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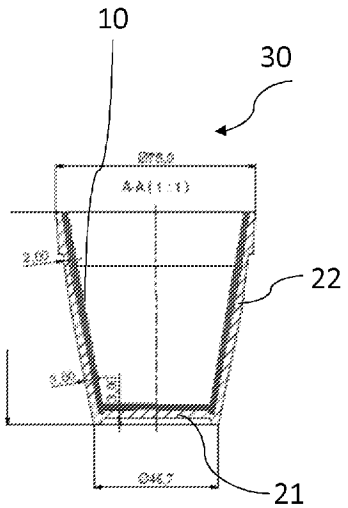

Fig. 3

(57) Abstract: The present invention relates to a container (20) for liquids comprising a bottom part (21) and a wall part (22), wherein an inlay (10) is placed in the container (20), said container (20) being composed of a first material and the inlay (10) of a second material, wherein the second material holds the liquid in place and the first material provides thermal insulation, and wherein the combination of the first and second material provides the container with mechanical integrity.

WO 2019/017773 A1

CONTAINER FOR LIQUIDS, METHODS FOR PRODUCING IT AND USE

Description

The present invention relates to a container for liquids comprising a bottom part and a wall part, a method for producing a container and use thereof.

Containers for liquids are generally known. In ancient times, drinking cups were made of pottery, but such drinking cups are now generally produced from synthetic materials, namely plastics.

US 2008/187694 relates to a container comprising: an innermost thermoformed plastic sleeve, the innermost sleeve providing barrier resistance from material placed within the container, an insulating molded foam support layer, the foam support layer providing thermal resistance from material placed within the container, and an outermost paper sleeve bonded to an outer surface of the foam support layer, wherein the innermost sleeve comprises thermoformed polystyrene.

WO2008/10765 relates to a hot beverage receptacle comprising an inner vessel, an insulated outer shell and a compartment disposed between the inner vessel and the outer shell comprising a phase change material for absorbing thermal energy from a hot beverage in the inner vessel to cool the hot beverage and then releasing the thermal energy to the beverage to maintain the temperature of the cooled beverage. The inner vessel is made from plastic, such as high impact polystyrene (HIPS) or metal, such as stainless steel, aluminium, aluminium alloys, copper or copper alloys. The material for the insulated outer shell is expanded polyurethane, polyethylene or polystyrene.

US 5,759,624 relates to a container from a blank 20, which is cut from a substrate which may be plastic, paper or paper board, and solid bleached sulfate. The substrate is coated one side with an inner coating, which is a thermoplastic, polyethylene. Typical examples of the materials of the outer shell would be polyvinylidene copolymers or glass. The outer surface of the sidewall supports an insulating syntactic foam coating.

US 2009/0218390 relates to a bio-degradable cup comprising a paper cup with a bio-degradable film coated to an inside thereof, a foam cup in which the paper cup is received, the foam cup made by microfoam made by way of super-critical carbon dioxide extrusion, a lip connected to a top edge of the foam cup and a foam pad is connected to an underside of the foam cup.

CN 204169564 relates to a bio-degradable cup comprising a cup cover and a cup body, both of which are made of modified polylactic acid PLA, wherein the cup cover is arranged at the upper end of the cup body, the cup body includes an integrally formed inner cup body and outer cup body. No details have been provided about modified polylactic acid PLA.

CN 204950365 relates to a mug, comprising a lid, an inner body and inner and outer cup, the inlayer cup is provided with a vacuum layer between the outer cup wherein inner cup and outer cup are made of modified PLA containing 3% rare earth nucleating agent to enhance the crystallization rate of PLA wherein the degree of crystallinity is 53%.

US 2009/0263601 relates to a biodegradable container comprising a body structure formed into a desired shape, wherein said body structure is made of a dried foamed hydrocolloid gelling matrix system having a fibrous material and a firming agent embedded therein; and a water-resistant coating disposed on a surface of said body structure. The hydrocolloid gelling agents are for example polysaccharides, agar, agarose, aloe mannans/xanthan, algin/alginates, water-insoluble alginates, borate complexes of 1,3-cis diols (locust bean gum, guar gum, cassia gum, konjac) and carrageenans.

For drinking cups used to consume warm or hot liquids, for example those provided by the coffee chain Starbucks, etc., it is desirable that the hot contents do not impair the user's ability to hold the cup.

In order to solve this problem, so-called sleeves or holders are placed around the outside of the drinking cup in order to ensure that the cup containing the warm liquid is not hot to the touch. Such sleeves are disclosed in US Patent 6,863,644.

Another drawback of drinking cups is that they have a negative impact on the environment. Drinking cups are produced from fossil fuels and are resistant to biodegrading. When such drinking cups are carelessly discarded by users, they remain intact in the environment for many years. Large numbers of such drinking cups are also dumped in landfill sites or used as fuel in incinerators.

Governments have now realized that the large-scale use of drinking cups produced from fossil materials must come to a stop. For example, the Malaysian government has banned all EPS (expanded polystyrene) and plastic foam packages, and there is an urgent demand for biodegradable alternatives. Moreover, the State of California recently passed a law on May 4, 2017, that is intended to protect the

environment by prohibiting the use of polystyrene (Styrofoam). Polystyrene is considered to be an environment-contaminating material that is widely used in so-called disposable food service cups, plates and containers. It is also considered to be one of the chief culprits in pollution of the oceans.

One aspect of the present invention is therefore the provision of a container for liquids, with said container to be considered environmentally friendly.

Another aspect of the present invention is the provision of a container for liquids in which warm liquids can be placed without causing the outside of the container to feel unpleasantly hot to the user.

A further aspect of the present invention is the provision of a container for liquids, wherein the container will not change shape, crack, or leak when it contains a hot liquid.

The present invention therefore relates to a container for liquids comprising a bottom part and a wall part, characterized in that an inlay is placed in the container, wherein the container is composed of a first material and the inlay of a second material, wherein the second material holds the liquid in place and the first material provides thermal insulation, and wherein the combination of the first and second material provides the container with mechanical integrity.

In use such a container, one or more of the aforementioned aspects is achieved. The present container for liquids is thus composed of an inlay that can considered an "inner cup" for the container. The second material is to be configured such that the liquid in contact with the inlay does not penetrate said inlay. The inlay thus prevents any leakage of the liquid from occurring. The first material, which in principle forms the "outer cup" and is held by the user, provides thermal insulation properties that make it possible to dispense with use of the above-mentioned sleeve. The combination of the inlay and the container makes it possible for the final container to be mechanically stable, which means that the container does not collapse when it is filled with warm liquid.

According to an embodiment, the inlay is connected in a liquid-tight manner to the bottom part and the wall part of the container. Such a design ensures that the inlay cannot come loose from the bottom part and the wall part of the container. This design also ensures that the occurrence of cracks in the inlay is kept to a minimum.

In an embodiment, no adhesive is used to connect the inlay in a liquid-tight manner to the bottom part and the wall part of the container. The use of an adhesive requires an additional process step in producing the present container. Moreover, it is not always possible in containers having complex shapes to favourably apply an adhesive between the inlay and the container, resulting in a high risk of delamination, particularly when hot liquids are used in the container.

In an embodiment, the thickness of the inlay is in the range of 0.04-0.5 mm, preferably 0.25-0.30 mm. Such dimensions make it possible to produce containers in complex shapes. Moreover, such thicknesses do not substantially reduce the volume the container can hold.

Due to environmental considerations, the first material and the second material comprise biodegradable materials. Such biodegradable materials allow the containers to degrade in a natural manner and thus have a low impact on the environment.

In an embodiment, the second material is composed of a biodegradable thermoformed material.

In an embodiment, the second material is a hot-drawn film.

The biodegradable thermoformed material is preferably selected from the group of bio-based and biodegradable polymers such as polylactic acid (PLA), copolymer of PLLA with 1-10% D, polybutene succinate (PBS), polycaprolactone (PCL), poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), polyhydroxyalkanoate (PHA) and polyhydroxybutyrate (PHB), cellulose acetate butyrate (CAB), lignocellulose (LC) or copolyester of butane diol, adipic acid and terephthalic acid (PBAT), or mixtures of the aforementioned components.

In an embodiment, the first material is composed of a biodegradable particulate foam material.

The biodegradable particulate foam material is preferably selected from the group of bio-based and biodegradable polymers such as polylactic acid (PLA), copolymer of PLLA with 1-10% D, polybutene succinate (PBS), polycaprolactone (PCL), poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), polyhydroxyalkanoate (PHA) and polyhydroxybutyrate (PHB), cellulose acetate butyrate (CAB), lignocellulose (LC) or copolyester of butane diol, adipic acid and terephthalic acid (PBAT), or mixtures of the aforementioned components.

A particular embodiment is a container wherein the first material and the second material comprise polylactic acid (PLA).

In an embodiment, the first material and/or the second material comprise one or a plurality of additional components selected from the group of colourants such as talc and TiO_2, plasticisers such as triethyl citrate (TEC) and acetyl tributyl citrate (ATBC), tributyl citrate, TbC, and diethyl bis(hydroxymethyl)malonate, DBM, DOA (dioctyl adipate), poly(ethylene glycol) (PEG), citrate esters, oligomeric lactic acid and triacetin.

The present invention further relates to a method for producing a container for liquids comprising a bottom part and a wall part, said method comprising the following steps:

i) provision of a first material,

ii) moulding of the first material into a container,

iii) provision of a second material, and

iv) placement of the second material in the interior of the container of step ii), wherein the bottom part and the wall part of the container are enclosed by the second material.

According to such a method, the "outer cup" is first produced in step ii). The inlay is then placed as a so-called “inner cup” in the interior of the container thus obtained as specified in step iv), after which the final container is obtained.

The present invention further relates to another method for producing a container for liquids comprising a bottom part and a wall part, said method comprising the following steps:

a) provision of a second material,

b) moulding of the second material into a container,

c) provision of a first material, and

d) placement of the first material around the exterior of the container of step b), wherein the first material encloses the bottom part and the wall part of the container.

According to such a method, the "inner cup" is first produced in step b). The first material is then placed as a so-called "outer cup" on the outside of the second material as specified in step d), after which the final container is obtained.

According to an embodiment of the methods described above, the first material and the second material comprise biodegradable materials.

The first material is preferably composed of a biodegradable particulate foam material, in particular a particulate foam material with a particle size in the range of 0.2-1.6 mm, preferably 0.6-1.2 mm and particularly preferably 0.6-0.9 mm.

The biodegradable particulate foam material is preferably selected from the group of bio-based and biodegradable polymers such as polylactic acid (PLA), copolymer of PLLA with 1-10% D, polybutene succinate (PBS), polycaprolactone (PCL), poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), polyhydroxyalkanoate (PHA) and polyhydroxybutyrate (PHB), cellulose acetate butyrate (CAB), lignocellulose (LC) or copolyester of butane diol, adipic acid and terephthalic acid (PBAT), or mixtures of the aforementioned components.

The second material is preferably composed of a biodegradable thermoformed material, and the biodegradable thermoformed material is selected in particular from the group of bio-based and biodegradable polymers such as polylactic acid (PLA), copolymer of PLLA with 1-10% D, polybutene succinate (PBS), polycaprolactone (PCL), poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), polyhydroxyalkanoate (PHA) and polyhydroxybutyrate (PHB), cellulose acetate butyrate (CAB), lignocellulose (LC) or copolyester of butane diol, adipic acid and terephthalic acid (PBAT), or mixtures of the aforementioned components.

In the present method the second material is preferably provided as a hot-drawn film, wherein the thickness of the second material is preferably in the range of 0.04-0.5 mm, more preferably 0.25-0.30 mm.

In an embodiment of the present methods for producing a container, the first material and the second material comprise polylactic acid (PLA).

The present invention further relates to the use of a container as described above or a container obtained by the methods described above for drinking cups, cups for noodles, and cups for hot liquids such as soups and sauces.

The invention will be described below by means of a number of examples, and it is to be noted that these examples are given purely for explanatory purposes.

Fig. 1 is a front view of an inlay.

Fig. 2 is a front view of a container.

Fig. 3 shows the composite container according to the invention.

Examples

The following PLA type materials were used for producing the inlay, specifically the second material.

Table 1. PLA grades

Test #	Type	Manufacturer
2732	Synterra PLLA 2010	Synbra Technology
2735	PLLA L175	Corbion
2736	Synterra TF2010	Synbra Technology
2737	Ingeo 2004	Nature Works

In the table, PLLA L175 refers to a PLA copolymer with approx. 5% D-PLA in the chain, and Synterra TF2010 refers to a PLA blend with 90% PLLA, 5% PDLA and 5% DOA plasticiser. Ingeo 2004 PLA is a copolymer with approx. 4% D-PLA in the chain.

Films of all the above-mentioned materials were produced using an extruder in thicknesses of 0.55, 0.35 and 0.25 mm. The inlays thus obtained are shown in Table 2.

Table 2: Production of inlays

			Temperatuure resistance Extruded sheet thickness		
Test #	Type	Manufacturer	0.55	0.35	0.25
2732	Synterra PLLA	Synbra	not	not	not
2735	PLLA L175	Corbion	not	not	not
2736	Synterra TF2010	Synbra	not	not	not
2737	Ingeo 2004	Natureworks	not	not	not

The inventors found that when the materials were cold-drawn, they were not resistant to boiling water. The materials shrank. However, it was decided to produce several inlays in order to investigate their behaviour in a cup.

Inlays were made from all of the material types. When the materials were hot-drawn, they were resistant to boiling water, wherein Synterra TF2010 and PLLA 2010 showed the best performance with respect to shape stability.

The following step comprised a thermoforming step using a manual mould. The first samples of the materials were produced in a thickness of 0.25 mm, as these are the most critical. If these materials meet the criteria, it is not necessary to test the thicker sheets. The manual mould can be equipped with various settings, such as pre-drawing length, sheet pre-heating temperature, bottom temperature, wall temperature, and residence time in the mould.

Table 3 shows the settings used for producing the samples.

Table 3: Manual mould settings

	2732	2735	2736	2737
[key] Pre-drawing (mm)	70	65	70	65
Pre-heating (sec)	3,5	6,5	7,0	6,5
Residence time in mould (sec)	25	15	20	15
Wall temperature wall (°C)	95	96	91	96
Bottom temperature (°C)	115	114	111	114

For the final moulding, a method was used in which the inlay was inserted during moulding and then the inlay was provided with foam, i.e. foamed.

The moulding properties were as follows: material Synterra BF710M (unexpanded 0.7-1.0 mm), supplier Synbra Technology, foamed with 7% CO_2, impregnated at a pressure of 17 bar and foamed to a density of 60 g/l. A coating of 4% Epotal P100 ECO (on a dry matter basis), supplier BASF, was applied. The aforementioned inlays were processed on a Thermoware THW 3516 D moulding machine under the following conditions. The total cycle time was 11 seconds, specifically comprising insertion of the inlay for moulding and foaming thereof.

Table 4: Processing conditions:

Preheating	2.5 s
Deceleration	3.3 s
Steaming	4 s
Cooling	15 s
Steam pressure	2 bar
Cooling water	8°C

The inventors found that drinking cups produced from particulate polylactic acid foam, specifically BioFoam, were not resistant to high temperature, and after a time, the hot liquid, such as coffee, leaked out. The present inventors also found that a single inlay of hot-drawn PLLA in a low thickness was not sufficient to contain warm liquids such as hot coffee, with the result that the material collapsed.

Surprisingly, the inventors also found that these two materials, which in principle are too weak, can be combined to obtain a strong composite material, wherein the foam material insulates the hands of the user and the thin inlay is supported by the surrounding foam, thus providing a composite wherein the occurrence of fluid leakage is no longer dependent on thermal insulation.

Fig. 1 is a front view of an inlay 10, in particular obtained by thermoforming.

Fig. 2 is a front view of container 20 provided with an interior space 23, with said container 20 further comprising a bottom part 21 and a wall part 22.

Fig. 3 shows the composite or final container according to the invention, wherein the inlay 10 (see Figure 1) is placed in the interior of the container 20 (see Figure 2). The composite or final container 30 contains the inlay 10, wherein the intermediate container 20 is composed of a first material and the inlay 10 of a second material, wherein the second material is used to hold the liquid (not shown) and the first material provides thermal insulation, and wherein the combination of the first and second material provides the composite or final container 30 with mechanical integrity.

CLAIMS

1. Container for liquids, comprising a bottom part and a wall part, characterized in that an inlay is placed in the container, wherein the container is composed of a first material and the inlay of a second material, wherein the second material holds the liquid in place and the first material provides thermal insulation, and wherein the combination of the first and second material provides the container with mechanical integrity.

2. Container according to Claim 1, characterized in that the inlay is connected in a liquid-tight manner to the bottom part and the wall part of the container.

3. Container according to Claim 2, characterized in that no adhesive is used to connect the inlay in a liquid-tight manner to the bottom part and the wall part of the container.

4. Container according to one or more of the preceding claims, characterized in that the thickness of the inlay is in the range of 0.04-0.5 mm, preferably 0.25-0.30 mm.

5. Container according to one or more of the preceding claims, characterized in that the inlay is a hot-drawn film.

6. Container according to one or more of the preceding claims, characterized in that the first material and the second material comprise biodegradable materials.

7. Container according to one or more of the preceding claims, characterized in that the first material is composed of a biodegradable particulate foam material, in particular a particulate foam material with a particle size in the range of 0.2-1.6 mm, preferably 0.6-1.2 mm and particularly preferably 0.6-0.9 mm.

8. Container according to Claim 7, characterized in that the biodegradable particulate foam material is selected from the group of bio-based and biodegradable polymers such as polylactic acid (PLA), copolymer of PLLA with 1-10% D, polybutene succinate (PBS), polycaprolactone (PCL), poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), polyhydroxyalkanoate (PHA) and polyhydroxybutyrate (PHB), cellulose acetate butyrate (CAB), lignocellulose (LC) or copolyester of butane diol, adipic acid and terephthalic acid (PBAT), or mixtures of the aforementioned components.

9. Container according to one or more of Claims 1-6, characterized in that the second material is composed of a biodegradable thermoformed material.

10. Container according to Claim 9, characterized in that the biodegradable thermoformed material is selected from the group of bio-based and biodegradable polymers such as polylactic acid (PLA), copolymer of PLLA with 1-10% D, polybutene succinate (PBS), polycaprolactone (PCL), poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), polyhydroxyalkanoate (PHA) and polyhydroxybutyrate (PHB), cellulose acetate butyrate (CAB), lignocellulose (LC) or copolyester of butane diol, adipic acid and terephthalic acid (PBAT), or mixtures of the aforementioned components.

11. Container according to one or more of the preceding claims, characterized in that the first material and the second material comprise polylactic acid (PLA).

12. Container according to one or more of the preceding claims, characterized in that the first material and/or the second material comprise one or a plurality of additional components selected from the group of colourants such as talc and TiO_2, plasticisers such as triethyl citrate (TEC) and acetyl tributyl citrate (ATBC), tributyl citrate, TbC, and diethyl bis(hydroxymethyl)malonate, DBM, DOA (dioctyl adipate), poly(ethylene glycol) (PEG), citrate esters, oligomeric lactic acid and triacetin.

13. Method for producing a container for liquids comprising a bottom part and a wall part, said method comprising the following steps:

i) provision of a first material,

ii) moulding of the first material into a container,

iii) provision of a second material, and

iv) placement of the second material in the interior of the container of step ii), wherein the bottom part and the wall part of the container are enclosed by the second material.

14. Method for producing a container for liquids, comprising a bottom part and a wall part, said method comprising the following steps:

a) provision of a second material,

b) moulding of the second material into a container,

c) provision of a first material,

d) placement of the first material around the exterior of the container of step b), wherein the first material encloses the bottom part and the wall part of the container.

15. Method for producing a container according to one or more of Claims 13-14, characterized in that the first material and the second material comprise biodegradable materials.

16. Method for producing a container according to one or more of Claims 13-15, characterized in that the first material is composed of a biodegradable particulate foam material, in particular a particulate foam material with a particle size in the range of 0.2-1.6 mm, preferably 0.6-1.2 mm and particularly preferably 0.6-0.9 mm.

17. Method for producing a container according to one or more of Claims 13-16, characterized in that the biodegradable particulate foam material is selected from the group of bio-based and biodegradable polymers such as polylactic acid (PLA), copolymer of PLLA with 1-10% D, polybutene succinate (PBS), polycaprolactone (PCL), poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), polyhydroxyalkanoate (PHA) and polyhydroxybutyrate (PHB), cellulose acetate butyrate (CAB), lignocellulose (LC) or copolyester of butane diol, adipic acid and terephthalic acid (PBAT), or mixtures of the aforementioned components.

18. Method for producing a container according to one or more of Claims 13-17, characterized in that the second material is composed of a biodegradable thermoformed material, preferably the thickness of the second material is in the range of 0.04-0.5 mm, more preferably 0.25-0.30 mm.

19. Method for producing a container according to one or more of Claims 13-18, characterized in that the second material is provided as a hot-drawn film.

20. Method for producing a container according to one or more of Claims 13-19, characterized in that the biodegradable thermoformed material is selected from the group of bio-based and biodegradable polymers such as polylactic acid (PLA), copolymer of PLLA with 1-10% D, polybutene succinate (PBS), polycaprolactone (PCL), poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), polyhydroxyalkanoate (PHA) and polyhydroxybutyrate (PHB), cellulose acetate butyrate (CAB), lignocellulose (LC) or copolyester of butane diol, adipic acid and terephthalic acid (PBAT), or mixtures of the aforementioned components.

21. Method for producing a container according to one or more of Claims 13-20, characterized in that the first material and the second material comprise polylactic acid (PLA).

22. Use of a container according to one or more of Claims 1-12 or a container obtained by the method according to one or more of Claims 13-21 for drinking cups, cups for noodles, or cups for hot liquids such as soups and sauces.

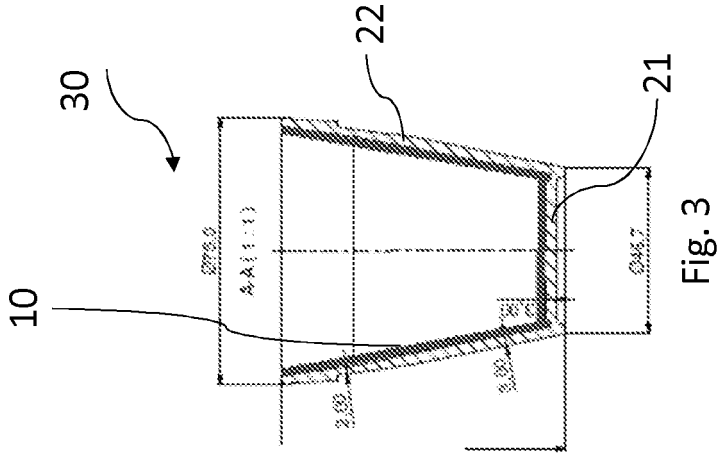

Fig. 3

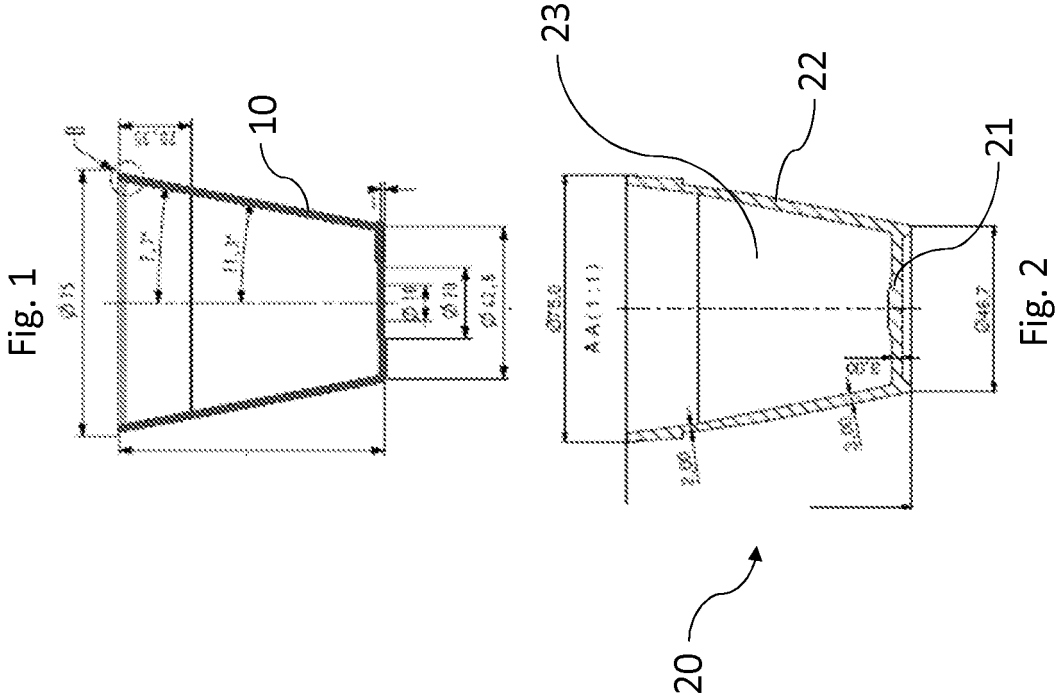

Fig. 2

Fig. 1

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2018/050461

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D81/38 B65D25/14
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2014/161653 A1 (CEDAR ADVANCED TECHNOLOGY GROUP LTD [CH]) 9 October 2014 (2014-10-09) pages 1-30 figures 1, 2	1-22
X	EP 2 502 850 A1 (PACCOR DEUTSCHLAND GMBH [DE]) 26 September 2012 (2012-09-26)	1-6, 9-15, 18-22
Y	paragraphs [0001] - [0087] figures 1-4	7,8,16, 17
X	DE 20 2010 008367 U1 (HUHTAMAKI CONSUMER GOODS PLASTICS GMBH [DE]) 2 December 2010 (2010-12-02)	1-6, 9-15, 18-22
Y	paragraphs [0001] - [0103] figures 1-3	7,8,16, 17

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
26 September 2018	20/11/2018

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2

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INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2018/050461

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2014/136746 A1 (KUREHA CORP [JP]) 12 September 2014 (2014-09-12) paragraph [0043] -----	7,8,16, 17
A	US 2009/263601 A1 (RENN DONALD W [US]) 22 October 2009 (2009-10-22) cited in the application paragraphs [0001] - [0099] figures 1, 2B -----	1-22
A	KR 2007 0068331 A (SUNG WOO ENVITECH CO LTD [KR]) 29 June 2007 (2007-06-29) pages 1-5 figures 1-6 -----	1-22

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/NL2018/050461

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014161653 A1	09-10-2014	NONE	
EP 2502850 A1	26-09-2012	DE 102011001548 A1	27-09-2012
		EP 2502850 A1	26-09-2012
		HU E033228 T2	28-11-2017
		PL 2502850 T3	29-09-2017
DE 202010008367 U1	02-12-2010	DE 202010008367 U1	02-12-2010
		EP 2423120 A2	29-02-2012
WO 2014136746 A1	12-09-2014	JP WO2014136746 A1	09-02-2017
		WO 2014136746 A1	12-09-2014
US 2009263601 A1	22-10-2009	CA 2654771 A1	27-12-2007
		EP 2032470 A1	11-03-2009
		JP 2009541502 A	26-11-2009
		US 2007292643 A1	20-12-2007
		US 2009263601 A1	22-10-2009
		WO 2007149452 A1	27-12-2007
KR 20070068331 A	29-06-2007	NONE	