containing polyester resin. A bonding agent based on a protein compound is proposed in order to enable the connection. However, polyester resins are not food-safe and are therefore completely unsuitable in the food packaging sector. Polyester resins are not biodegradable either.

GB 917 458 proposes a foil for billboards made of cellulose hydrate. The foil is glued to the billboard with an adhesive. The adhesive is water-soluble for quick removal of the foil. This foil application is therefore completely unsuitable for foodstuffs that mostly contain water.

EP 0 865 915 describes a recyclable and biodegradable, heat- and deep-freeze resistant multi-layer laminate, in particular for the storage, packaging, freezing, heating up and/or baking or roasting of foodstuffs in microwave and conventional ovens. The laminate preferably has a carrier layer of cardboard and at least one second layer of food-safe, heat- and grease-resistant paper, an adhesive for binding the carrier layer and the paper as well as a further non-stick layer provided on food-safe, grease-resistant paper. The aforementioned paper is preferably steam- and water-repellent as well. The laminate made of cellulose is completely biodegradable and is also suitable for recycling.

WO 2011/089015 relates to a multi-layer packaging material, preferably with moisture- and/or grease-repellent properties. The packaging material comprises at least one substrate layer and at least one barrier layer. The substrate layer consists of cardboard, paper or fibres made from renewable and/or preferably biodegradable raw materials and a single or multi-layer barrier layer. The barrier layer is made of paper, cardboard or parchment which is impregnated. This packaging material is completely biodegradable, but unsuitable for use at very high or low temperatures, such as in ovens or freezers.

WO99/44909 relates to a material for trays or packaging, wherein the material is constructed from a number of layers. These layers, seen from the inside of the tray/package, comprise a first layer of parchment paper, an adhesive layer and a second layer of parchment paper. A water-repellent layer is applied outside the second layer of parchment paper. This outer layer consists primarily of an acrylic polymer or silicone. Because the coating material is paper-based, it inevitably has a high moisture vapour permeability.

Object of the invention

The object of the invention is therefore to propose a container for packaging food that is recyclable, biodegradable and compostable, and at the same time suitable for freezing or heating foodstuffs in ovens and has a good barrier against water vapour and gases.

Description

According to the invention, the object is achieved in a container for storing food as per the preamble to claim 1 in that the barrier layer comprises a cellulose hydrate foil which is provided with a first vapour-barrier coating on at least the side facing towards or away from the food to be stored. The coating prevents the barrier layer from being penetrated by water vapour. Otherwise, the carrier layer would absorb the water vapour and soften up. Furthermore, such a barrier layer has the additional benefit of mechanically reinforcing the carrier layer or the container. This means that the carrier layer can be thinner, thus saving material.

The cellulose hydrate foil is expediently provided with a second vapour-barrier coating on the uncoated side. This doubles the barrier against water vapour, gases and odours. The provision of a second coating also increases safety, since the additional coating is still intact in the event of damage to a coating.

In an especially favourable design form, the first and second vapour-barrier coating is a biopolymer coating with a polyvinylidene chloride (PVCD) percentage. PVCD is known as an excellent barrier material against oxygen and water vapour and also possesses good heat-sealing properties at 120-160 °C. PVCD can be distributed homogeneously throughout the biopolymer coating. It is also possible to apply PVCD to the biopolymer coating as a coating, paint, foil or barrier layer. The biodegradability of the barrier layer is not affected by the PVCD.

Expediently, the PVCD fraction is a maximum of 10% by weight, preferably a maximum of 7% by weight and particularly preferably a maximum of 5% by weight. This weight proportion of PVCD in the biopolymer coating provides all the advantages of the PVCD, such as good barrier and heat-sealing properties, without compromising the food compatibility or biodegradability of the container or vessel according to the invention.

In a further preferred design form, the biopolymer coating is manufactured from renewable raw materials. These sustainable biopolymer coatings are independent of non-renewable raw materials and their heat resistance is continuously being improved. At present, they can withstand temperatures of up to 120 °C.

In a further preferred design form, the first and second vapour-barrier coating comprises biopolymer nanoparticles. As a result, the barrier layer remains recyclable, biodegradable and compostable, even with the water vapour-barrier coating applied. The biopolymer nanoparticles can be obtained through a method which comprises a crosslinking step using a crosslinking agent (e.g. a polyaldehyde). The biopolymer nanoparticles are applied using standard coating processes such as rolling, spraying, printing or dipping, etc. The cross-linked nanoparticles form a dense coating with very low permeability values for water vapour and gases. The bio-polymer nanoparticle coating is preferably made from renewable raw materials that are not suitable for food production. These include cellulose, hemicellulose chitin, inulin, and lignin. Derivatives and/or mixtures of these raw materials may also be used.

It is advantageous for the nanoparticles to have an average particle size of 5 to 300 nm, preferably from 10 to 200 nm and particularly preferably from 10 to 100 nm. This particle range provides the best barrier properties.

In a particularly preferred embodiment, the open edge of the container is a peripheral beaded edge. The rigidity and dimensional stability of the container can be improved by providing the beaded edge. A peripheral beaded edge is preferred, although it is also conceivable that the beaded edge is only provided on the straight edges and is recessed in the region of the corners. The beaded edge also makes it easier to unstack the relevant empty stacked containers. This is due to the fact that the beaded edge of the containers stacked inside one another is spaced slightly apart, so the containers are joined together less tightly as a result.

Advantageously, a water-repellent layer, preferably made of an acrylic polymer, is arranged on the side of the carrier layer facing away from the food to be stored. This layer protects the cardboard or paper of the carrier layer from water from the outside. External moisture protection is particularly advantageous in refrigerators or freezers with moist surfaces.

Because the water vapour permeability of the barrier layer at 38 °C and 90% air humidity over 24 hours is less than 40 g/m2, preferably less than 30 g/ m2 and most preferably less than 15 g/m2, the barrier layer, which comprises the cellulose hydrate foil and at least one vapour-barrier coating, is almost vapour-tight.

Advantageously, the oxygen permeability of the barrier layer at 23 °C and 50% humidity over 24 hours is less than 30 cm^3/m^2.24h.bar, preferably less than 15 cm^3/m^2.24h.bar and most preferably less than 10 cm^3/m^2.24h.bar. This allows food to be kept fresh in the container and keeps it sufficiently protected from atmospheric oxygen.

In a further preferred design form, the laminate is free from adhesive and its function is assumed by the second vapour-barrier coating, which is a nanopolymer coating. It is understood that the second coating must be arranged between the cellulose hydrate foil and the carrier layer in order to bond these layers. Since the nanopolymer coating has good hot-sealing properties, an additional adhesive can be dispensed with.

It is advantageous if the barrier layer is transparent. This allows the barrier layer and/or carrier layer to be printed with advertising, logos, instructions, information etc. and makes the printing legible to the user of the vessel.

It is advantageous if the barrier layer can be hot-sealable or cold-sealable, since a sealing foil can then be quickly applied to the sealing edge of the vessel in order to seal the vessel.

In a further design example, the barrier layer has a thickness between 10 and 50 µm, and preferably between 20 and 30 µm. This thickness is optimized to make the barrier layer is deep drawable in order to form a three-dimensional container together with the carrier layer. On the other hand, the barrier layer has good mechanical properties at this layer thickness so that the layer thickness of the carrier layer can be reduced.

It is preferred if the barrier layer also has these properties in order for the entire container to be recyclable, biodegradable and compostable.

It is advantageous if the laminate to be deep drawable and thermoformable so that food containers can be produced from it. For this purpose, the laminate must have sufficient mechanical strength so as not to be torn or damaged during the deep-drawing process. It must also be sufficiently flexible so that a sealing edge can be formed on which the container can be sealed with a foil.

A further aspect of this invention also relates to the laminate described above, since this is also possible for applications other than a container. Examples of these include advertising surfaces manufactured from the material according to the invention.

Further advantages and features result from the following description of a design example of the invention with reference to the schematic diagrams. It shows the following in a non-scale representation:

Figure 1: A cross-section through the laminate according to the invention.

The container for packaging foodstuffs according to the invention is manufactured from a laminate. Figure 1 shows the laminate, in particular the packaging laminate, which is collectively designated with the reference number 11. The base of the laminate forms a carrier layer 13, which gives the laminate stability. The carrier layer 13 is preferably cardboard, a stiff single or multi-layer paper or made from cellulose fibres. The carrier layer 13 is preferably manufactured from purely mechanically crushed and bleached pulp. The carrier layer has the necessary tensile strength in order for it to be deep-drawn for the manufacture of vessels. This can reduce manufacturing waste and increase production speed. The elasticity is 3% and preferably 6%. The carrier layer is also so stiff that it meets the requirements for a food container and in particular a food bowl. In addition to trays, the packaging laminate can be formed into bowls, cups, trays, etc.

The carrier layer 13 has an inner first surface facing the food to be packaged and a second outer surface facing away from the food. A water-repellent layer 21 is preferably provided on the outer surface. This water-repellent layer 21 can consist of an acrylic polymer, for example, since these polymers do not impair biodegradability and the requirements for the temperature range. The water-repellent layer 21 can be applied during the laminating or during a printing process step in the offset or flexographic printing process. For a recyclable and biodegradable packaging laminate, it is understood that the water-repellent layer 21 and all other laminate layers must also possess these properties. If foodstuffs are frozen in a container made of the packaging laminate according to the invention, it is important that the carrier layer 13 provided with the water-repellent layer 21, since there is always frozen water in a freezer which could penetrate the carrier layer 13.

The barrier layer 15 is applied to the inner surface of the carrier layer 13 on the same. This can be done with adhesive 17. Adhesive 17 contains as little water content as possible in order to avoid subsequent drying of adhesive 17. Excessive water content causes the carrier layer to form ripples, thus losing its planar surface. Furthermore, the adhesive 17 must withstand temperatures from -40 °C to at least 140 °C and preferably up to 220°C, since the packaging laminate 11 should be suitable for freezing, thawing and heating food. Generally, it is preferable if the inherently stable container for packaging food can withstand temperatures between -40 °C and 220 °C.

The barrier layer 15 preferably comprises a foil 14, which can be produced from cellulose regenerate. Other biopolymers are also conceivable if they are made from renewable raw materials, which are preferably not intended for food production, and are biodegradable. Cellulose hydrate is also known as cellulose film and is produced from a cellulose regenerate. Cellulose hydrate is known to have a high water vapour permeability, which can prevent condensation in a closed cellulose hydrate package. Vapour permeability is, however, undesirable in the present package laminate 11, since the vapour penetrating the cellulose hydrate softens the carrier layer 13. For this reason, the foil 14 is provided at least on the side facing the food with a first vapour-barrier coating 19a, for which coating 19a the cellulose hydrate serves as carrier foil 14. A second vapour-barrier coating 19b is preferably also applied on the side facing away from the food in order to further improve the vapour barrier and to have an additional safety barrier. This is particularly advantageous if the first coating 19b would be damaged. Another advantage of the second coating 19b is that it can act as adhesive 17 and the barrier layer 15 can be bonded to the carrier layer 13 by means of the second vapour-barrier coating 19b. This can be done by applying heat and pressure, since the coatings 19a, 19b can be hot-sealed. In addition to the barrier for water vapour, the barrier layer 15 also constitutes a barrier for gases, liquids and greases. The vapour-barrier coatings 19a, 19b are preferably a biopolymer coating with a polyvinylidene chloride (PVCD) percentage or comprise biopolymer nanoparticles, both of which have excellent vapour-barrier properties and also present a barrier for gases, such as oxygen. The vapour-barrier biopolymer coatings 19a, 19b also have good heat-sealing properties due to the PVCD or nanoparticle content. PVCD is preferably homogeneously distributed in the biopolymer coating. The weight content of PVCD is kept as low as possible so that the biopolymer coating has optimized barrier and hot-sealing properties, but food compatibility and biodegradability of the container are not impaired. The water vapour transmission at 38°C and 90% humidity over 24 h is only 10 g/m^2. At 25°C and 50% humidity over 24 hours, the O2 flow is only 3 g/m^2. The size of the nanoparticles used is preferably in the range from 10 to 100 nm, which results in the excellent barrier properties of the coating 19a, 19b. The coatings 19a, 19b are hot-sealable, whereby a container from the packaging laminate 11 can be sealed with a foil through hot sealing. This creates adhesive bonds with a thickness of 200g/25mm. The coatings 19a, 19b are also made of a recyclable and biodegradable biopolymer. The biopolymer can be cellulose, hemicellulose, starch or chitin or a derivative thereof and/or mixtures thereof. Renewable raw materials that are not used as foodstuffs are preferred, although carbohydrates, plant and animal proteins, polysaccharides and other food raw materials are also possible. A mechanically thermoplastic process is used to manufacture the biopolymer, which comprises a crosslinking step using a cross-linking agent. Coatings 19a, 19b can be applied with known coating methods, such as printing, roller painting, dipping and spraying.

The barrier layer 15 has a tear resistance of 22% in the processing direction and 70% in the transverse direction. The barrier layer 15 and the coatings 19a, 19b are transparent, whereby a pressure applied to the carrier layer 13 is visible on the inner side of the package laminate 11. There, as already stated above, the barrier layer 15 and the coatings 19a, 19b have good mechanical properties, the carrier layer 13 can be dimensioned less and the packaging laminate nevertheless has the required mechanical properties.

The barrier layer 15 has a thickness of 10 to 50 µm and preferably from 20 to 30 µm in order to obtain the required properties.

The packaging laminate 11 can be deep-drawn into the container under heat and pressure due to the properties of the individual layers 13, 14, 17, 19 and 21, is recyclable, biodegradable, compostable and manufactured from renewable, renewable resources, which are preferably not used as foodstuffs. The laminate is referred to as compostable, since it complies with EN 13432 and is degraded by at least 90% within 12 weeks.

Legend:

11	Laminate, packaging laminate
13	Carrier layer
14	Cellulose hydrate foil, carrier foil
15	Barrier layer
17	Adhesive
19a, 19b	First and second vapour-barrier coating
21	Water-repellent layer

PATENTKRAV

1. Egenstabil beholder til opbevaring af levnedsmidler, hvilken beholder er udformet af et laminat (11) omfattende:

- et bærelag (13) af pap, som er fremstillet af mekanisk findelt pulp, af et enkelt-lags- eller flerlagspapir, cellulose eller sekundære fibre,

- mindst ét spærrelag (15) af et fedt-, vand- og varmebestandigt materiale på den side, der vender mod det levnedsmiddel, der skal opbevares, og

- et klæbemiddel (17) til binding af bærelaget (13) og spærrelaget (15), hvor bærelaget (13), klæbemidlet (17) og spærrelaget (15) er levnedsmiddelsikre,

kendetegnet ved, at spærrelaget (15) omfatter en cellulosehydratfolie (14), der i det mindste på den side, der vender mod eller væk fra det levnedsmiddel, der skal opbevares, er forsynet med en første dampspærrebelægning (19a, 19b).

2. Beholder ifølge krav 1, kendetegnet ved, at cellulosehydratfolien (14) på den ikke-overtrukne side er forsynet med en anden dampspærrebelægning (19a, 19b).

3. Beholder ifølge krav 2, kendetegnet ved, at den første og den anden dampspærre-belægning (19a, 19b) er en biopolymerbelægning med en andel af polyvinylidenchlorid (PVCD).

4. Beholder ifølge krav 3, kendetegnet ved, at PVCD-andelen er højst 10 vægtprocent, fortrinsvis højst 7 vægtprocent og særligt foretrukket højst 5 vægtprocent.

5. Beholder ifølge et hvilket som helst af kravene 3 eller 4, kendetegnet ved, at biopoly-merbelægningen er fremstillet af vedvarende råmaterialer.

6. Beholder ifølge krav 2, kendetegnet ved, at den første og den anden dampspærre-belægning (19a, 19b) omfatter biopolymer-nanopartikler.

7. Beholder ifølge krav 6, kendetegnet ved, at nanopartiklerne har en gennemsnitlig partikelstørrelse på 5 til 300 nm, fortrinsvis fra 10 til 200 nm og særligt foretrukket fra

10 til 100 nm.

8. Beholder ifølge et hvilket som helst af kravene 1 til 7, kendetegnet ved, at beholderens åbne kant er en perifer bertelkant.

9. Beholder ifølge et hvilket som helst af kravene 1 til 8, kendetegnet ved, at et vandafvisende lag (21), fortrinsvis af en acrylpolymer, er placeret på den side af bærelaget (13), der vender væk fra det levnedsmiddel, der skal opbevares.

10. Beholder ifølge et hvilket som helst af kravene 1 til 9, kendetegnet ved, at vanddamppermeabiliteten af spærrelaget (15) ved 38°C og 90% luftfugtighed over 24 timer er mindre end 40 g/m^2, fortrinsvis mindre end 30 g/m^2 og mest foretrukket mindre end 15 g/m^2.

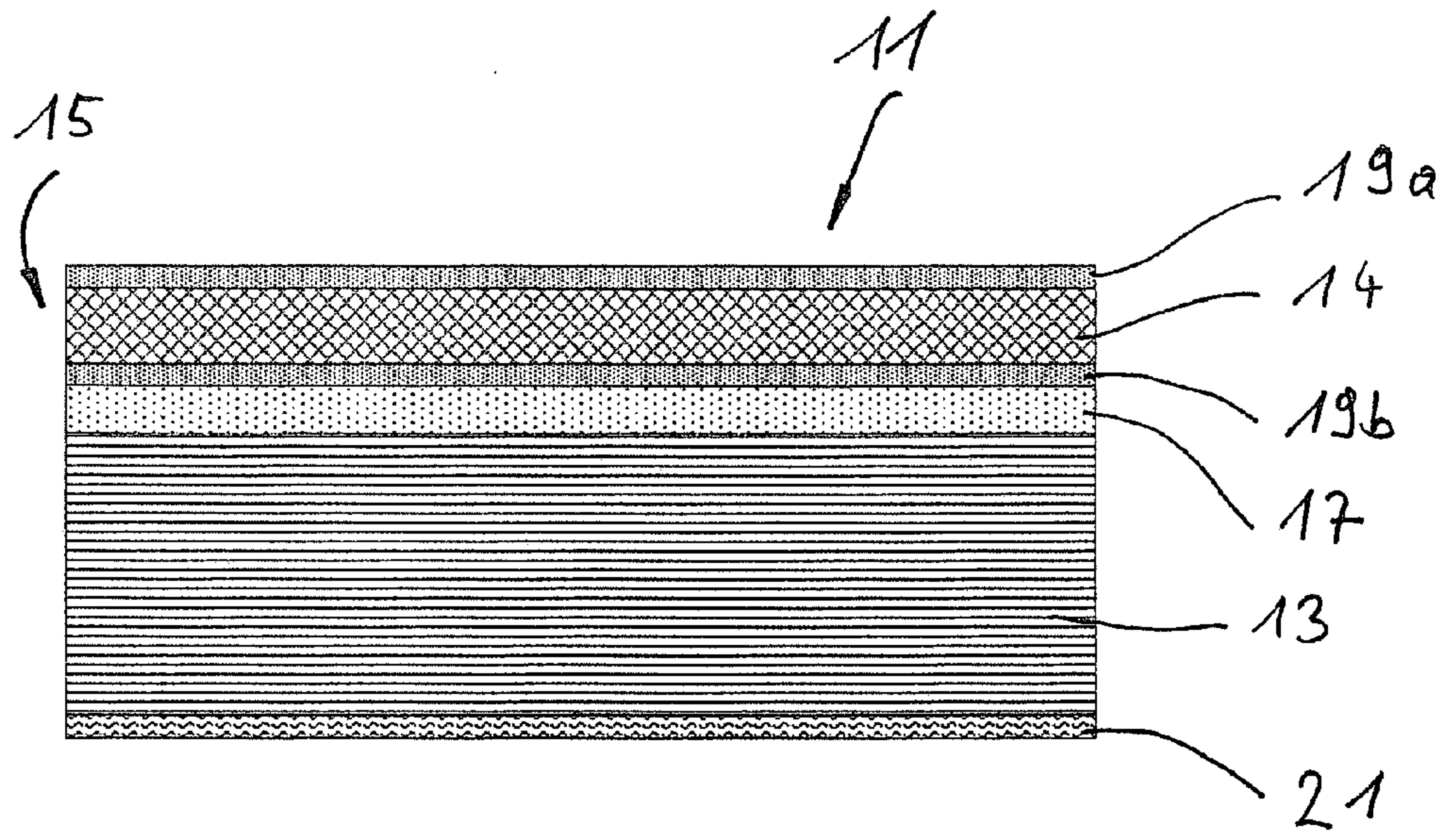
11. Beholder ifølge et hvilket som helst af kravene 1 til 10, kendetegnet ved, at iltpermeabiliteten af spærrelaget (15) ved 23°C og 50% luftfugtighed over 24 timer er mindre end 30 cm^3/m^2.24h.bar, fortrinsvis mindre end 15 cm^3/m^2.24h.bar og mest foretrukket mindre end 10 cm^3/m^2.24h.bar.

12. Beholder ifølge et hvilket som helst af kravene 1 til 11, kendetegnet ved, at laminatet (11) er fri for klæbemiddel (17), og hvis funktion overtages af den anden dampspærrebelægning (19b), som er en nanobiopolymerbelægning.

13. Beholder ifølge et hvilket som helst af kravene 1 til 12, kendetegnet ved, at spærrelaget (15) kan varmeforsegles eller koldforsegles.

14. Beholder ifølge et hvilket som helst af kravene 1 til 13, kendetegnet ved, at spærrelaget (15) er genanvendeligt, biologisk nedbrydeligt og komposterbart.

15. Beholder ifølge et hvilket som helst af kravene 1 til 14, kendetegnet ved, at laminatet (11) er dybtrækkeligt og termoformbart, for at der derudfra kan fremstilles egenstabile levnedsmiddelbeholdere.



Figur 1