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(54) **PACKAGING UNIT COMPRISING NON-WOOD LIGNOCELLULOSIC BIOMASS AND METHOD FOR MANUFACTURING SUCH PACKAGING UNIT**

NAHRUNGSVERPACKUNGFORMTEIL BESTEHEND AUS GRASFASERN UND
ENTSPRECHENDES HERSTELLUNGSVERFAHREN

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Description

[0001] The present invention relates to a packaging unit made of moulded pulp for products like eggs and similar products like kiwis and tomatoes, for example, according to claim 1. Furthermore, the present invention relates to a method of manufacturing a packaging unit according to claim 7.

[0002] Packaging unit such as egg cases, containers or cartons known in practice are generally fabricated from carton made from moulded pulp originating from paper material, also referred to as paper pulp. Such units comprise a bottom part, provided with compartments for individual products, and often a cover part that is mostly hingedly connected to the bottom part. Products like eggs are transported in these units and displayed on shelves in supermarkets, for example. In many modern food retailing operations, e. g. supermarkets and hardware stores, various products like fruit, meat, eggs and the like, are presented and displayed to the retail customer such packaging units including trays of many types and sizes, said trays being manufactured from paper pulp. Often the colour or appearance of such trays, for example egg trays, is e. g. greyish and, therefore, not attractive or aesthetically appealing to the retail customer.

[0003] WO 2013/019107 A1 discloses an egg package made from moulded pulp. DE 196 18 554 A1 discloses the use of straw, paper and a binding agent for a product.

[0004] WO 2013/141686 A1 discloses a packaging unit made of moulded pulp for products like eggs, comprising:- a bottom part provided with compartments for individual products, wherein the moulded pulp comprises at least 5 wt.% non-wood lignocellulosic biomass.

[0005] In addition, usually, fibre packaging materials such as egg boxes and fibre trays are uniform in colour. However, such fibre packaging materials are less appealing to the customer. Although the package as a whole could be provided with different colours by employing labelling and/or printing techniques, such techniques are generally much too expensive. Consequently, there is a need within the art for a cheap and uncomplicated process for the manufacture of more appealing fibre packaging materials.

[0006] Alternative packaging materials comprise less attractive materials such as white coloured expanded polystyrene and similar synthetic materials that can be recycled only with difficulty and which are detrimental to the environment. At present there exists a long felt need to provide more appealing packaging materials, in particular for food products such as fruit that are more appealing to the retail customer.

[0007] Articles based on paper pulp are manufactured in a pulp moulding process wherein pulp moulding machines are employed. The basic principles of manufacture are to provide recovered paper (including newspaper, magazines) or paper furnish that is re-pulped. Relevant regulation for recovered paper in this connection is for example EN 643. Subsequently, various chemicals

may be added to the pulp. For example, chemicals are added to give finished products water resistance, wet strength and/or colour. The pulp is cleaned of contaminants such as staples, sand and plastic particles, and transferred to the moulding machine. The moulding dies of the machine are dipped into the pulp and a vacuum is applied to the die and in that way a product is created. The wet product is placed on a conveyor belt and sent through a drying tunnel. Finally, the dried products may be pressed, counted, bundled, printed, labelled, palletised and despatched to the end user. Reference is for example made to US 3,320,120 and US 3,654,076.

[0008] One of the further problems with paper pulp is the reduced availability of this material for the manufacturing of packaging units. In addition, in practice the quality of the (recycled) raw paper pulp is often insufficient or at least less optimal for the manufacturing process. The present invention has for its object to obviate or at least reduce one or more of the above stated problems in known packaging units such as egg cases or egg cartons.

[0009] The present invention provides for this purpose a packaging unit according to claim 1.

[0010] By providing lignocellulosic biomass from other resources as the conventional paper recycling an alternative source for the material for the packaging unit of moulded pulp is provided. This improves the availability of starting material when manufacturing these packaging units.

[0011] Furthermore, the use of non-wood lignocellulosic biomass provides additional visual effects that may provide the packaging unit with a more natural feel.

[0012] Also, in case the biomass originates from a rest stream it further improves the sustainability of the packaging unit according to the invention.

[0013] From experiments it was shown that the non-wood lignocellulosic biomass has a protein content below 2 dry wt.%. A high protein content reduces material strength too much, especially during the manufacturing process wherein side wall of the packaging unit may bend or collapse.

[0014] In a presently preferred embodiment the protein content is below 1.75 dry wt.%.

[0015] Having a lower protein content in the biomass, below 2 dry wt.%, further improves the overall stability of the packaging unit. This obviates the need for additional measures in the manufacturing process and/or the need to provide the packaging with other dimensions, such as thicker side wall for example. In the manufacturing process especially having a protein content below 2 dry wt. % prevents foaming, problematic dewatering of the pulp resulting in lower manufacturing speed and higher drying costs for the wet product. Dry wt. % can be measured using the so-called Kjeldahl content with a Buchi Kjeldahl lab analysis from which the protein content is calculated.

[0016] In a presently preferred embodiment of the packaging unit according to the invention the moulded pulp comprises at least 10 wt. % non-wood lignocellulosic biomass, preferably at least 50 wt.% non-wood lignocel-

lulosic biomass, more preferably at least 80 wt.% non-wood lignocellulosic biomass, even more preferably at least 85 wt.% non-wood lignocellulosic biomass, and most preferably at least 92.5 wt. % non-wood lignocellulosic biomass.

[0017] Increasing the amount of non-wood lignocellulosic biomass improves the flexibility for the use non-wood biomass as starting material when manufacturing packaging unit according to the invention. Furthermore, increasing the amount of biomass improves the natural feel for the consumer. Also, especially in case the biomass originates from a rest flow, the sustainability of the packaging unit is further enhanced.

[0018] In a presently preferred embodiment the the non-wood lignocellulosic biomass comprises biomass originating from plants of the Order Poales, the Order Solanales, the Order Arecales, the Order Malphighiales, the Order of Rosales, the Order of Malvales and/or herbaceous plants.

[0019] The aforementioned origin of the non-wood lignocellulosic biomass has shown good properties for use in packaging units according to the invention. Examples of plants from the Order Poales are grass, sugar cane, bamboo and cereals including barley and rice. Examples of plants of the order Solanales include tomato plants of which the leaves and/or stems could be used, for example. Examples of plants from the Order Arecales include palm oil plants of which leaves could be used, for example. Examples of plants from the Order Maphighiales include flax. Examples of plants from the Order of Rosales include hemp and ramie. Examples of plants from the Order of Malvales include cotton, kenaf and jute. The plant type of herbaceous plants includes, besides grass type plants and some of the aforementioned plants, also jute, Musa including banana, Amarantha, hemp, cannabis etcetera.

[0020] Preferably, the lignocellulosic biomass comprises biomass originating from plants of the Family of Poaceae (to which is also referred to as Gramineae). This family includes grass type of plants including grass and barley, maize, rice, wheat, oats, rye, reed grass, bamboo, sugar cane (of which residue from the sugar processing can be used that is also referred to as bagasse), maize (corn), sorghum, rape seed, other cereals, etc. Especially the use of so-called nature grass provides good results when manufacturing packaging units such as egg packages. Such nature grass may originate from a natural landscape, for example.

[0021] This family of plants has shown good manufacturing possibilities in combination with providing a sustainable product to the consumer.

[0022] In a presently preferred embodiment the packaging unit comprises one or more reinforcement elements configured to increase stability of the packaging unit.

[0023] Especially when using a higher amount of non-wood biomass, preferably plants of the Family of Poaceae, more specifically grass type plants, mechanical prop-

erties of the packaging unit according to the invention start to become limiting. Providing the packaging unit with reinforcement elements, such as ribs, grooves, protrusions, etc., improves the mechanical properties including strength, stability, tensile strength, three-point bending stiffness and compression etc. This enables the use of a higher amount of non-wood lignocellulosic biomass. More specifically, this enables the use of an amount above 80 wt. %, more preferably above 85 wt. % is possible. Preferably, the use of reinforcement elements allows for the use an amount above 92.5 wt. %. This provides a sustainable packaging unit with a natural feel and has good mechanical properties both in the manufacturing process and its actual use.

[0024] In a presently preferred embodiment the reinforcement elements comprise a number of ribs extending over at least a front surface of the bottom part. This rib or these ribs strengthen the front surface of the bottom part. This improves the manufacturing process and the strength of the packaging unit according to the invention in use.

[0025] In an embodiment according to the invention the packaging unit further comprises a cover part configured for engaging the bottom part, wherein the cover part comprises reinforcement elements to increase stability of the packaging unit. Preferably the cover part comprises top, front, side and rear surfaces with the front surface preferably comprising one or more openings configured for receiving the first locking element, such as a notch, cam or protrusion provided on the bottom part, in a closed position of the packaging unit. Having a packaging unit with a bottom part and a cover part enables transport and display of products without damaging the products. This is especially relevant in case of vulnerable products like eggs. In a preferred embodiment, the cover part is hingedly connected to the bottom part on the rear side thereof. On the front side a lock is provided comprising the first locking element on the bottom part and an opening in the cover part as second locking element that is configured for receiving the first locking element.

[0026] Preferably, the reinforcement elements comprise a number of ribs and/or grooves extending over at least a front surface of the cover part. Optionally, these elements extend from the top surface of the cover part to the front surface of the cover part, thereby further improving the mechanical properties of the packaging unit.

[0027] In a presently preferred embodiment according to the invention the packaging unit further comprises visible non-wood lignocellulosic biomass fibres protrude from a package surface to such an extent that separate visible non-wood lignocellulosic biomass fibres can be distinguished by sight and/or touch.

[0028] Providing distinguishable fibres contributes to the natural and/or sustainable feel for the consumer when confronted with such embodiment of the packaging unit according to the invention.

[0029] Preferably, the protruding fibres are arranged to provide a cushioning effect for products placed in the

compartments. The cushioning effect reduces the risk of product damage during transport and/or display of the products. This is especially relevant when dealing with vulnerable products such as eggs. This effect may be enhanced by locally allowing a lower mechanical strength providing some flexibility to the packaging unit, especially in or around a product compartment thereof. This may reduce product damage.

The invention further also relates to a method for manufacturing a moulded fibre packaging unit, in particular a food package, more particular an egg package, according to claim 7.

[0030] Such method provides the same effect and advantages as described with respect of the packaging unit. This includes the effects and advantages of the non-wood biomass content and/or protein content as described previously for the packaging unit.

[0031] The method according to the invention enables to obtain a package in a more environmental friendly way. It will be clear that the invention is, besides as an egg packaging, also beneficial for fruit and vegetable packages, cup carriers and industrial buffering means. Yet another effect of the invention is the provision of a food package which appearance is more appealing to the customer during display and/or use.

[0032] The non-wood lignocellulosic biomass preferably containing between 0 to 2% protein in dry weight enables to perform the method in an economical that is to obtain packages therewith that can compete in the market. In contrast with the current invention; when used in a moulded fibre process, ordinary grass, containing much more protein, does suffer from bad drainage, long drying times and/or high energy consumption which lead to slow production and/or high production cost. The high content of lignocellulosic biomass not originating from wood wherein the lignocellulosic biomass preferably contains between 0 to 2% protein in dry weight enables to optimize operations in that a choice can be made between raw material flow being ordinary pulp originating from paper thus wood and the lignocellulosic biomass not originating from wood. Also the production process is much more efficient. In addition, the high content lignocellulosic biomass not originating from wood enables to provide a package a "green" appearance. Moreover, packages obtained by the method according to the invention perform surprisingly well in known compression tests for egg packages. This was not expected because lignocellulosic biomass not originating from wood is much weaker than wood based fibres. It is found that about 50% lignocellulosic biomass not originating from wood still provides the effect of the invention without compromising too much on strength of the package. Thus, the lignocellulosic biomass not originating from wood being added to the wood based fibre pulp at a rate of 5-80 % lignocellulosic biomass, or even a higher amount of non-wood lignocellulosic biomass, on dry fibre weight enables to manufacturing a moulded fibre food packaging in an environmental friendly way without compromising too much on

strength of the package. In addition, using lignocellulosic biomass not originating from wood as raw material for the fibre pulp mix results in the manufacturing process becoming less independent of wood fibres. This is relevant when paper as journals will become less available what will lead to higher prices of paper in the future.

[0033] In an embodiment of the method, the lignocellulosic biomass originates from grass type plants. The grass originates preferably from controlled cultivation such that regulation in connection with food contact may be respected with more ease. More preferably this controlled cultivation does not involve fertilizing. It is conceivable to use other grass as well like roadside grass for non food packages. It will be understood that the invention is not limited to grass fibres including other graminaceous plants. It is conceivable that other natural fibres, other than wood, like straw fibres, sugar beet residue, are used in the invention.

[0034] In an embodiment, the method comprises, before adding the lignocellulosic biomass to the pulp mix in a pulp container, processing the lignocellulosic biomass for removing protein from the lignocellulosic biomass such that the lignocellulosic biomass preferably contains between 0 to 2% protein in dry weight. Such a process for removing protein from lignocellulosic biomass is known per se, like from the patent publication WO 2012/023848 A1 to Danvos B.V. This removing of protein even more enables to optimize operations in that a choice can be made between raw material flows. In the technical field of moulded fibre packaging the pulp container is also referred to with "thin stock tank".

[0035] In an embodiment, the method comprises pre-processing of the lignocellulosic biomass, the pre-processing comprising soaking the lignocellulosic biomass in water for a soaking period of at least 1 day preferably at least 2 days. Pre-processing here means processing the lignocellulosic biomass before adding the lignocellulosic biomass to a pulp container with the pulp mix. In an embodiment of the method, the pre-processing comprises cutting the lignocellulosic biomass, preferably before the soaking, for obtaining visible lignocellulosic biomass fibres having a length such that the visible lignocellulosic biomass fibres may surface on the fibre pulp mix, the visible lignocellulosic biomass fibres preferably having an average length smaller than 5 cm, preferably smaller than 2 cm, more preferably between 1.5 and 2 cm.

[0036] The visible lignocellulosic biomass fibres having a length such that the fibres may surface on the fibre pulp mix ensure that during moulding these relatively long fibres are positioned at a package surface. These long fibres are then visible on a package and can be distinguished by touch. This provides an improved appearance to the food package. In this connection, visible has its ordinary meaning that the fibre can be seen with the naked eye without any aid. It will therefore be understood that fibre does not refer to fibres on cellulose level. Instead a fibre here is on biomass level and may have a

width typical between 0.1 mm to 2 mm

[0037] In an embodiment of the method, the pre-processing comprises refining the visible lignocellulosic biomass fibres for facilitating interaction between the fibre pulp and the visible lignocellulosic biomass fibres in the pulp mix. Refining is a process which is known per se in the paper and paper pulp processing industry. The interaction has both a mechanical and chemical component, a mechanical component in that binding surface between fibres is increased, and a chemical component in that e.g. forming of hydrogen bridges is promoted. This refining seems important in connection with strength of the thus manufactured package. Optionally, refining may provide smaller fibres up to sizes that are not visibly detectable.

[0038] It will be understood that the refining pre-processing step does not necessarily require performing the aforementioned soaking pre-processing step. For example, providing the starting material from a silage, such as a grass silage, may provide the starting material with the required conditions without requiring a separate soaking pre-processing step.

[0039] In an embodiment of the method, the pre-processing comprises adjusting the degree of refining the visible lignocellulosic biomass fibres for facilitating firstly interaction between the fibre pulp and the visible lignocellulosic biomass fibre in the pulp mix, and secondly allowing a portion of the visible lignocellulosic biomass fibres to surface on the pulp mix. Because of the adjusting, an optimum can be chosen for both the strength of the package and the so called "green" appearance.

[0040] In an embodiment of the method, the pre-processing comprises providing a refining device comprising a number of refiner discs arranged at a mutual disc distance wherein adjusting the degree of refining the visible lignocellulosic biomass fibres comprises adjusting the disc distance less than 1.5 mm, preferably between 0.5 and 1.5 mm, and wherein the refining comprises refining the visible lignocellulosic biomass fibres at a concentration of between 10 kg to 75 kg, preferably about 25 kg visible lignocellulosic biomass fibres in dry weight, per 1000 litre of water. An example of such a refiner is a Sprout Waldron disc refiner.

[0041] In an embodiment of the method, the refining comprising fibrillating the visible lignocellulosic biomass fibres for increasing binding surface of the visible lignocellulosic biomass fibres. This even more for facilitates interaction between the fibre pulp and the visible lignocellulosic biomass fibres in the pulp mix. In this connection, fibrillate means the partly splitting of a fibre into fibrils. In an embodiment, the method comprises providing a vacuum mould which has a mesh work for sucking up said fibre pulp mix and forming the packaging, wherein the mesh work has mesh openings having a mesh size and the visible lignocellulosic biomass fibres have a length between 50 to 150 times the mesh size, preferably about 100 times the mesh size. This ensures that the visible lignocellulosic biomass fibres extend lengthwise

along the mould such that the fibre is visible at a surface of the manufactured package. A typical mesh size for moulding packages is 60 Tyler Mesh which corresponds with a mesh size of 0.251 mm

[0042] In an embodiment, the method comprises the step of adding an aromatic substance to the fibre pulp mix for providing a grass smell to the moulded fibre food packaging. The possibly grassy smell can be strengthened or covered as desired by the addition of the aromatic substance.

[0043] In an embodiment, the pulp mix is coloured by adding a colour agency, preferably a green colour agency comprising chlorophyll, to the fibre pulp mix. It is conceivable that the visible lignocellulosic biomass fibres are coloured before adding the visible lignocellulosic biomass fibres to the fibre pulp mix to provide an increased contrast between the grass fibre and the moulded fibre package. This even more improves the appealing effect of the package. In connection with colouring fibres before adding these to the pulp, specific reference is made to WO 2006/091102.

[0044] Further advantages, features and details of the invention are elucidated on a basis of preferred embodiments thereof, wherein reference is made to the accompanying drawings, in which:

Fig. 1 shows a packaging unit according to the invention;

Fig. 2 shows the packaging unit of figure 1 without label with reinforcement elements;

Fig. 3 shows the packaging unit of figure 2 in an open position;

Figs. 4, 5 and 6 show a top, side and front views of the packaging unit of figure 1;

[0045] Fig. 7 shows a detail of the packaging unit of figure 6; and

Fig. 8 shows a detail of the packaging unit of figure 7.

[0045] A packaging unit 2 (Figures 1, 3-7) comprises a bottom part 4 with a front surface 6, two side surfaces 8, a back side 10, and a bottom side 12. In the illustrated embodiment, a cover part 14 is hingedly connected with hinge 16 to bottom part 4 to allow cover part 14 to move relatively to bottom part 4 between an open and a closed position. Cover part 14 further comprises front surface 18, two side surfaces 20, a back side surface 22 and a top surface 24.

[0046] On the inside of bottom part 4 product receiving compartments 26 are provided having contours matching at least partially the outer contours of the products, like eggs, kiwis and tomatoes, for example. Support cones 28 are provided to add stability and strength to packaging unit 2. Lock 30 comprises opening 32 in cover part 14 and cam 34 of bottom part 4. Furthermore, packaging unit 2 is provided with label 36.

[0047] The package 1 is made from moulded fibre containing a substantial amount of grass fibres, for example 50 %, or 80 %, or 90 % or 95 %.

[0048] Reinforcing elements (Figure 2) comprise a groove 38 with starting position 40 at top 24 of cover part 14 and ending position 42 at front surface 18 of cover part 14. Alternative reinforcing elements that may be applied in combination with grooves 38 comprise strengthening rods, rims and/or protrusions 44. Groove 38 comprises side wall 46 (Figure 8).

[0049] Fibres 48 (Figure 2), in the illustrated embodiment grass fibres, are provided in the packaging material. Some of the (grass) fibres 50 may protrude from a package surface (Figure 3), including the surface of compartment 26, that protrude to such an extent that separate (grass) fibres can be distinguished by sight and/or touch. In compartment 26 protruding fibres 50 provide a cushioning effect that may further contribute to the reduction of product damage.

[0050] These longer (grass) fibres 48, 50 have a length of about 25 mm. The longer (grass) fibres 48, 50 have a length such that the fibres are able to float on a fibre pulp or pulp mix during manufacturing, which enables that during moulding these long fibres are positioned at the package surface. These protruding fibres 50 even more improve the appealing effect of the package 1. Fibres 50 protrude even more from a package inside surface also because that inside surface is determined by the suction side of a mould. This suction side of a mould is a well known concept in manufacturing a moulded fibre food packaging.

[0051] When manufacturing packaging unit 2, a fibre pulp, for a moulding process, is contained in a pulp container also referred to as storage tank and also known as thick stock tank. The process of moulding a moulded fibre package is not described here since this is known per se. Such a process of moulding a moulded fibre package is fed with the fibre pulp mix from the pulp container.

[0052] According to the invention, the pulp comprises lignocellulosic biomass not originating from wood, wherein in the illustrated embodiment the lignocellulosic biomass contains between 0 to 2% protein in dry weight.

[0053] The method comprises pre-processing of the lignocellulosic biomass involving a number of steps. Depending on the product all steps are required or, alternatively only some steps need to be performed optionally with further steps. This pre-processing may be done on site or (partly) elsewhere. When the lignocellulosic biomass is pre-processed elsewhere, the lignocellulosic biomass fibres may be added directly to the pulp mix. Here, the pre-processing comprises soaking the lignocellulosic biomass in water for a soaking period of at least 1 day preferably at least 2 days. Here, the pre-processing comprises cutting the lignocellulosic biomass, preferably before the soaking, for obtaining visible lignocellulosic biomass fibres having a length such that the visible lignocellulosic biomass fibres may surface on the fibre pulp mix.

[0054] The pre-processing in the illustrated embodiment comprises refining the visible lignocellulosic biomass fibres for facilitating interaction between the fibre

pulp and the visible lignocellulosic biomass fibres in the pulp mix.

[0055] The refining is performed in a refining device (not shown) comprising a number of refiner discs arranged at a mutual disc distance. The degree of refining the visible lignocellulosic biomass fibres is set by adjusting the disc distance between 0.5 and 1.5 mm. The refining of the visible lignocellulosic biomass fibres is done at a concentration of between 10 kg to 75 kg, preferably about 25 kg visible lignocellulosic biomass fibres in dry weight, per 1000 litre of water. An example of such a refiner is a Sprout Waldron disc refiner.

[0056] Before providing the lignocellulosic biomass, the lignocellulosic biomass may be processed for removing protein from the lignocellulosic biomass such that the lignocellulosic biomass contains between 0 to 2% protein in dry weight. This process is not shown here.

[0057] Optionally, in the manufacturing process colouring agents/pigments can be added. Also, additional components can be added, for example including dewatering polymers.

[0058] The present invention is by no means limited to the above described, preferred embodiments thereof. The rights sought are defined by the following claims, within the scope of which many modifications are possible. For example, the packaging unit according can be applied to eggs and other vulnerable food and non-food products as well as to other products. Non-limiting examples of products include eggs, vegetables, fruit, electronic products such as DVD players, displays, mobile phones, tablets etc. The use of biomass material according to the invention may reduce the need for additional layers in the packaging unit for these products.

Claims

1. Packaging unit (2) made of moulded pulp for products like eggs, comprising:
 - a bottom part (4) provided with compartments (26) for individual products, wherein the moulded pulp comprises at least 5 wt.% non-wood lignocellulosic biomass, **characterized by** the non-wood lignocellulosic biomass having a protein content below 2 dry wt. % of the biomass.
2. Packaging unit according to claim 1, wherein the protein content is below 1.75 dry wt.% of the biomass.
3. Packaging unit according to claim 1 or 2, wherein the moulded pulp comprises at least 10 wt.% non-wood lignocellulosic biomass, preferably at least 50 wt.% non-wood lignocellulosic biomass, more preferably at least 80 wt.% non-wood lignocellulosic biomass, even more preferably at least 85 wt.% non-wood lignocellulosic biomass, and most preferably at least 92.5 wt.% non-wood lignocellulosic biomass.

4. Packaging unit according to claim 1, 2 or 3, wherein the non-wood lignocellulosic biomass comprises biomass originating from plants of the Order Poales, the Order Solanales, the Order Arecales, the Order Malpighiales, the Order of Rosales, the Order of Malvales and/or herbaceous plants, wherein the non-wood lignocellulosic biomass preferably comprises biomass originating from plants of the Family of Poaceae.
5. Packaging unit according to one or more of the foregoing claims, further comprising one or more reinforcement elements configured to increase stability of the packaging unit, wherein the reinforcement elements preferably comprise a number of ribs extending over at least a front surface of the bottom part, further preferably comprising a cover part configured for engaging the bottom part, wherein the cover part comprises reinforcement elements to increase stability of the packaging unit, and wherein the reinforcement elements preferably comprise a number of ribs and/or grooves (38) extending over at least a front surface of the cover part.
6. Packaging unit according to one or more of the foregoing claims, wherein visible non-wood lignocellulosic biomass fibres (48,50) protrude from a package surface to such an extent that separate visible non-wood lignocellulosic biomass fibres can be distinguished by sight and/or touch, wherein preferably the protruding fibres are arranged to provide a cushioning effect for products placed in the compartments.
7. Method for manufacturing a moulded fibre packaging unit (2), in particular a food package, more particular an egg package, comprising:
 - providing a fibre pulp for a moulding process;
 - moulding the moulded fiber packaging unit, wherein the method comprises the step of:
 - adding an amount of non-wood lignocellulosic biomass to obtain a pulp mix comprising at least 5 wt.% non-wood lignocellulosic biomass, with the non-wood lignocellulosic biomass having a protein content below 2 dry wt. %.
8. Method according to claim 7, wherein the non-wood lignocellulosic biomass comprises biomass originating from plants of the Order Poales, the order Solanales, the Order Arecales and/or herbaceous plants, wherein the non-wood lignocellulosic biomass comprises biomass preferably originating from plants of the Family of Poaceae.
9. Method according to claim 7 or 8, wherein before adding the non-wood lignocellulosic biomass to the pulp mix, the lignocellulosic biomass has been processed for removing protein from the lignocellulosic biomass such that the lignocellulosic biomass contains between 0 to 2 dry wt.% protein.
10. Method according to one or more of the claims 7-9, the method comprising pre-processing of the lignocellulosic biomass, the pre-processing comprising soaking the lignocellulosic biomass in water for a soaking period of at least 1 day preferably at least 2 days.
11. Method according to one or more of the claims 7-10, the pre-processing comprising cutting the lignocellulosic biomass, preferably before the soaking, for obtaining visible lignocellulosic biomass fibres having a length such that the visible lignocellulosic biomass fibres may surface on the fibre pulp mix, the visible lignocellulosic biomass fibres preferably having an average length smaller than 5 cm, preferably smaller than 2 cm, more preferably between 1.5 and 2 cm.
12. Method according to one or more of the claims 7-11, the pre-processing comprising refining the visible non-wood lignocellulosic biomass fibres for facilitating interaction between the fibre pulp and the visible non-wood lignocellulosic biomass fibres in the pulp mix, and preferably comprising adjusting the degree of refining the visible non-wood lignocellulosic biomass fibres for facilitating firstly interaction between the fibre pulp and the visible non-wood lignocellulosic biomass fibre in the pulp mix, and secondly allowing a portion of the visible non-wood lignocellulosic biomass fibres to surface on the pulp mix, and/or preferably comprising providing a refining device comprising a number of refiner discs arranged at a mutual disc distance wherein adjusting the degree of refining the visible non-wood lignocellulosic biomass fibres comprises adjusting the disc distance less than 1,5 mm, preferably between 0,5 and 1,5 mm, and wherein the refining comprises refining the visible non-wood lignocellulosic biomass fibres at a concentration of between 10 kg to 75 kg, preferably about 25 kg visible non-wood lignocellulosic biomass fibres in dry weight, per 1000 litre of water, wherein the refining preferably comprising fibrillating the visible non-wood lignocellulosic biomass fibres for increasing binding surface of the visible non-wood lignocellulosic biomass fibres.
13. Method according to one or more of the claims 7-12, comprising providing a vacuum mould which has a mesh work for sucking up said fibre pulp mix and forming the packaging, wherein the mesh work has mesh openings having a mesh size and the visible non-wood lignocellulosic biomass fibres have a length between 50 to 150 times the mesh size, preferably about 100 times the mesh size.

14. Method according to one or more of the claims 7-13, wherein the method comprises the step of adding an aromatic substance to the fibre pulp mix for providing a grass smell to the moulded fibre food packaging.
15. Method according to one or more of the claims 7-14, wherein the pulp mix is coloured by adding a colour agency, preferably a green colour agency comprising chlorophyll, to the fibre pulp mix.

Patentansprüche

1. Verpackungseinheit (2) bestehend aus einem Faserformteil für Produkte wie Eier, die aufweist:
- ein Bodenteil (4), das mit Fächern (26) für einzelne Produkte vorgesehen ist, wobei das Faserformteil wenigstens 5 Gewichtsprozent nicht aus Holz bestehende lignocellulose Biomasse aufweist,
 - dadurch gekennzeichnet,**
 - das die nicht aus Holz bestehende lignocellulose Biomasse einen Proteingehalt von unter 2 % Trockengewicht der Biomasse hat.
2. Verpackungseinheit nach Anspruch 1, wobei der Proteingehalt unter 1,75 % Trockengewicht der Biomasse liegt.
3. Verpackungseinheit nach Anspruch 1 oder 2, wobei das Faserformteil wenigstens 10 Gewichtsprozent nicht aus Holz bestehende lignocellulose Biomasse aufweist, vorzugsweise wenigstens 50 Gewichtsprozent nicht aus Holz bestehende lignocellulose Biomasse, bevorzugter wenigstens 80 Gewichtsprozent nicht aus Holz bestehende lignocellulose Biomasse, sogar noch bevorzugter wenigstens 85 Gewichtsprozent nicht aus Holz bestehende lignocellulose Biomasse und am meisten bevorzugt wenigstens 92,5 Gewichtsprozent nicht aus Holz bestehende lignocellulose Biomasse.
4. Verpackungseinheit nach Anspruch 1, 2 oder 3, wobei die nicht aus Holz bestehende lignocellulose Biomasse aufweist, die von Pflanzen der Ordnung Poales, der Ordnung Solanales, der Ordnung Arecales, der Ordnung Malpighiales, der Ordnung der Rosales, der Ordnung der Malvales und/oder der Ordnung der krautigen Pflanzen stammt, wobei die nicht aus Holz bestehende lignocellulose Biomasse vorzugsweise Biomasse aufweist, die von Pflanzen der Familie der Süßgräser (Poaceae) stammt.
5. Verpackungseinheit nach einem oder mehreren der vorhergehenden Ansprüche, die weiterhin ein oder mehrere Verstärkungselemente aufweist, die aus-

gestaltet sind, die Stabilität der Verpackungseinheit zu erhöhen, wobei die Verstärkungselemente vorzugsweise eine Anzahl von Rippen aufweisen, die über wenigstens eine Vorderseite des unteren Teils verlaufen, weiter bevorzugt ein Verkleidungsteil aufweisen, das ausgestaltet ist, um in das Bodenteil einzugreifen, wobei das Verkleidungsteil Verstärkungselemente aufweist, um die Stabilität der Verpackungseinheit zu erhöhen, und wobei die Verstärkungselemente vorzugsweise eine Anzahl von Rippen und/oder Nuten (38) aufweisen, die über wenigstens eine Vorderseite des Verkleidungsteils verlaufen.

6. Verpackungseinheit nach einem oder mehreren der vorhergehenden Ansprüche, wobei erkennbare nicht aus Holz bestehende lignocellulose Biomassefasern (48, 50) von einer Packungsoberfläche in einem solchen Ausmaß hervorstehenden, dass eigenständig erkennbare nicht aus Holz bestehende lignocellulose Biomassefasern visuell und/oder durch Berührung unterschieden werden können, wobei vorzugsweise die hervorstehenden Fasern angeordnet sind, um einen Dämpfungseffekt für die in den Fächern angeordneten Produkte vorzusehen.

7. Verfahren zum Herstellen einer Formteil-Verpackungseinheit (2), im Besonderen eine Nahrungsverpackung, weiter im Besonderen eine Eierverpackung, das aufweist:

- Vorsehen einer Faserpulpe für einen Formprozess;
- Formen des Verpackungseinheitformteils,

wobei das Verfahren den Schritt aufweist:

- Hinzufügen einer Menge von nicht aus Holz bestehender lignocelluloser Biomasse, um eine Pulpenmischung zu erhalten, die wenigstens 5 Gewichtsprozent nicht aus Holz bestehende lignocellulose Biomasse mit einem Proteingehalt von unter 2 % Trockengewicht aufweist.

8. Verfahren nach Anspruch 7, wobei die nicht aus Holz bestehende lignocellulose Biomasse aufweist, die von Pflanzen der Ordnung Poales, der Ordnung Solanales, der Ordnung Arecales und/oder der Ordnung der krautigen Pflanzen stammt, wobei die nicht aus Holz bestehende lignocellulose Biomasse vorzugsweise Biomasse aufweist, die von Pflanzen der Familie der Süßgräser (Poaceae) stammt.
9. Verfahren nach Anspruch 7 oder 8, wobei vor dem Hinzufügen der nicht aus Holz bestehenden lignocellulosen Biomasse zur Pulpenmischung die lignocellulose Biomasse aufbereitet wurde, um Protein

aus der lignocellulösen Biomasse zu entfernen, so dass die lignocellulöse Biomasse zwischen 0 bis 2 % Trockengewicht Protein enthält.

10. Verfahren nach einem oder mehreren der Ansprüche 7 bis 9, wobei das Verfahren die Vorverarbeitung der lignocellulösen Biomasse aufweist, wobei die Vorverarbeitung das Einweichen der lignocellulösen Biomasse in Wasser für eine Einweichdauer von wenigstens einen Tag, vorzugsweise wenigstens 2 Tagen aufweist. 5
11. Verfahren nach einem oder mehreren der Ansprüche 7 bis 10, wobei die Vorverarbeitung das Schneiden der lignocellulösen Biomasse vorzugsweise vor dem Einweichen aufweist, um erkennbare lignocellulöse Biomassefasern zu erhalten, sodass die erkennbaren lignocellulösen Biomassefasern eine Oberfläche auf der Faserpulpenmischung bilden können, wobei die erkennbaren lignocellulösen Biomassefasern vorzugsweise eine durchschnittliche Länge kleiner als 5 cm, vorzugsweise kleiner als 2 cm, bevorzugter zwischen 1,5 und 2 cm haben. 10
12. Verfahren nach einem oder mehreren der Ansprüche 7 bis 11, wobei die Vorverarbeitung das Verfeinern der erkennbaren nicht aus Holz bestehenden lignocellulösen Biomassefasern aufweist, um die Interaktion zwischen der Faserpulpe und den erkennbaren nicht aus Holz bestehenden lignocellulösen Biomassefasern in der Pulpenmischung zu erleichtern, und vorzugsweise das Anpassen des Verfeinerungsgrads der erkennbaren nicht aus Holz bestehenden lignocellulösen Biomassefasern aufweist, um als Erstes die Interaktion zwischen der Faserpulpe und den erkennbaren nicht aus Holz bestehenden lignocellulösen Biomassefasern in der Pulpenmischung zu vereinfachen und zweitens zu ermöglichen, dass ein Teil der erkennbaren nicht aus Holz bestehenden lignocellulösen Biomassefasern eine Oberfläche auf der Pulpenmischung bildet und/oder vorzugsweise das Vorsehen einer Verfeinerungsvorrichtung aufweist, die eine Anzahl von Verfeinerungsscheiben aufweist, die in einem Scheibenabstand zueinander angeordnet sind, wobei das Anpassen des Verfeinerungsgrads der erkennbaren nicht aus Holz bestehenden lignocellulösen Biomassefasern das Einstellen des Scheibenabstands auf weniger als 1,5 mm, bevorzugt zwischen 0,5 und 1,5 mm aufweist, und wobei das Verfeinern das Verfeinern der erkennbaren nicht aus Holz bestehenden lignocellulösen Biomassefasern in einer Konzentration von zwischen 10 kg bis 75 kg, vorzugsweise etwa 25 kg erkennbarer nicht aus Holz bestehender lignocellulöser Biomassefasern im Trockengewicht pro 1000 l Wasser aufweist, wobei das Verfeinern vorzugsweise ein Fibrillieren der erkennbaren nicht aus Holz bestehenden lignocellulösen Biomassefa- 15

sern zum Erhöhen der Bindefläche der erkennbaren nicht aus Holz bestehenden lignocellulösen Biomassefasern aufweist.

13. Verfahren nach einem oder mehreren der Ansprüche 7 bis 12, das das Vorsehen einer Vakuumform aufweist, die ein Drahtgeflecht zum Aufsaugen der Faserpulpenmischung und zum Formen der Verpackung hat, wobei das Drahtgitter Gitteröffnungen hat, die eine Gittergröße haben und die erkennbaren nicht aus Holz bestehenden lignocellulösen Biomassefasern eine Länge zwischen dem 50- bis 150-Fachen der Gittergröße haben, vorzugsweise etwa das 100-Fache der Gittergröße. 20
14. Verfahren nach einem oder mehreren der Ansprüche 7 bis 13, wobei das Verfahren den Schritt des Hinzufügens einer aromatischen Substanz zur Faserpulpenmischung aufweist, um einen Grasgeruch für das Nahrungsverpackungsformteil vorzusehen. 25
15. Verfahren nach einem oder mehreren der Ansprüche 7 bis 14, wobei die Pulpenmischung eingefärbt wird, indem der Faserpulpenmischung ein Farbstoff hinzugefügt wird, vorzugsweise ein grüner Farbstoff, der Chlorophyll aufweist. 30

Revendications

1. Unité d'emballage (2) réalisée en pâte moulée pour des produits tels que des œufs, comprenant : 35
 - une partie inférieure (4) dotée de compartiments (26) pour des produits individuels, dans laquelle la pâte moulée comprend au moins 5 % en poids de biomasse lignocellulosique ne provenant pas du bois, **caractérisée par** la biomasse lignocellulosique ne provenant pas du bois présentant une teneur en protéine inférieure à 2 % de la masse sèche de la biomasse. 40
2. Unité d'emballage selon la revendication 1, dans laquelle la teneur en protéine est inférieure à 1,75 % de la masse sèche de la biomasse. 45
3. Unité d'emballage selon la revendication 1 ou 2, dans laquelle la pâte moulée comprend au moins 10 % en poids de biomasse lignocellulosique ne provenant pas du bois, de préférence au moins 50 % en poids de biomasse lignocellulosique ne provenant pas du bois, de manière davantage préférée au moins 80 % en poids de biomasse lignocellulosique ne provenant pas du bois, de manière encore plus préférée au moins 85 % en poids de biomasse lignocellulosique ne provenant pas du bois, et de manière préférée entre toutes au moins 92,5 % en poids de biomasse lignocellulosique ne provenant pas du 50

bois.

4. Unité d'emballage selon la revendication 1, 2 ou 3, dans laquelle la biomasse lignocellulosique ne provenant pas du bois comprend de la biomasse provenant de plantes de l'ordre Poales, ordre Solanales, ordre Arecales, ordre Malpighiales, ordre de Rosales, ordre de Malvales et/ou de plantes herbacées, dans laquelle la biomasse lignocellulosique ne provenant pas du bois comprend de préférence de la biomasse provenant de plantes de la famille de Poaceae.

5. Unité d'emballage selon l'une ou plusieurs des revendications précédentes, comprenant en outre un ou plusieurs éléments de renforcement configurés pour augmenter la stabilité de l'unité d'emballage, dans laquelle les éléments de renforcement comprennent de préférence un nombre de nervures s'étendant sur au moins une surface avant de la partie inférieure, en outre de préférence comprenant une partie de couvercle configurée pour la mise en prise de la partie inférieure, dans laquelle la partie de couvercle comprend des éléments de renforcement pour augmenter la stabilité de l'unité d'emballage, et dans laquelle les éléments de renforcement comprennent de préférence un nombre de nervures et/ou de rainures (38) s'étendant sur au moins une surface avant de la partie de couvercle.

6. Unité d'emballage selon l'une ou plusieurs des revendications précédentes, dans laquelle des fibres de biomasse lignocellulosique ne provenant pas du bois visibles (48, 50) font saillie d'une surface d'emballage dans une telle étendue que des fibres de biomasse lignocellulosique ne provenant pas du bois visibles séparées puissent être distinguées par la vue et/ou le toucher, dans laquelle de préférence les fibres en saillie sont agencées pour fournir un effet d'amortissement pour des produits placés dans les compartiments.

7. Procédé de fabrication d'une unité d'emballage (2) de fibre moulée, en particulier d'un emballage alimentaire, plus particulièrement un emballage d'œufs, comprenant :

- la fourniture d'une pâte fibreuse pour un processus de moulage ;
- le moulage de l'unité d'emballage de fibre moulée,

dans lequel le procédé comprend l'étape de :

- l'ajout d'une quantité de biomasse lignocellulosique ne provenant pas du bois pour obtenir un mélange de pâte comprenant au moins 5 % en poids de biomasse lignocellulosique ne pro-

venant pas du bois, la biomasse lignocellulosique ne provenant pas du bois présentant une teneur en protéine inférieure à 2 % de la masse sèche.

8. Procédé selon la revendication 7, dans laquelle la biomasse lignocellulosique ne provenant pas du bois comprend la biomasse provenant de plantes de l'ordre Poales, ordre Solanales, ordre Arecales et/ou de plantes herbacées, dans lequel la biomasse lignocellulosique ne provenant pas du bois comprend de la biomasse provenant de préférence de plantes de la famille de Poaceae.

9. Procédé selon la revendication 7 ou 8, dans laquelle avant l'ajout de la biomasse lignocellulosique ne provenant pas du bois au mélange de pâte, la biomasse lignocellulosique a été traitée pour le retrait de protéine de la biomasse lignocellulosique de sorte que la biomasse lignocellulosique contienne entre 0 et 2 % de protéine en masse sèche.

10. Procédé selon l'une ou plusieurs des revendications 7 à 9, le procédé comprenant le prétraitement de la biomasse lignocellulosique, le prétraitement comprenant le trempage de la biomasse lignocellulosique dans de l'eau pendant une période de trempage d'au moins 1 jour de préférence au moins 2 jours.

11. Procédé selon l'une ou plusieurs des revendications 7 à 10, le prétraitement comprenant la découpe de la biomasse lignocellulosique, de préférence avant le trempage, pour obtenir des fibres de biomasse lignocellulosique visibles présentant une longueur telle que les fibres de biomasse lignocellulosique visibles puissent faire surface sur le mélange de pâte fibreuse, les fibres de biomasse lignocellulosique visibles présentant de préférence une longueur moyenne inférieure à 5 cm, de préférence inférieure à 2 cm, de manière davantage préférée entre 1,5 et 2 cm.

12. Procédé selon l'une ou plusieurs des revendications 7 à 11, le prétraitement comprenant le raffinage des fibres de biomasse lignocellulosique ne provenant pas du bois visibles pour faciliter l'interaction entre la pâte fibreuse et les fibres de biomasse lignocellulosique ne provenant pas du bois visibles dans le mélange de pâte, et de préférence comprenant l'ajustement du degré de raffinage des fibres de biomasse lignocellulosique ne provenant pas du bois visibles pour faciliter tout d'abord l'interaction entre la pâte fibreuse et la fibre de biomasse lignocellulosique ne provenant pas du bois visible dans le mélange de pâte, et ensuite la permission donnée à une portion des fibres de biomasse lignocellulosique ne provenant pas du bois visibles de faire surface sur le mélange de pâte, et/ou de préférence comprenant

la fourniture d'un dispositif de raffinage comprenant un nombre de disques de raffinage agencés à une distance de disque mutuelle, dans lequel l'ajustement du degré de raffinage des fibres de biomasse lignocellulosique ne provenant pas du bois visibles comprend l'ajustement de la distance de disque inférieure à 1,5 mm, de préférence entre 0,5 et 1,5 mm, et dans lequel le raffinage comprend le raffinage des fibres de biomasse lignocellulosique ne provenant pas du bois visibles à une concentration entre 10 kg et 75 kg, de préférence environ de 25 kg de fibres de biomasse lignocellulosique ne provenant pas du bois visibles en poids sec, par 1000 litres d'eau, dans lequel le raffinage comprenant de préférence la fibrillation des fibres de biomasse lignocellulosique ne provenant pas du bois visibles pour augmenter la surface de liaison des fibres de biomasse lignocellulosique ne provenant pas du bois visibles.

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13. Procédé selon l'une ou plusieurs des revendications 7 à 12, comprenant la fourniture d'un moule à vide qui présente un travail de maillage pour l'aspiration dudit mélange de pâte fibreuse et la formation de l'emballage, dans lequel le travail de maillage présente des ouvertures de maillage présentant une taille de maillage et les fibres de biomasse lignocellulosique ne provenant pas du bois visibles présentent une longueur entre 50 et 150 fois la taille de maillage, de préférence environ de 100 fois la taille de maillage.

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14. Procédé selon l'une ou plusieurs des revendications 7 à 13, dans lequel le procédé comprend l'étape d'ajout d'une substance aromatique au mélange de pâte fibreuse pour la fourniture d'une odeur d'herbe à l'emballage alimentaire de fibre moulée.

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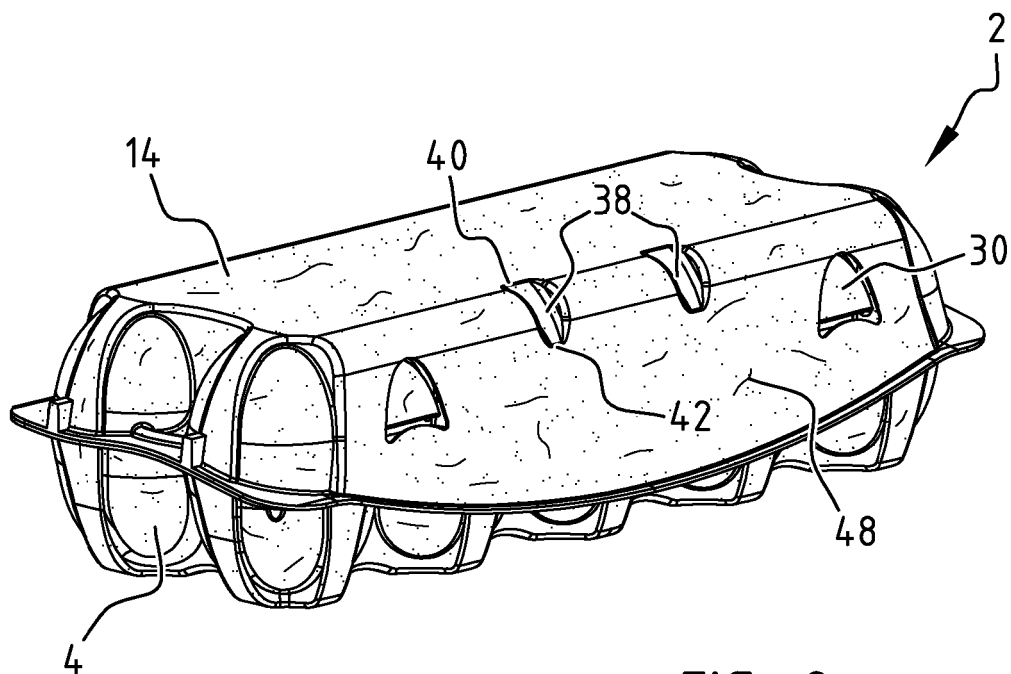
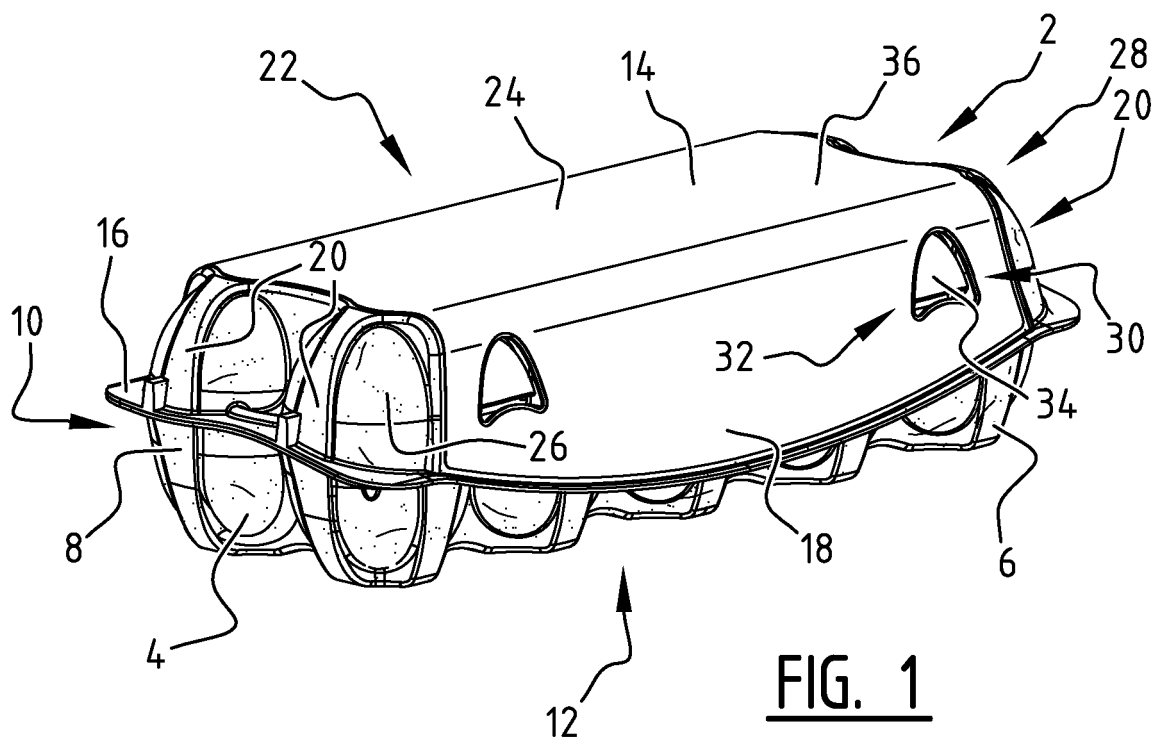
15. Procédé selon l'une ou plusieurs des revendications 7 à 14, le mélange de pâte est coloré par ajout d'un colorant, de préférence un colorant vert comprenant de la chlorophylle, au mélange de pâte fibreuse.

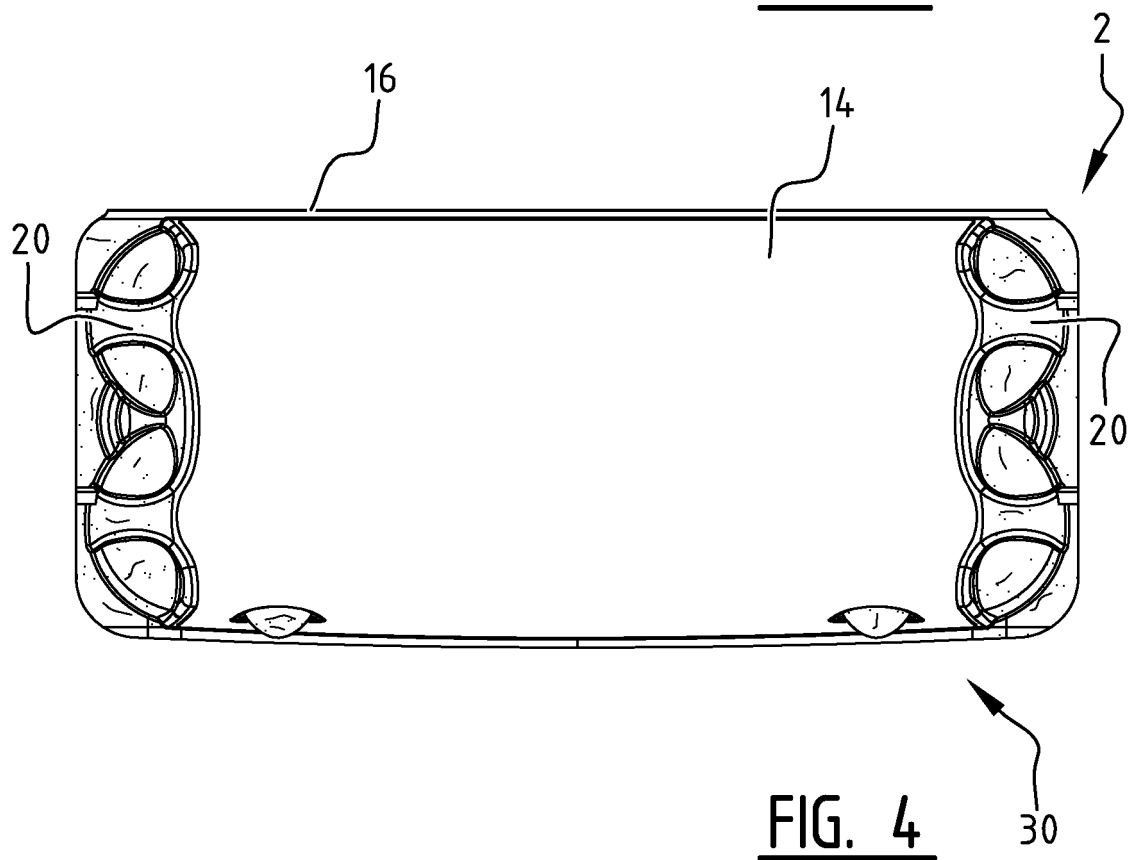
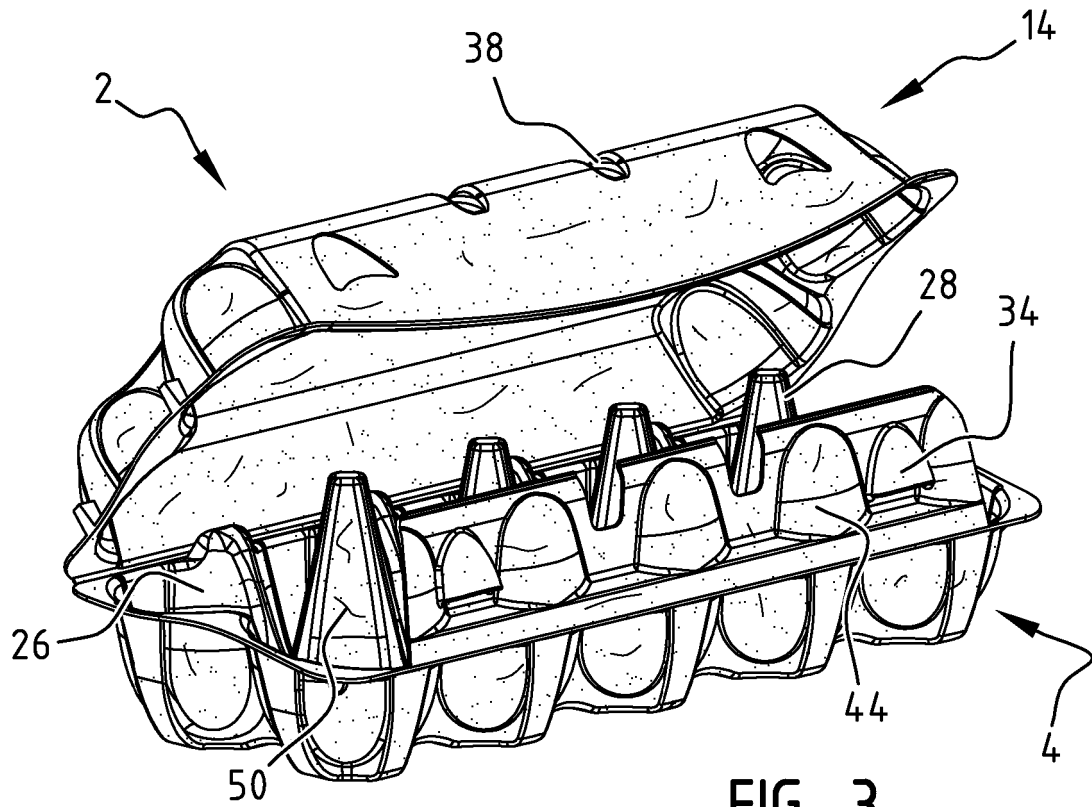
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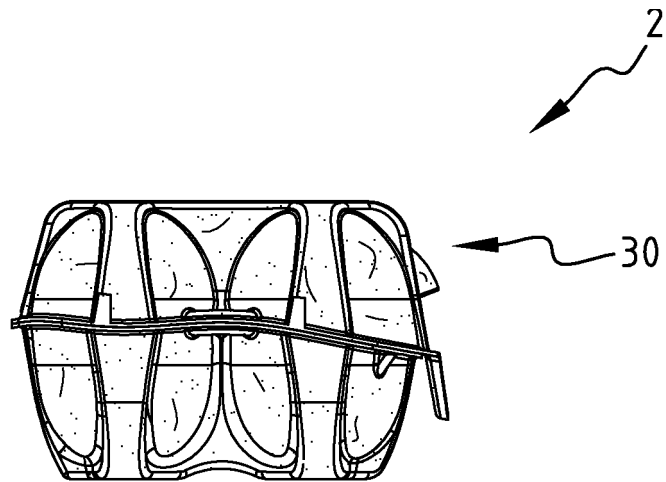


FIG. 5

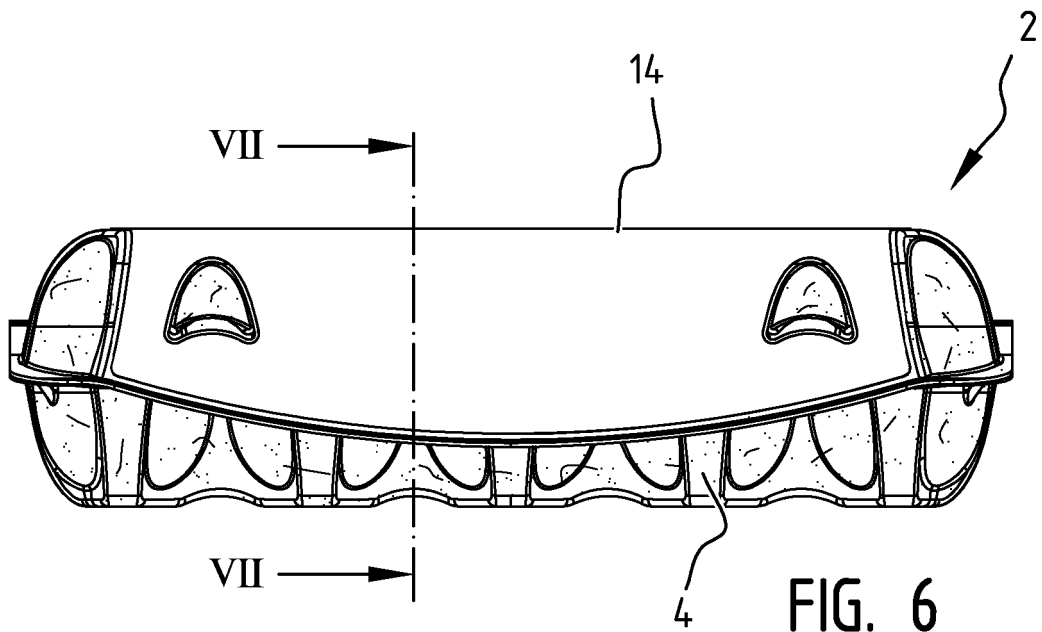


FIG. 6

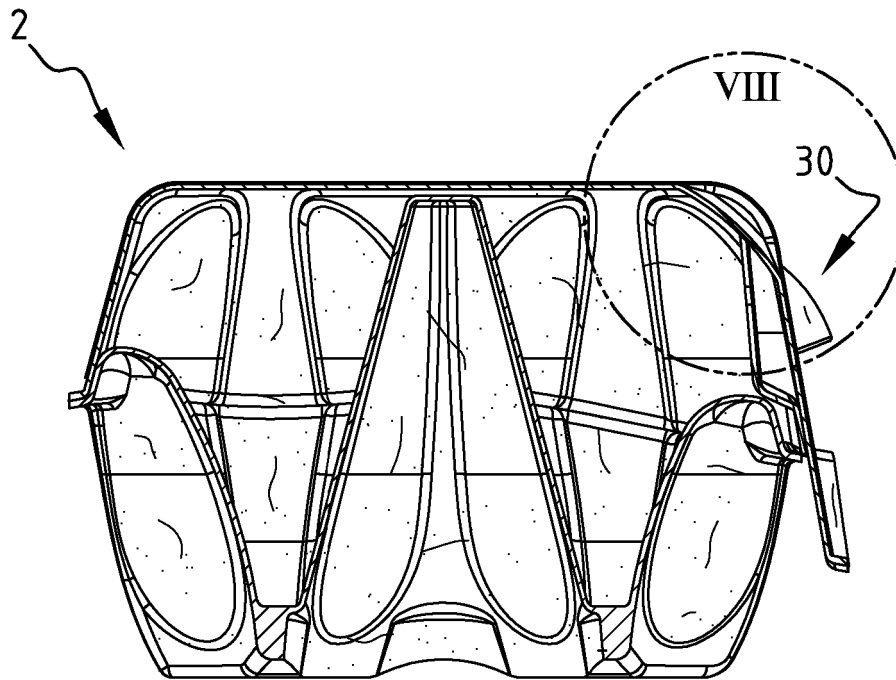


FIG. 7

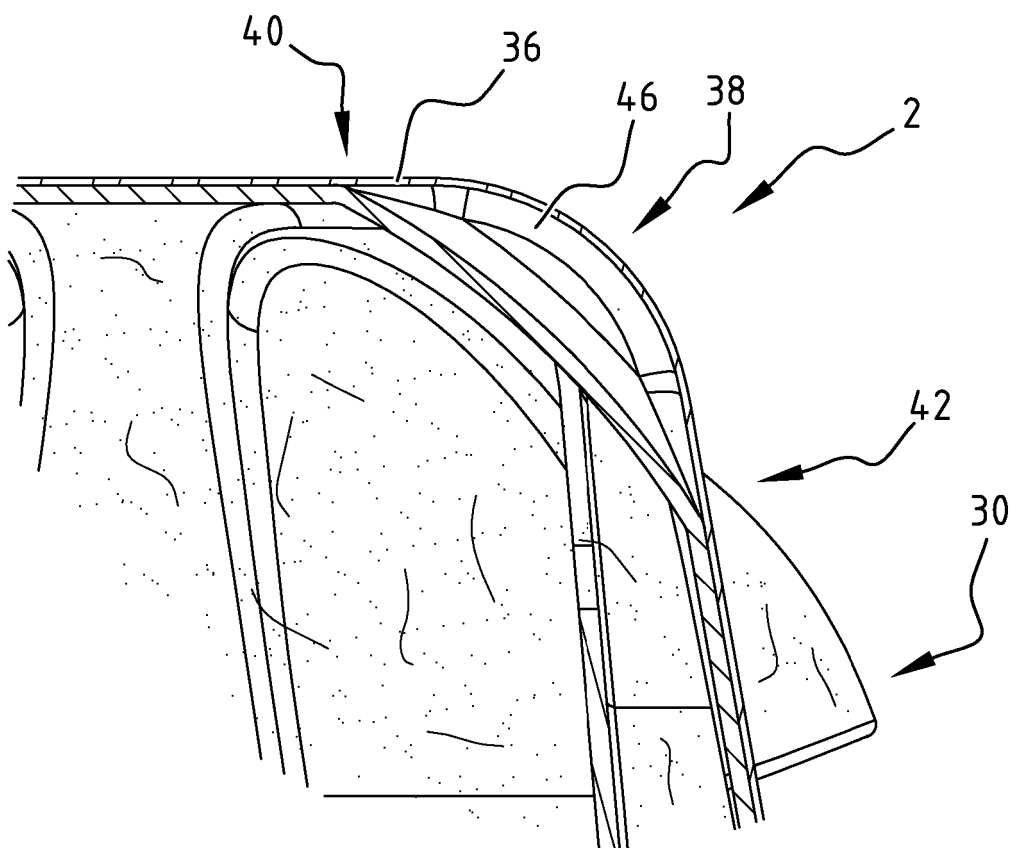


FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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