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PAPER FOR OVERWRAPPING

- (57)

The present disclosure provides a heat-sealable paper product for use in overwrapping, wherein the heat-sealable paper product:
- comprises a paper substrate being a machine-glazed (MG) kraft paper having a glazed side and a non-glazed side, wherein the glazed side of the MG kraft paper is coated with a heat-sealable coating;
- has thickness of equal to or below 85 µm according to ISO 534:2011;
- has a tensile energy absorption (TEA) in cross direction (CD) of at least 60 J/m² according to ISO 1924-3:2011; and
- has a burst strength of at least 150 kPa according to ISO 2758:2014.

The present disclosure also provides a method of producing a heat-sealable paper product for use in overwrapping as well as a method of overwrapping an item in a heat-sealable paper product.

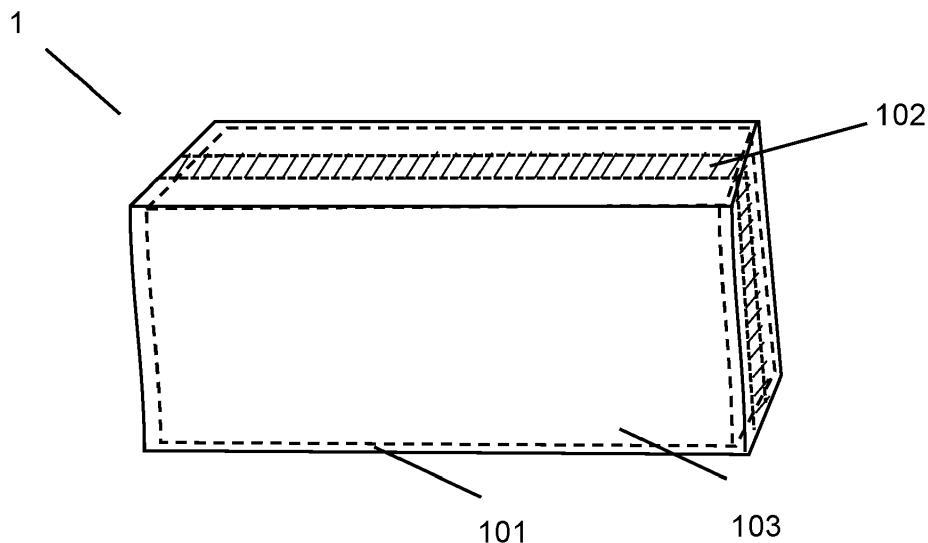


Fig. 1

Description

TECHNICAL FIELD

5 [0001] The present disclosure relates to the field of overwrapping and in particular to tissue overwrapping.

BACKGROUND

10 [0002] Traditionally, many overwrapped items have been wrapped in plastic films due to price and material properties. However, due to environmental concerns, there is a strive to replace the plastics with paper-based materials.

[0003] Overwrapping is the process of wrapping an item inside a protective material. Example of an item being over-wrapped by plastic films is tissue, e.g. rolls of kitchen paper towels or toilet paper. The item is overwrapped by the plastic and sealed, thereby making a sealed package.

15 SUMMARY

[0004] The present disclosure aims to provide a paper-based material that can replace plastic films in overwrapping, especially in tissue overwrapping. The inventors have realized that such paper-based material should meet most, preferably all, of the following criteria:

- 20 - sealant layer adhesion (i.e. capable of binding a sealant composition applied in a high-speed process);
- provision of a strong and durable seal that holds the overwrap together;
- 25 - sufficient strength of both paper and seal to not break upon handling, for example breakage from fingers entering the holes of tissue rolls when grabbing a package, or during transport;
- folding properties, being flexible and operable in packing lines; and
- 30 - satisfactory printability when using existing printing technology.

[0005] Accordingly, the present disclosure provides the following listing of itemized embodiments:

- 35 1. A heat-sealable paper product for use in overwrapping, wherein the heat-sealable paper product:
 - comprises a paper substrate being a machine-glazed (MG) kraft paper having a glazed side and a non-glazed side, wherein the glazed side of the MG kraft paper is coated with a heat-sealable coating;
 - has thickness of equal to or below 85 μm according to ISO 534:2011;
 - 40 - has a tensile energy absorption (TEA) in cross direction (CD) of at least 60 J/m^2 according to ISO 1924-3:2011; and
 - has a burst strength of at least 150 kPa according to ISO 2758:2014.
- 45 2. The heat-sealable paper product of item 1, wherein the non-glazed side of the MG kraft paper forms a printing side.
3. The heat-sealable paper product of item 1 or 2, wherein the stretch at break in machine direction (MD) according to ISO 1924-3:2011 is 5 % or lower, such as 1-5 %, such as 1-4 %.
- 50 4. The heat-sealable paper product of any one of the preceding items, wherein the stretch at break in cross direction (CD) according to ISO 1924-3:2011 is 2-7 %, such as 3-6%.
- 55 5. The heat-sealable paper product of any one of the preceding items, wherein the TEA in CD is at least 70 J/m^2 , such as 70-100 J/m^2 , according to ISO 1924-3:2011.
6. The heat-sealable paper product of any one of the preceding items, wherein the burst strength is at least 170 kPa, such as 170-230 kPa, according to ISO 2758:2014.

7. The heat-sealable paper product of any one of the preceding items, wherein the tear strength in MD is 245-310 mN according to ISO 1974:2012.

8. The heat-sealable paper product of any one of the preceding items, wherein the tear strength in CD is 290-350 mN according to ISO 1974:2012.

9. The heat-sealable paper product of any one of the preceding items, wherein the grammage is 35-80 g/m², such as 40-65 g/m², according to ISO 536:2020.

10. The heat-sealable paper product of any one of the preceding items, wherein the thickness of the paper product is equal to or below 75 µm, such as 35-75 µm, such as 35-70 µm according to ISO 534:2011.

11. The heat-sealable paper product of any one of the preceding items, wherein the paper product is for use in tissue overwrapping.

12. Method of overwrapping an item comprising the steps of:

a) providing a paper product of any one of the preceding items;

b) overwrapping the item with the paper product; and

c) heat-sealing at least part of the paper product so that the item is overwrapped by the paper product.

13. The method of item 12, wherein the overwrapping an item is tissue overwrapping.

14. The method of item 12 or 13, wherein the paper product is sealed to itself in step c).

15. The method of any one of the items 12-14, wherein the paper product is sealed to a second paper product in step c).

16. A method of producing a heat-sealable coated paper product for use in overwrapping, comprising the steps of:

- providing a paper substrate being a machine-glazed (MG) kraft paper having a glazed side and a non-glazed side, wherein the paper substrate has:

◦ an air resistance measured according to ISO 5636-5:2013 of at least 35 s;

◦ a thickness of equal to or below 70 µm according to ISO 534:2011;

◦ a Cobb 60s of equal to or below 26 g/m² according to ISO 535:2014 on the glazed side of the paper substrate;

◦ a tensile energy absorption (TEA) in cross direction (CD) of at least 60 J/m² according to ISO 1924-3:2011; and

◦ a burst strength of at least 150 kPa according to ISO 2758:2014; and

- and coating a heat-sealable coating on the glazed side of the paper substrate.

17. The method of item 16, wherein the MG kraft paper contains less than 5 % by dry weight inorganic fillers, such as less than 3 % by dry weight inorganic fillers, such as is free of inorganic fillers.

18. The method of item 16 or 17, wherein the thickness of the paper substrate is equal to or below 65 µm, such as 35-65 µm, according to ISO 534:2011.

19. The method of any one of the items 16-18, wherein the paper substrate has an air resistance measured according to ISO 5636-5:2013 of at least 40 s, such as 40-80 s.

20. The method of any one of the items 16-19, wherein the paper substrate has a Cobb 60s of equal to or below 25 g/m², such as 20-25 g/m², according to ISO 535:2014 on the glazed side of the paper substrate.

21. The method of any one of the items 16-20, wherein the paper substrate has a Bendtsen surface roughness of 30-80 ml/min according to ISO 8791-2:2013 on the glazed side of the paper substrate.

22. The method of any one of the items 16-21, wherein the paper substrate has been calendered.

23. The method of any one of the items 16-22, wherein the fibres in the paper substrate are at least 90 % by dry weight, such as at least 95 % by dry weight, such as 100 % by dry weight, softwood fibres.

24. The method of any one of the items 16-22, wherein the paper substrate is bleached.

25. The method of any one of the items 16-24, wherein at least 80 dry wt.% of the fibres used to form the paper substrate are never-dried.

26. The method of any one of the items 16-25, wherein the coat weight of the heat-sealable coating is 3-30 g/m², such as 5-25 g/m².

27. The method of any one of the items 16-26, wherein starch is added in amount of 3-6 kg/ton, such as 4-5 kg/ton, as a surface sizing to the MG kraft paper.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Fig 1 shows a schematic drawing of an overwrapped product.

Fig 2 shows a schematic drawing of an overwrapped tissue product.

DETAILED DESCRIPTION

[0007] As a first aspect of the present disclosure, there is provided a heat-sealable paper product for use in overwrapping, wherein the heat-sealable paper product:

- comprises a paper substrate being a machine-glazed (MG) kraft paper having a glazed side and a non-glazed side, wherein the glazed side of the MG kraft paper is coated with a heat-sealable coating;
- has thickness of equal to or below 75 μm according to ISO 534:2011;
- has a tensile energy absorption (TEA) in cross direction (CD) of at least 60 J/m² according to ISO 1924-3:2011; and
- has a burst strength of at least 150 kPa according to ISO 2758:2014.

[0008] The paper substrate is a machine-glazed (MG) kraft paper. The MG paper is preferably calendered since an even smoother surface is advantageous for the distribution of sealant and, thus, sealability of the heat-sealable coating, as well as optional printing. An MG paper has a glazed side and a non-glazed side. The glazed side is the side that faced the Yankee cylinder (a polished metal cylinder sometimes referred to as a MG cylinder) used for drying the paper web in the MG papermaking machine. The contact with the polished metal surface during drying makes the glazed side smoother than the non-glazed side. A heat-sealable coating is provided on the smooth, glazed side. It is beneficial to provide the heat-sealable coating on the glazed side as the inventors have realized that the sealability is much improved over providing it on the non-glazed side. The paper substrate may have been treated in a size press or similar to smoothen the surface.

[0009] The inventors have realized that by the combination of limiting the thickness according to ISO 534:2011 to 85 μm or below, coating the MG kraft paper on the glazed side and that the TEA in CD according to ISO 1924-3:2011 is at least 60 J/m², the heat-sealable coating will form a heat-seal that is strong and durable in an overwrapped item. Otherwise, the seal can open under use and the item contained will then be contaminated by the surroundings or even fall out. The specified thickness ensures that the heat-transfer during heat-sealing from the opposite side of the paper is sufficient. Such thickness is also beneficial for folding properties and flexibility. In embodiments, the thickness of the paper product may be equal to or below 75 μm , such as 35-75 μm , such as 35-70 μm according to ISO 534:2011. Typically, the paper product is for use in tissue overwrapping, such as overwrapping of rolls of kitchen paper towels

and/or toilet paper.

[0010] The inventors have realized that the burst strength should be at least 150 kPa according to ISO 2758:2014 to prevent the paper from damage or even breakage when a consumer grabs and holds an overwrapped package with the fingers.

[0011] Typically, the less smooth, non-glazed, side of the MG kraft paper forms a printing side. The non-glazed side is the side that faces out towards the consumer and a print is, thus, more appealing. To enhance the printability, the non-glazed side may be coated with a pigmented coating in one or several layers. A lacquer may be provided on top of the optional print, e.g. to modify gloss, friction and/or release properties.

[0012] The stretch at break in machine direction (MD) according to ISO 1924-3:2011 of the paper product is typically 5 % or lower, such as 1-5 %, such as 1-4 %. The stretch at break in cross direction (CD) according to ISO 1924-3:2011 is typically 2-7 %, such as 3-6%. Such stretch is advantageous as a suitable seal area toughness for transport and handling is provided.

[0013] The TEA in CD of the paper product is typically at least 70 J/m², such as 70-100 J/m², according to ISO 1924-3:2011. Such TEA will further ensure the durability in the sealing area.

[0014] The burst strength of the paper product is typically at least 170 kPa, such as 170-230 kPa, according to ISO 2758:2014. Such burst strength will further prevent the paper from damage or even breakage when a consumer grabs and holds an overwrapped package with the fingers.

[0015] The tear strength in MD of the paper product is typically 245-310 mN according to ISO 1974:2012 and the tear strength in CD is typically 290-350 mN according to ISO 1974:2012.

[0016] The grammage is of the paper product is typically 35-80 g/m², such as 40-65 g/m², according to ISO 536:2020. Such grammage is, as the thickness, beneficial for heat-transfer in coating, folding properties and flexibility.

[0017] As a second aspect of the present disclosure there is provided a method of overwrapping an item comprising the steps of:

- a) providing a paper product of the first aspect;
- b) overwrapping the item with the paper product; and
- c) heat-sealing at least part of the paper product so that the item is overwrapped by the paper product.

[0018] The overwrapping of the item is typically tissue overwrapping. In such case, the item is tissue, such as rolls of kitchen paper towels and/or toilet paper. In one embodiment, overwrapping does not include flow wrapping.

[0019] The paper product may be sealed to itself in step c). In such case, the overwrapped item can be produced from a single paper product by folding the paper product followed by heat-sealing. Alternatively, the paper product is sealed to a second paper product in step c). In such case, the overwrapped item can be produced without the need for folding any of the paper products.

[0020] The examples and embodiments discussed above in connection to the first aspect apply to the second aspect *mutatis mutandis*.

[0021] As a third aspect of the present disclosure there is provided a method of producing a heat-sealable coated paper product for use in overwrapping, comprising the steps of:

- providing a paper substrate being a machine-glazed (MG) kraft paper having a glazed side and a non-glazed side, wherein the paper substrate has:
 - an air resistance measured according to ISO 5636-5:2013 of at least 35 s;
 - a thickness of equal to or below 70 μm according to ISO 534:2011;
 - a Cobb 60s of equal to or below 26 g/m² according to ISO 535:2014 on the glazed side of the paper substrate;
 - a tensile energy absorption (TEA) in cross direction (CD) of at least 60 J/m² according to ISO 1924-3:2011; and
 - a burst strength of at least 150 kPa according to ISO 2758; and
- and coating a heat-sealable coating on the glazed side of the paper substrate.

[0022] The air resistance according to ISO 5636-5:2013 is a measure of how dense the surface is, the higher the value, the denser the surface is. For the paper substrate, the air resistance is at least 35 s. The Cobb 60s is a measure

of how easily the surface is wetted. For the paper substrate, the Cobb 60s is equal to or below 26 g/m² according to ISO 535:2014 on the glazed side of the paper substrate. Typically, the Cobb 60s is equal to or below 25 g/m², such as 20-25 g/m², according to ISO 535:2014 on the glazed side of the paper substrate. Such dense and wettable surface is beneficial distribution upon application of surface-treating chemicals as AKD and sizing, as well as the heat-sealable coating.

[0023] The MG kraft paper typically contains less than 5 % by dry weight inorganic fillers, such as less than 3 % by dry weight inorganic fillers, such as is free of inorganic fillers. Limiting or avoiding the addition of inorganic filler in the papermaking process results in a low ash content. Accordingly, the ash content (measured according to ASTM D586-97) of the MG kraft paper is preferably below 6.5%, such as below 5.5%, such as below 1.5%.

[0024] The fibres in the paper substrate are typically at least 90 % by dry weight, such as at least 95 % by dry weight, such as 100 % by dry weight, softwood fibres. Typically, at least 80%, preferably at least 90%, by dry weight of the fibres used to produce the MG kraft paper are virgin fibres. By keeping the amount of inorganic fillers low or even omitted, the mechanical properties are advantageously improved. Moreover, using a high content, or even only, softwood fibres the mechanical properties, such as burst strength, TEA in CD and stretch at break are further improved. The fibres are typically bleached.

[0025] The thickness of the paper substrate is typically equal to or below 65 µm, such as 35-65 µm, according to ISO 534:2011. Such thickness is beneficial since the heat-transfer from the opposite side of the paper substrate is facilitated and thereby heat-sealing is improved.

[0026] To improve burst strength as well as curl prevention, starch may be added, typically in amount of 3-6 kg/ton, such as 4-5 kg/ton, as a surface sizing to the MG kraft paper produced. Surface sizing can be added by for example a size press or a film press.

[0027] The air resistance measured according to ISO 5636-5:2013 of the paper substrate is typically at least 40 s, such as 40-80 s. The Bendtsen surface roughness is typically 30-80 ml/min according to ISO 8791-2:2013 on the glazed side of the paper substrate. Such dense and smooth surface is beneficial for coating, printing and heat-sealing.

[0028] The coat weight of the heat-sealable coating is typically 3-30 g/m², such as 5-25 g/m². Such coat weight facilitates heat-sealing. Another wording for heat-sealable coating is heat-sealable lacquer.

[0029] The examples and embodiments discussed above in connection to the first aspect apply to the second and third aspects *mutatis mutandis*.

[0030] The aspects of the present disclosure will now be described more fully hereinafter with reference to the accompanying drawings, in which certain embodiments of the invention are shown. Like numbers refer to like elements throughout the description.

[0031] Fig 1 is a schematic drawing of an overwrapped product 1, wherein an item 103 is overwrapped with a paper product 101 according to the present disclosure that is heat-sealed in a sealing line 102 so that the product 103 is overwrapped securely.

[0032] Fig 2 is a schematic drawing of an overwrapped tissue product 2, wherein a tissue product 203 is overwrapped with a paper product 101 according to the present disclosure that is heat-sealed in a sealing line 102 so that the tissue product 203 is overwrapped securely.

EXAMPLES

[0033] The present inventors have developed a suitable paper-based material for overwrapping. The inventors realized that a machine-glazed (MG) kraft paper produced from never-dried bleached softwood (SW) pulp is suitable as the paper substrate. The MG kraft paper was free of inorganic fillers. The paper was calendered on the glazed side and surface sized with starch (about 4-5 kg/ton) and AKD (about 0.1 kg/ton). The properties of the paper is shown in table 1 below. Moreover, a comparative example (CE) from a paper-based tissue overwrap package from a competitor (Floralys) was used as a reference.

Table 1. Properties of an inventive example (IE1) of the MG kraft paper produced as well as the properties of the comparative example (CE1).

Property	Unit	Standard method	Value IE	Value CE1
Grammage	g/m ²	ISO 536:2020	45	55
Thickness	µm	ISO 534:2011	55	80
Tensile Strength MD	kN/m	ISO 1924-3:2011	5.2	5.9
Tensile Strength CD	kN/m	ISO 1924-3:2011	2.8	2.5
Stretch at break MD	%	ISO 1924-3:2011	1.5	1.7

EP 4 382 667 A1

(continued)

Property	Unit	Standard method	Value IE	Value CE1
Stretch at break CD	%	ISO 1924-3:2011	4.0	4.3
Tear strength MD	mN	ISO 1974:2012	325	394
Tear strength CD	mN	ISO 1974:2012	354	512
TEA MD	J/m ²	ISO 1924-3:2011	51	64
TEA CD	J/m ²	ISO 1924-3:2011	82	78
TEA Index MD	J/g	ISO 1924-3:2011	1.1	1.2
TEA Index CD	J/g	ISO 1924-3:2011	1.8	1.4
Air resistance (Gurley)	s	ISO 5636-5:2013	43	73
Bendtsen Roughness glazed side	ml/min	ISO 8791-2:2013	54	102
Bendtsen Roughness non-glazed side	ml/min	ISO 8791-2:2013	372	413
Burst strength	kPa	ISO 2758:2014	194	127
Burst index	kN/g	ISO 2758:2014	4.3	2.3
Cobb 60s glazed side	g/m ²	ISO 535:2014	22	23
ISO Brightness	%	ISO 2470	85	80
Hardwood	%		0	25
Softwood	%		100	75

[0034] The IE paper was also produced in grammage of 35 g/m² (IE2), i.e. with a thickness of about 43 μm.

[0035] The paper substrates were then coated with a heat-sealable coating on the glazed side to obtain a total grammage of about 60 g/m². The thickness of the coating was about 15 μm (about 15 g/m²) as determined from a cross-section of a coated paper with SEM. The IE paper (IE1), thus, had a total thickness of about 70 μm (15 μm coating + 55 μm paper) and the IE2 paper a total thickness of about 58 μm. In another example, the paper was coated manually with an adhesive on the glazed side (IE3) and on the non-glazed side (CE2).

[0036] 4 rolls of paper towels were overwrapped with each coated paper and 4 rolls were wrapped in plastic as a reference (CE3). The overwrapped packages of paper towel rolls were thereafter tested according to the test "ISTA 3A drops", wherein the following drops are made:

- 13 drops from 460 mm
- 2 drops from 910 mm
- 1 drop on hazard 460 mm
- 1 hazard box drop 400 mm (4.1 kg 300×300×300 mm)

[0037] In addition, the overwrapped packages were also dropped from 2 m and 3 m according to:

- 10 drops from 2m (6 flat, 4 edge)
- 10 drops from 3m (6 flat, 4 edge)

[0038] An average of 3 packages was evaluated for each test. The test fails when the package brakes by either breakage of paper and/or the seal. The results from the drop tests are presented in table 2 below. In the case of IE3 and CE2, wherein adhesive was applied manually on the paper, the glue joint failed, but the paper itself was intact. However, as shown by the comparison of IE3 and CE2, it is advantageous to apply the glue to the glazed side of the paper.

Table 2. Results from the drop tests of overwrapped tissue packages.

Test	70 μm thickness, coated on glazed side (IE1)	58 μm thickness, coated on glazed side (IE2)	70 μm thickness, manual gluing on glazed side (IE3)	Floralys (CE1)	70 μm thickness, manual gluing on non-glazed side (CE2)	Plastic (CE3)
ISTA 3A	Pass	Pass	Pass	Pass	Fail	Pass
2m	Pass	Pass	Pass	Pass	-	Pass
3m	10 drops	2.7 drops	0.2 drops	2 drops	-	13 drops

[0039] From the examples, it is clear that a combination of strong yet flexible paper that is easy to coat so that a good sealing is obtained is achieved by the papers according to the inventive examples.

[0040] If a glue for sealing is applied on the non-glazed, rough, side of the MG kraft paper, the sealing will not hold. On the other hand, the sealant is applied on the glazed, smooth, side of the MG kraft paper, the sealing is strong.

Claims

1. A heat-sealable paper product for use in overwrapping, wherein the heat-sealable paper product:

- comprises a paper substrate being a machine-glazed (MG) kraft paper having a glazed side and a non-glazed side, wherein the glazed side of the MG kraft paper is coated with a heat-sealable coating;
- has thickness of equal to or below 85 μm according to ISO 534:2011;
- has a tensile energy absorption (TEA) in cross direction (CD) of at least 60 J/m² according to ISO 1924-3:2011; and
- has a burst strength of at least 150 kPa according to ISO 2758:2014.

2. The heat-sealable paper product of claim 1, wherein the non-glazed side of the MG kraft paper forms a printing side.

3. The heat-sealable paper product of any one claim 1 or 2, wherein the TEA in CD is at least 70 J/m², such as 70-100 J/m², according to ISO 1924-3:2011.

4. The heat-sealable paper product of any one of the preceding claims, wherein the burst strength is at least 170 kPa, such as 170-230 kPa, according to ISO2758.

5. The heat-sealable paper product of any one of the preceding claims, wherein the grammage is 35-80 g/m², such as 40-65 g/m², according to ISO 536:2020.

6. The heat-sealable paper product of any one of the preceding claims, wherein the paper product is for use in tissue overwrapping.

7. Method of overwrapping an item comprising the steps of:

- a) providing a paper product of any one of the preceding claims;
- b) overwrapping the item with the paper product; and
- c) heat-sealing at least part of the paper product so that the item is overwrapped by the paper product.

8. The method of claim 7, wherein the overwrapping an item is tissue overwrapping.

9. The method of claim 7 or 8, wherein the paper product is sealed to itself in step c).

10. The method of any one of the claims 7-9, wherein the paper product is sealed to a second paper product in step c).

11. A method of producing a heat-sealable coated paper product for use in overwrapping, comprising the steps of:

- providing a paper substrate being a machine-glazed (MG) kraft paper having a glazed side and a non-glazed side, wherein the paper substrate has:

- an air resistance measured according to ISO 5636-5:2013 of at least 35 s;
- a thickness of equal to or below 70 μm according to ISO 534:2011;
- a Cobb 60s of equal to or below 26 g/m^2 according to ISO 535:2014 on the glazed side of the paper substrate;
- a tensile energy absorption (TEA) in cross direction (CD) of at least 60 J/m^2 according to ISO 1924-3:2011; and
- a burst strength of at least 150 kPa according to ISO 2758; and

- and coating a heat-sealable coating on the glazed side of the paper substrate.

12. The method of claim 11, wherein the MG kraft paper contains less than 5 % by dry weight inorganic fillers, such as less than 3 % by dry weight inorganic fillers, such as is free of inorganic fillers.

13. The method of any one of the claims 11 or 12, wherein the paper substrate has an air resistance measured according to ISO 5636-5:2013 of at least 40 s, such as 40-80 s.

14. The method of any one of the claims 11-13, wherein the paper substrate has a Cobb 60s of equal to or below 25 g/m^2 , such as 20-25 g/m^2 , according to ISO 535:2014 on the glazed side of the paper substrate.

15. The method of any one of the claims 11-14, wherein the paper substrate has a Bendtsen surface roughness of 30-80 ml/min according to ISO 8791-2:2013 on the glazed side of the paper substrate.

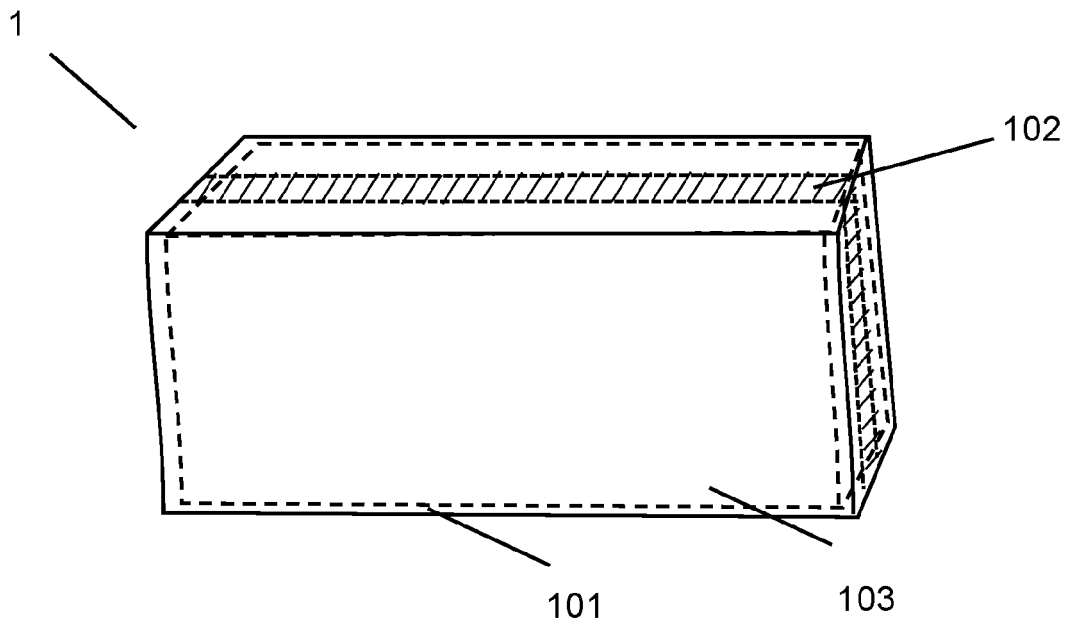


Fig. 1

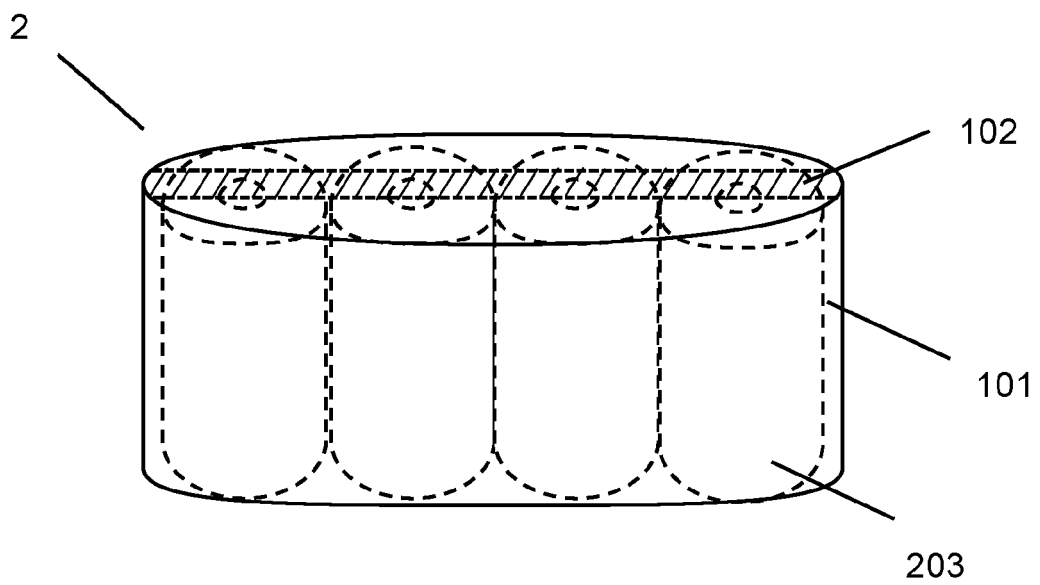


Fig. 2



EUROPEAN SEARCH REPORT

Application Number

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2021/282604 A1 (KNAUF GARY H [US] ET AL) 16 September 2021 (2021-09-16) * claims 1-27; figures 1-17 * * paragraph [0004] - paragraph [0006] * * paragraph [0046] - paragraph [0049] * * examples 1-5 * * paragraphs [0109], [0064] * -----	1-15	INV. D21H19/72 A47K10/16 B65D65/14 B65D75/44 D21F5/02 D21H25/04 D21H27/10
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