

(19)



(11)

EP 4 772 447 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
08.07.2026 Bulletin 2026/28

(51) International Patent Classification (IPC):
B65B 5/04 (2006.01)

(21) Application number: **25197144.6**

(52) Cooperative Patent Classification (CPC):
**B31B 70/10; B31B 70/16; B31B 70/262;
B31B 70/644; B31B 70/645; B65B 5/022;
B65B 5/045; B65B 43/04; B31B 2155/0012;
B31B 2155/003; B31B 2160/10**

(22) Date of filing: **02.06.2023**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR**

• **Prosper, Wouter**
714 93 Kopparberg (SE)
• **van der Merwe, Mark**
22589 Hamburg (DE)

(62) Document number(s) of the earlier application(s) in
accordance with Art. 76 EPC:
23176886.2 / 4 470 764

(74) Representative: **Kransell & Wennborg KB**
P.O. Box 27834
115 93 Stockholm (SE)

(71) Applicant: **Billerud Aktiebolag (publ)**
169 27 Solna (SE)

Remarks:

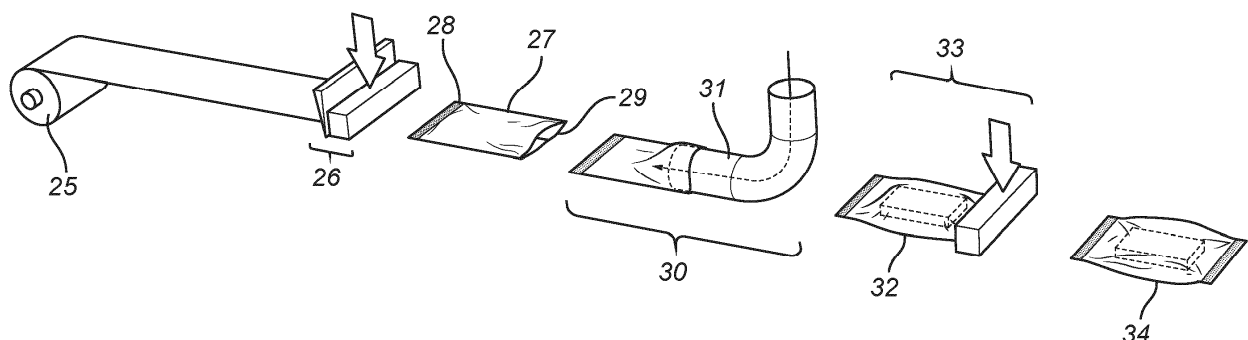
This application was filed on 20.08.2025 as a
divisional application to the application mentioned
under INID code 62.

(72) Inventors:
• **Hjelt, John**
952 42 Kalix (SE)

(54) ROLLED PAPER TUBE

(57) There is provided a rolled paper tube, wherein an inside of the paper of the tube is coated with a sealing layer, such as a heat-sealable layer, which sealing layer is optionally provided on a pre-coating layer. Further, there is provided a use of the rolled paper tube for forming a pillow bag. There is also provided a method of forming a pillow bag containing a product, said method comprising the steps of: providing a rolled paper tube, wherein an inside of the paper of the tube is coated with a sealing

layer, such as a heat-sealable layer, which sealing layer is optionally provided on a pre-coating layer; unwinding the paper tube from the roll; cutting and cross-sealing the paper tube to form a bag having a sealed end portion and a non-sealed end portion; filling the bag with the product to obtain a filled bag; and cross-sealing the non-sealed end portion of the filled bag such that the pillow bag containing the product is formed.

**Fig. 2B**

Description**TECHNICAL FIELD**

[0001] The present disclosure relates to the field of packaging.

BACKGROUND

[0002] Plastics is still the predominant packaging material in the world. However, due to the enormous problems of plastic waste and the concern about carbon dioxide emissions, there is a great demand for alternative packaging solutions.

[0003] Paper is a very attractive alternative to plastics since it is easily recyclable, biodegradable and formed from a renewable material. However, the properties of paper are very different from those of plastics, which means that replacing plastics with paper typically requires new package designs and/or significant investments in new machinery. The unwillingness to adopt new designs and make the necessary investments has hampered the transformation to eco-friendly packaging.

SUMMARY

[0004] The present inventors have found that the plastic material used to package products like pillows and duvets can be replaced with paper if a rolled paper tube is employed. In the development work behind this invention, the inventors first formed a tube from a flat paper material and then, after flattening the tube, rolled it around a core. The rolled paper tube obtained thereby could be used in existing packaging machinery after only minor modifications of the unwinding arrangement. This is a significant achievement since it enables replacement of plastic packaging material with paper without a substantial investment in new machinery.

[0005] To facilitate sealing in the packaging machine, an inside of the paper of the tube is preferably coated with a sealing layer, such as a heat-sealable layer. However, there are alternative sealing techniques that do not require a sealing layer, such as gluing, ultrasonic sealing (see e.g. US9399330 B2) and pressure sealing (e.g. using the pressure seal module from HDG-Verpackungsmaschinen).

[0006] For an optimal balance between runnability in the packaging machine and strength and durability of the final package, the paper of the rolled paper tube advantageously has a strain-at-break in the machine direction (i.e. the longitudinal direction of the tube) of 3.0%-6.9%, such as 3.2%-6.0%.

[0007] The tube forming is preferably achieved with a lap seal, which is significantly stronger than a fin seal. Further, a lap seal results in a thinner structure than a folded fin seal (see Fig. 1), which means that a lap seal results in more even rolls and that a longer tube (i.e. more packaging material) fits on a roll of a given diameter. Uneven rolls are less stable and more difficult to handle.

[0008] The overlap of the lap seal may be in the range of 20-50 mm.

[0009] However, a lap seal still results in a portion of a flattened tube being three layers thick, whereas the rest of the flattened tube is two layers thick. To avoid that the three-layered portion always overlaps with itself in the roll, which would reduce the capacity of the roll, the rolling of the tube is preferably oscillated.

[0010] The present disclosure also provides a method of forming a pillow bag containing a product, said method comprising the steps of:

- unwinding a paper tube from a roll;
- cutting and cross-sealing the paper tube to form a bag having a sealed end portion and a non-sealed end portion;
- filling the bag with the product to obtain a filled bag; and
- cross-sealing the non-sealed end portion of the filled bag such that the pillow bag containing the product is formed.

[0011] As understood by the skilled person, the rolled paper tube described above is advantageously used in this method.

[0012] The present disclosure further provides a coated paper that is specifically developed for the packaging application discussed above. This coated paper comprises a kraft paper substrate, a pre-coating and a heat-sealable coating provided on the pre-coating, wherein:

- the paper substrate is a kraft paper having a grammage of 70-100 g/m² when measured according to ISO 536:2019;
- the pre-coating comprises binder and pigment, which pigment amounts to at least 78% of the dry weight of the pre-coating;
- the heat-sealable coating comprises

- a) EAA-based polymer in an amount of at least 51 % by weight, based on the dry weight of the heat-sealable coating, and
- b) talc pigment and/or calcium carbonate pigment; and

- 5 - the coated paper has a strain-at-break in the machine direction of 3.0%-6.9% when measured according to ISO 1924-3:2005.

BRIEF DESCRIPTION OF THE DRAWINGS

10 [0013]

Fig 1A shows a section of a tub having a lap seal. Fig 1B shows a section of a tub having a lap seal.

Fig 2A illustrates steps of a method of forming a rolled paper tube according to the present disclosure from a paper roll.

- 15 Fig 2B illustrates steps of a method of forming a filled and sealed pillow bag from a rolled paper tube according to the present disclosure.

DETAILED DESCRIPTION

20 [0014] As a first aspect of the present disclosure, there is provided a rolled paper tube. As understood by the skilled person, the rolled paper tube is formed by rolling in the longitudinal direction of the tube. As also understood by the skilled person, the paper tube is flattened to facilitate rolling.

[0015] The rolled paper tube preferably comprises a lap seal. As understood by the skilled person, the paper of the rolled paper tube is sealed to itself by this lap seal. The lap seal may be obtained by applying glue. Alternatively, heat-sealing may be used to obtain the lap seal. In such case, the paper is coated with a heat-sealable layer (discussed below).

25 [0016] The tube may be gusseted or non-gusseted.

[0017] In one embodiment, the rolling of the tube is oscillated, which stabilizes the roll. This stabilizing effect is particularly advantageous in case of a non-gusseted tube.

[0018] Benefits of a gusseted tube are that thicker packages can be obtained and that the width of the roll can be reduced. Gussets also have a stabilizing effect. Hence a gusseted tube is typically not oscillated.

30 [0019] The depth of a gusset of a gusseted tube is typically in the range of 30-130 cm.

[0020] The rolled paper tube is typically wound around a core. Accordingly, the present disclosure also provides a product comprising the rolled paper tube and a core, wherein the paper tube is wound around a core.

[0021] The core is typically pipe-shaped. However, it could also be cylinder-shaped for example. The pipe-shaped core is preferably a paperboard tube.

35 [0022] The core suitably has a diameter of 50-100 mm, such as 60-90 mm.

[0023] The rolled paper tube is typically a roll having a width of 170-800 mm, such as 185-720 mm. The exact width depends on the width of the packaging machine and the package size. The diameter of the roll is typically in the range of 300 to 2000 mm, such as 450 to 1900 mm. A larger diameter is advantageous since it fits a longer tube and hence facilitates longer periods of operation without interruption for roll changes. The space available for the roll is however typically limited, which sets an upper limit for the diameter.

[0024] The length of the paper tube is preferably at least 800 m, such as at least 1000 m. As discussed above, the upper limit for the length is typically decided by the space available in the machine for the roll.

45 [0025] The paper tube typically has a circumference of 300-1500 mm, such as 370-1440 mm. The circumference depends to the width of the packaging machine and the package size. If the width of the packaging machine is limited, gussets may enable a greater circumference.

[0026] To achieve high runnability in the packaging machine in combination with a resilient package, the paper of the rolled paper tube preferably has a strain-at-break in the machine direction (MD) of 3.0%-6.9%, more preferably 3.2%-6.0%. In a particularly preferred embodiment, the strain-at-break in the MD is 3.5%-5.0%. In the present disclosure, strain-at-break is measured according to ISO 1924-3:2005.

50 [0027] For the same reasons, the paper may (in particular when it is coated with a sealing layer) have a bending resistance index of 85-130 Nm⁶/kg³, preferably 95-120 Nm⁶/kg³, in the MD and/or 55-85 Nm⁶/kg³, preferably 59-82 Nm⁶/kg³, in the cross direction (CD).

[0028] In the present disclosure, bending resistance is measured according to ISO 2493-1:2010 using a bending angle of 15° and a test span length of 10 mm.

55 [0029] Further, the paper of the rolled paper tube may (in particular when it is coated with a sealing layer) have a tensile energy absorption (TEA) index of 1.5-2.9 J/g in the MD and/or 2.5-3.5 J/g in the CD. A preferred TEA index in the MD is 1.7-2.5 J/g.

[0030] In the present disclosure, TEA is measured according to ISO 1924-3:2005.

[0031] If not coated with a sealing layer, the grammage of the paper of the tube is typically in the range of 40-110 g/m², preferably 70-100 g/m².

[0032] When coated with a sealing layer, the grammage of the paper of the tube is typically in the range of 50-125 g/m², preferably 85-115 g/m².

[0033] In the present disclosure, grammage is measured according to ISO 536:2019.

[0034] As already indicated, an inside of the paper of the tube is preferably coated with a sealing layer, such as a heat-sealable layer. The sealing layer may be provided on a pre-coating layer. The pre-coating layer typically comprises at least 78% by dry weight of inorganic pigment, such as 80% by dry weight of inorganic pigment. The pigment of the pre-coating advantageously comprises calcium carbonate pigment and/or clay pigment.

[0035] If a pre-coating layer is not used, the base paper on which the sealing layer is coated is preferably calendered.

[0036] The sealing layer typically comprises a polymeric binder. When the sealing layer is a heat-sealable layer, the polymeric binder is preferably an ethylene acrylic acid-based (EAA-based). For example, the EAA-based polymeric binder may be an ethylene (meth)acrylic acid copolymer (EAA/EMAA), an ethylene-acrylic acid-methacrylic acid terpolymer (EAAMAA) or a mixture thereof.

[0037] The polymeric binder may amount to at least 51% of the dry weight of the heat-sealable layer, such as 51%-85% of the dry weight of the heat-sealable layer. Such proportion of polymeric binder is particularly preferred when the sealing layer is a heat-sealable layer.

[0038] In addition to the polymeric binder, the sealing layer typically comprises pigment, preferably talc and/or calcium carbonate pigment.

[0039] Pigment may for example amount to 15%-45%, such as 20%-40%, such as 25%-35%, of the dry weight of the sealing layer.

[0040] Taken together, the polymeric binder and the pigment typically amount to at least 90%, such as at least 95% of the dry weight of the sealing layer.

[0041] Further embodiments of the pre-coating and the heat-sealable layer are discussed below in connection with the fourth aspect.

[0042] Fig. 2A is a simplified illustration of the principal steps of a method of forming a rolled paper tube 25 according to the first aspect. This method starts by unwinding paper 20 from a paper roll 21. After unwinding, the paper 20 is tubed 22 and lap-sealed. The lap-sealing is preferably heat-sealing. Accordingly, the paper of the tube is preferably coated with a heat-sealable layer on the side facing the interior of the tube. The paper tube is then flattened 23. Finally, the flattened tube is rolled around a core 24 to obtain the rolled paper tube 25.

[0043] As a second aspect of the present disclosure, there is provided a use of the rolled paper tube of the first aspect for forming a pillow bag. As understood by the skilled person, the pillow bag formed according to the second aspect is preferably containing a product. Embodiments of such a product are discussed below in connection with the third aspect.

[0044] As a third aspect of the present disclosure, there is provided a method of forming a pillow bag containing a product. The method is particularly advantageous in case of a compressible product, such as a pillow, a duvet or insulation.

[0045] The method of the third aspect comprises the steps of:

- unwinding a paper tube from a roll;
- cutting and cross-sealing the paper tube to form a bag having a sealed end portion and a non-sealed end portion;
- filling the bag with the product to obtain a filled bag; and
- cross-sealing the non-sealed end portion of the filled bag such that the pillow bag containing the product is formed.

[0046] The product is preferably compressed when inserted into the bag.

[0047] As understood by the skilled person, the method of the third aspect is preferably initiated by providing a rolled paper tube according to the first aspect and then unwinding the paper tube from such a roll.

[0048] The cross-sealings of the method are preferably achieved by heat-sealing. Hence, the paper tube used in the method is preferably formed from a paper coated with a heat-sealable layer, as described herein.

[0049] The embodiments of the first aspect (discussed above) and the fourth aspect (discussed below) apply to the third aspect *mutatis mutandis*.

[0050] Fig. 2B is a simplified illustration of an embodiment of the method of the third aspect, in which a rolled paper tube 25 formed according to fig. 2A is used. Fig. 2B shows unwinding of the paper tube from the rolled paper tube 25 followed by cutting and cross-sealing 26 the paper tube to form a bag 27 having a sealed end portion 28 and a non-sealed end portion 29. The non-sealed end portion 29 is then opened and the bag 27 is filled 30 with a product to obtain a filled bag 32. For the filling 30, the opened non-sealed end portion 29 of the bag 27 may be arranged on a pipe 31 through which the product is delivered into the bag 27, e.g. by means of compressed air. In fig. 2B, the pipe 31 is curved for illustrative purposes. In practice, it may however be preferred to use a straight pipe to facilitate the delivery of the product. The non-sealed end portion of the filled bag 32 is then cross-sealed 33 to form the pillow bag 34 containing the product.

[0051] An example of a machine that can be used for the method of the third aspect is ME-306 from Merello Packaging Machines (Spain). This machine is designed to pack pillows and quilts in polyethylene bags, but it has surprisingly been shown that it can be operated with rolled paper tubes according to the present disclosure after a simple modification of the unwinding arrangement.

[0052] The various embodiment of the paper and the paper tube discussed above in connection with the first aspect and below in connection with the fourth aspect apply to the third aspect *mutatis mutandis*.

[0053] As a fourth aspect of the present disclosure, there is provided a coated paper comprising a kraft paper substrate, a pre-coating and a heat-sealable coating provided on the pre-coating. This coated paper is particularly advantageous in the tube of the first aspect, the use of the second aspect and the method of the third aspect.

[0054] The paper substrate of the fourth aspect is a kraft paper having a grammage of 70-100 g/m². The kraft paper substrate may for example be formed from a pulp comprising at least 80% by dry weight of virgin softwood pulp.

[0055] The pre-coating of the fourth aspect comprises binder and pigment. Pigment amounts to at least 78% of the dry weight of the pre-coating, such as at least 80% of the dry weight of the pre-coating. In one embodiment, pigment amounts to 81%-87% of the dry weight of the pre-coating. The binder of the pre-coating is typically a polymeric binder, such as starch, a styrene-butadiene copolymer, a styrene/acrylate copolymer or another acrylic polymer.

[0056] The coat weight of the pre-coating is preferably 5.0-17 g/m², such as 6.0-15 g/m², such as 6.0-12 g/m².

[0057] The heat-sealable coating of the fourth aspect comprises

- a) an ethylene acrylic acid-based (EAA-based) polymer, such as an ethylene (meth)acrylic acid copolymer (EAA/E-MAA), an ethylene-acrylic acid-methacrylic acid terpolymer (EAAMAA) or a mixture thereof, and
- b) talc pigment and/or calcium carbonate pigment.

[0058] a) amounts to at least 51 % of the dry weight of the heat-sealable coating.

[0059] Preferably, b) amounts to 15%-45%, such as 20%-40%, such as 25%-35%, of the dry weight of the heat-sealable coating.

[0060] Further, a) and b) together preferably amount to at least 90%, such as at least 95 %, of the dry weight of the heat-sealable coating.

[0061] The coat weight of the heat-sealable coating is preferably 2.5-10 g/m², such as 3.0-8.0 g/m², such as 3.5-7.5 g/m².

[0062] The combined coat weight of the pre-coating and the heat-sealable coating is preferably 10-19 g/m², such as 11-18 g/m².

[0063] The coated paper of the fourth aspect has a strain-at-break in the machine (MD) direction of 3.0%-6.9%, such as 3.2-6.0 %. Preferably, the strain-at-break value in the MD is in the range of 3.5%-5.0%.

[0064] The TEA index in the MD of the coated paper may be 1.5-2.9 J/g, such as 1.7-2.5 J/g.

[0065] The bending resistance index in the MD of the coated paper is typically in the range of 85-130 Nm⁶/kg³, preferably 95-120 Nm⁶/kg³. The bending resistance index in the CD of the coated paper is typically in the range of 55-85 Nm⁶/kg³, preferably 59-82 Nm⁶/kg³.

[0066] The tear index of the coated paper may be in the range of 9.5-13.5 mNm²/g in the MD and/or in the range of 10.5-14.5 mNm²/g in the CD. In the present disclosure, the tear index is measured according to ISO 1974:2012.

[0067] In an embodiment of the first aspect, the paper of the tube is a coated paper according to the fourth aspect.

EXAMPLE

[0068] A non-calendered kraft paper formed from bleached virgin softwood pulp was provided. In the production of the paper, a Clupak unit had been used to obtain the desired strain-at-break value. The grammage of the paper was about 80 g/m².

[0069] The paper was coated with of a pre-coating composition comprising (by dry weight) 100 parts of CaCO₃ pigment (Hydrocarb® 60 from OMYA), 19 parts of styrene butadiene latex (from Trinseo) and 0.62 parts of CMC rheology modifier (Finnfix 10 from Nouryon) to form a pre-coating layer. Hence pigment amounted to 83.6 of the dry weight of the pre-coating composition. The coat weight of the pre-coating layer was 8 g/m². The pre-coated paper substrate was then coated with a top coating composition comprising EAA-based polymeric binder and talc pigment in a 70:30 dry weight ratio to form a heat-sealable layer. The top coat composition further comprised 0.45% by dry weight of rheology modifier (Rheocoat 66 from Arkema) and a minor amount of a tenside. The coat weight of the heat-sealable layer was 6 g/m².

[0070] The back side of the paper was coated with 1 g/m² of starch.

[0071] Typical properties the resulting coated paper is shown in table 1 below.

EP 4 772 447 A2

Table 1. Typical properties of the coated paper. CS means coated side. BS means back/uncoated side.

Property	Unit		Value	Method
Grammage	g/m ²		95	ISO 536
Thickness	μm		115	ISO 534
Tensile strength	kN/m kN/m	MD CD	6.9 4.5	ISO 1924-3
Tensile index	Nm/g Nm/g	MD CD	75 50	ISO 1924-3
Strain-at-break	% %	MD CD	4.5 9.0	ISO 1924-3
TEA	J/m ² J/m ²	MD CD	190 280	ISO 1924-3
TEA Index	J/g J/g	MD CD	2.0 2.9	ISO 1924-3
TEA index geometric	J/g		2.4	
Tear strength	mN mN	MD CD	895 1020	ISO 1974
Tear index	mNm ² /g mNm ² /g	MD CD	9.4 10.7	ISO 1974
Brightness	%		83	ISO 2470
Opacity	%		77	ISO 2471
Gloss	%	CS	15	Tappi T480
PPS	μm	CS	4.0	ISO 8791
Cobb 60s	g/m ²	BS	27	ISO 535
Moisture	%		7.5	ISO 287

[0072] A roll of the coated paper was produced. The roll had a width of 450 mm and a diameter of 800 mm. A tube was then formed from the roll of the coated paper in a Windmüller & Hölscher POLYTEX machine. In the tubing, a lap seal was formed by applying glue. The overlap was 30 mm. In the tubing machine, the tube was also flattened (flattened tube width = 210 mm) and wound around a paperboard tube (core) having a diameter of 76 mm to form rolled paper tubes having diameters ranging from 794 mm (tube length: 2000 m) to 1090 mm (tube length: 3900 m). The rolling was oscillated (± 50 mm). Accordingly, the width of the roll formed of the rolled paper tube was 310 mm (210 mm + 2*50 mm).

[0073] The rolled paper tube was then used in a packaging machine (ME-306 from Merello Packaging Machines (Spain)), in which the unwinding arrangement had been modified. Pillow bags containing a compressible product were successfully produced in the machine.

ITEMIZED LISTING OF EMBODIMENTS

[0074]

1. A rolled paper tube.
2. The rolled paper tube of item 1, which comprises a lap seal.
3. The rolled paper tube of item 1 or 2, wherein the rolling of the tube is oscillated.
4. The rolled paper tube of any one of the preceding items, wherein the paper tube is wound around a core, which core preferably has a diameter of 50-100 mm, such as 60-90 mm.
5. The rolled paper tube of item 4, wherein the core has the shape of a pipe.

6. The rolled paper tube of item 5, wherein the core is a paperboard tube.

7. The rolled paper tube of any one of the preceding items, which forms a roll having a width of 170-800 mm, such as 185-720 mm.

8. The rolled paper tube of any one of the preceding items, which forms a roll having a diameter of 300-2000 mm, such as 450-1900 mm.

9. The rolled paper tube of any one of the preceding items, wherein the paper tube has a circumference of 300-2000 mm, such as 350-1500 mm.

10. The rolled paper tube of any one of the preceding items, wherein the length of the paper tube is at least 800 m, such as at least 1000 m.

11. The rolled paper tube of any one of the preceding items, wherein the paper has a strain-at-break in the machine direction of 3.0%-6.9%, such as 3.2%-6.0%, when measured according to ISO 1924-3:2005.

12. The rolled paper tube of any one of the preceding items, wherein the paper of the tube has a grammage of 50-120 g/m², such as 85-115 g/m², when measured according to ISO 1924-3:2005.

13. The rolled paper tube of any one of the preceding items, wherein an inside of the paper of the tube is coated with a sealing layer, such as a heat-sealable layer, which sealing layer is optionally provided on a pre-coating layer.

14. Use of the rolled paper tube of any one of the preceding items for forming a pillow bag.

15. A method of forming a pillow bag containing a product, said method comprising the steps of:

- unwinding a paper tube from a roll;
- cutting and cross-sealing the paper tube to form a bag having a sealed end portion and a non-sealed end portion;
- filling the bag with the product to obtain a filled bag; and
- cross-sealing the non-sealed end portion of the filled bag such that the pillow bag containing the product is formed.

16. The method of item 15, wherein the product is a compressible product, such as a pillow, a duvet or an insulation material.

17. A coated paper comprising a kraft paper substrate, a pre-coating and a heat-sealable coating provided on the pre-coating, wherein:

- the paper substrate is a kraft paper having a grammage of 70-100 g/m² when measured according to ISO 536:2019;
- the pre-coating comprises binder and pigment, which pigment amounts to at least 78% of the dry weight of the pre-coating;
- the heat-sealable coating comprises
 - a) an ethylene acrylic acid-based (EAA-based) polymer, such as an ethylene (meth)acrylic acid copolymer (EAA/EMAA), an ethylene-acrylic acid-methacrylic acid terpolymer (EAAMAA) or a mixture thereof, in an amount of at least 51 % by weight, based on the dry weight of the heat-sealable coating, and
 - b) talc pigment and/or calcium carbonate pigment; and
- the coated paper has a strain-at-break in the machine direction of 3.0%-6.9%, such as 3.2%-6.0%, when measured according to ISO 1924-3:2005.

Claims

1. A rolled paper tube, wherein an inside of the paper of the tube is coated with a sealing layer, such as a heat-sealable layer, which sealing layer is optionally provided on a pre-coating layer.

2. The rolled paper tube of claim 1, which comprises a lap seal.
3. The rolled paper tube of claim 1 or 2, wherein the rolling of the tube is oscillated.
- 5 4. The rolled paper tube of any one of the preceding claims, wherein the paper tube is wound around a core, which core preferably has a diameter of 50-100 mm, such as 60-90 mm.
5. The rolled paper tube of claim 4, wherein the core is a pipe-shaped core, such as a paperboard tube.
- 10 6. The rolled paper tube of any one of the preceding claims, which forms a roll having a width of 170-800 mm, such as 185-720 mm.
7. The rolled paper tube of any one of the preceding claims, which forms a roll having a diameter of 300-2000 mm, such as 450-1900 mm.
- 15 8. The rolled paper tube of any one of the preceding claims, wherein the paper tube has a circumference of 300-2000 mm, such as 350-1500 mm.
- 20 9. The rolled paper tube of any one of the preceding claims, wherein the length of the paper tube is at least 800 m, such as at least 1000 m.
10. The rolled paper tube of any one of the preceding claims, wherein the paper has a strain-at-break in the machine direction of 3.0%-6.9%, such as 3.2%-6.0%, when measured according to ISO 1924-3:2005.
- 25 11. The rolled paper tube of any one of the preceding claims, wherein the paper of the tube has a grammage of 50-120 g/m², such as 85-115 g/m², when measured according to ISO 1924-3:2005.
- 30 12. The rolled paper tube according to any one of the preceding claims, wherein the paper comprises a kraft paper substrate, a pre-coating and a heat-sealable coating provided on the pre-coating, wherein:
 - the paper substrate is a kraft paper having a grammage of 70-100 g/m² when measured according to ISO 536:2019;
 - the pre-coating comprises binder and pigment, which pigment amounts to at least 78% of the dry weight of the pre-coating;
 - 35 - the heat-sealable coating comprises
 - a) an ethylene acrylic acid-based (EAA-based) polymer, such as an ethylene (meth)acrylic acid copolymer (EAA/EMAA), an ethylene-acrylic acid-methacrylic acid terpolymer (EAAMAA) or a mixture thereof, in an amount of at least 51 % by weight, based on the dry weight of the heat-sealable coating, and
 - 40 b) talc pigment and/or calcium carbonate pigment; and
 - the coated paper has a strain-at-break in the machine direction of 3.0%-6.9%, such as 3.2%-6.0%, when measured according to ISO 1924-3:2005.
- 45 13. Use of the rolled paper tube of any one of the preceding claims for forming a pillow bag.
14. A method of forming a pillow bag containing a product, said method comprising the steps of:
 - providing a rolled paper tube, wherein an inside of the paper of the tube is coated with a sealing layer, such as a
 - 50 heat-sealable layer, which sealing layer is optionally provided on a pre-coating layer,
 - unwinding the paper tube from the roll;
 - cutting and cross-sealing the paper tube to form a bag having a sealed end portion and a non-sealed end portion;
 - filling the bag with the product to obtain a filled bag; and
 - 55 - cross-sealing the non-sealed end portion of the filled bag such that the pillow bag containing the product is formed.
15. The method of claim 14, wherein the product is a compressible product, such as a pillow, a duvet or an insulation material.

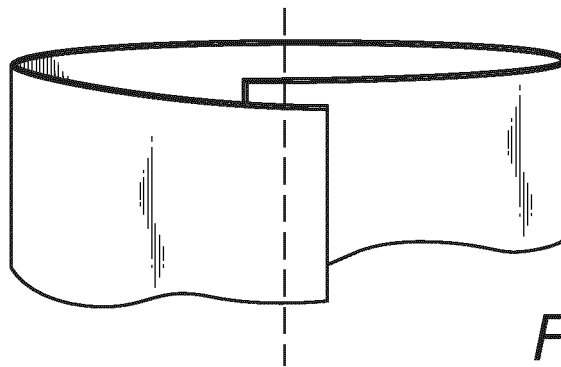


Fig. 1a

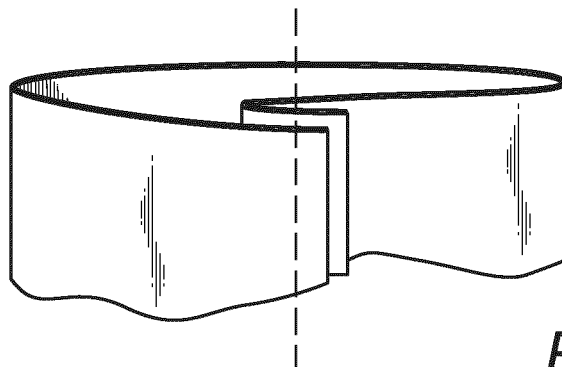


Fig. 1b

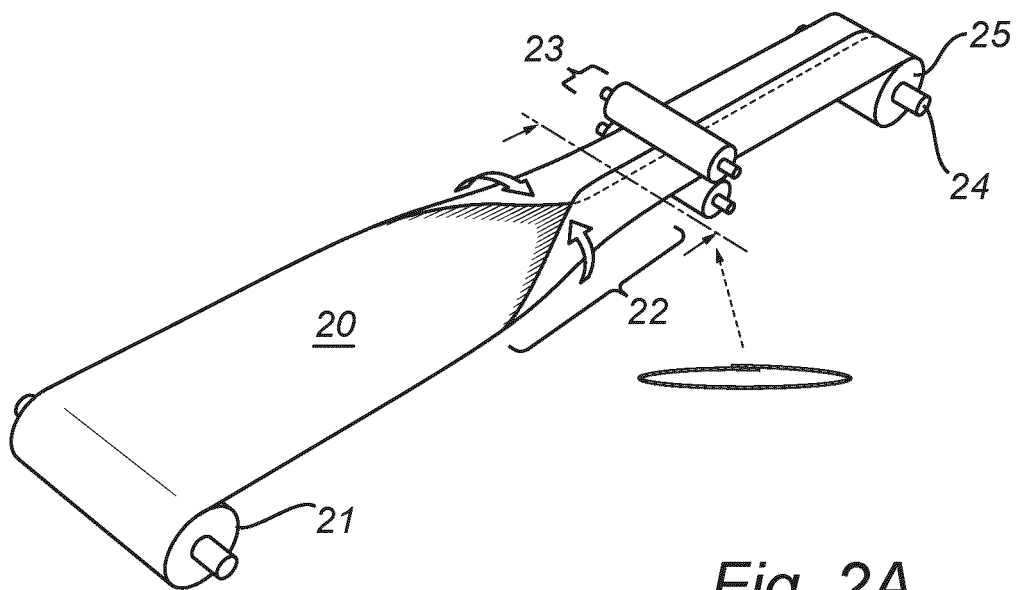


Fig. 2A

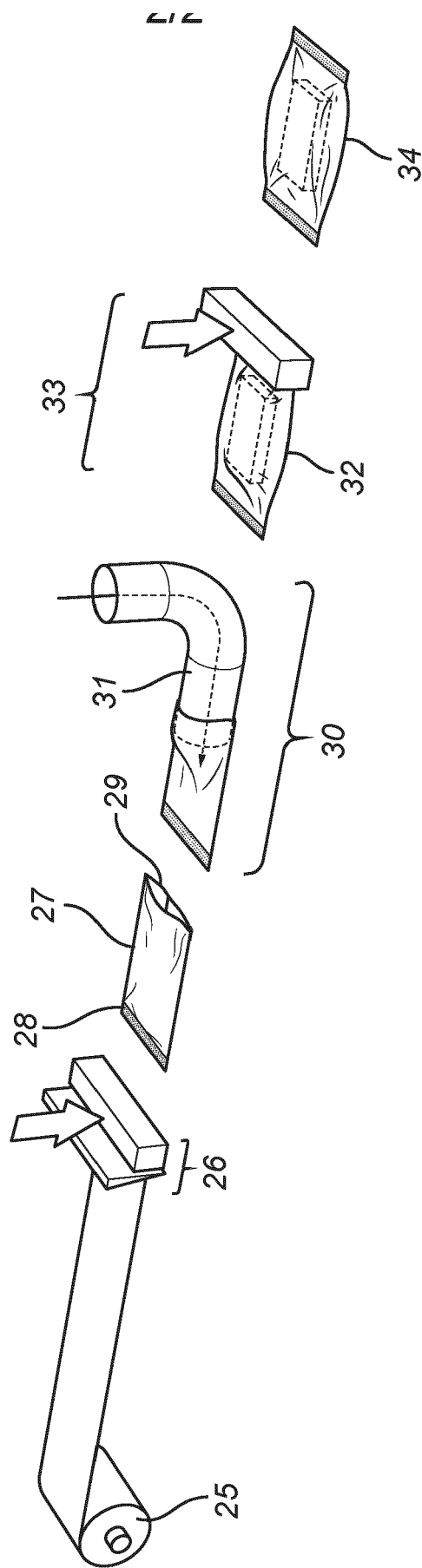


Fig. 2B

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 9399330 B2 [0005]