(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 501 140 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
05.02.2025 Bulletin 2025/06

(21) Application number: **22935370.1**

(22) Date of filing: **31.03.2022**

(51) International Patent Classification (IPC):
A24C 5/46 *(2006.01)* ***A24D 3/02*** *(2006.01)*
A24D 3/04 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A24C 5/46; A24D 3/02; A24D 3/04

(86) International application number:
PCT/JP2022/016387

(87) International publication number:
WO 2023/188225 (05.10.2023 Gazette 2023/40)

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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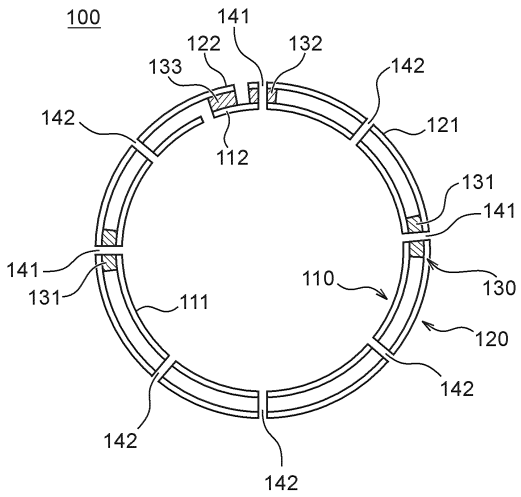
(54) **TUBULAR BODY**

(57) This tubular body comprises: a first sheet-shaped material that has a circular or elliptical cross-sectional shape orthogonal to the axial direction; a second sheet-shaped material that is provided to the outer circumference of the first sheet-shaped material and that has a circular or elliptical cross-sectional shape orthogonal to the axial direction; an adhesive layer that is provided between the first sheet-shaped material and the second sheet-shaped material and that adheres the first sheet-shaped material and the second sheet-shaped material to each other; and a plurality of vent holes that pass through the first sheet-shaped material and the second sheet-shaped material and that are formed in the circumferential direction of the tubular body. The plurality of vent holes include at least one first vent hole in which the adhesive layer is exposed to an inner surface of the vent hole, and at least one second vent hole in which the adhesive layer is not exposed to the inner surface of the vent hole.

Fig. 3



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Description

TECHNICAL FIELD

[0001] The present invention relates to a tubular body.

BACKGROUND ART

[0002] Conventionally, a double-layered tube (tubular body) manufactured from first and second material strip portions is known (see, for example, PTL 1). This double-layered tube is applicable, for example, to a flavor generating article for use in a non-combustible flavor inhaler for inhaling flavor or the like without combusting any material, or to a combustible smoking article.

[0003] In this tube, the second material strip portion is disposed around the first material strip portion, and the first and second material strip portions have abutment edges wound to be shifted from each other in a circumferential direction. Furthermore, in this tube, a positioning adhesive and a joint adhesive (collectively referred to as an adhesive) are provided on the entire surface or almost the entire surface between the first material strip portion and the second material strip portion.

CITATION LIST

PATENT LITERATURE

[0004] PTL 1: Japanese Patent Laid-Open No. 2018-93867

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] When a tube described in PTL 1 is applied to a flavor generating article or a smoking article, this application includes incorporating the tube into a semifinished product of the flavor generating article or the smoking article, then irradiating the tube with laser beams from an outer circumference toward an inner circumference of the tube and combusting a material of the tube at irradiated spots. Consequently, vent holes extending through the tube can be formed intermittently over an entire circumference of the tube in a circumferential direction.

[0006] Here, in the tube described in PTL 1, an adhesive is provided on the entire surface or almost the entire surface between a first material strip portion and a second material strip portion. Therefore, when forming the vent holes, combustion ash of the adhesive may close the vent holes.

[0007] Specifically, paper constituting the tube is, for example, organic wood pulp (almost pure cellulose from which lignin, hemicellulose, and the like contained in trees are removed) and an inorganic filler (calcium carbonate), and the combustion ash generated by irradiation with laser beams is mainly calcium carbonate.

[0008] In contrast, the adhesive is, for example, a kneaded material of modified starch, vinyl acetate or ethylene vinyl acetate, which is an organic polymer, alcohols and water, and the combustion ash generated by the irradiation with laser beams contains organic polymers left over from combustion.

[0009] Therefore, the combustion ash in the vent holes formed at spots to which the adhesive is applied is a mixture of calcium carbonate and organic polymers and is stickier and more likely to close the vent holes than calcium carbonate-dominant combustion ash in the vent holes formed at spots to which the adhesive is not applied.

[0010] If the tube with the vent holes closed is applied to the flavor generating article or the smoking article, air is not introduced from the vent holes into the flavor generating article or the smoking article. Consequently, aerosol generated by heating the flavor generating article or by combusting the smoking article is not cooled, and aerosol concentration is not reduced. There is therefore concern that the flavor generating article or the smoking article deteriorates in quality.

[0011] The present invention has been made to solve at least some of such problems as described above, and an object of the present invention is to obtain a tubular body capable of inhibiting combustion ash of an adhesive from closing vent holes if the vent holes are formed.

SOLUTION TO PROBLEM

[0012] In a first aspect of the present invention, a tubular body is provided. This tubular body includes a first sheet material that has a circular or elliptical cross-sectional shape perpendicular to an axial direction, a second sheet material that is provided on an outer circumference of the first sheet material and that has a circular or elliptical cross-sectional shape perpendicular to the axial direction, an adhesive layer that is provided between the first sheet material and the second sheet material and that bonds the first sheet material and the second sheet material to each other, and a plurality of vent holes formed in a circumferential direction of the tubular body through the first sheet material and the second sheet material, wherein the plurality of vent holes including at least one first vent hole in which the adhesive layer is exposed to a hole inner surface of the vent hole, and at least one second vent hole in which the adhesive layer is not exposed to the hole inner surface of the vent hole.

[0013] According to the first aspect of the present invention, the plurality of vent holes includes the at least one first vent hole in which the adhesive layer is exposed to the hole inner surface of the vent hole, and the at least one second vent hole in which the adhesive layer is not exposed to the hole inner surface of the vent hole. Consequently, probability of forming the vent hole at a spot provided with the adhesive layer can be reduced, and combustion ash of an adhesive can be inhibited from

closing the vent holes.

[0014] For a second aspect of the present invention, in the first aspect, the first sheet material and the second sheet material are shifted from each other and stacked such that ends of the first and second sheet materials in the circumferential direction do not overlap each other, the first sheet material includes a first body portion, and a first extending portion extending from the first body portion in the circumferential direction with respect to the opposing second sheet material, the second sheet material includes a second body portion, and a second extending portion extending from the second body portion in the circumferential direction with respect to the opposing first sheet material, the adhesive layer includes a positioning adhesive layer that bonds the first body portion and the second body portion to each other, and a joint adhesive layer that bonds the first extending portion and the second extending portion to each other, and the positioning adhesive layer has an adhesive pattern of a positioning glue applied linearly.

[0015] According to the second aspect of the present invention, since the positioning adhesive layer bonding the first body portion of the first sheet material and the second body portion of the second sheet material to each other has the adhesive pattern of the positioning glue applied linearly, an amount of adhesive applied can be reduced as compared with a case where the positioning adhesive layer is provided on the entire surface.

[0016] For a third aspect of the present invention, in the second aspect, the positioning glue is applied linearly in two or more lines.

[0017] According to the third aspect of the present invention, since the positioning adhesive layer has an adhesive pattern of the positioning glue applied linearly in two or more lines, the amount of adhesive applied can be reduced as compared with the case where the positioning adhesive layer is provided on the entire surface.

[0018] For a fourth aspect of the present invention, in the third aspect, the positioning glue is applied in a straight line.

[0019] According to the fourth aspect of the present invention, since the positioning adhesive layer has an adhesive pattern of the positioning glue applied in two or more straight lines, the amount of adhesive applied can be reduced as compared with the case where the positioning adhesive layer is provided on the entire surface.

[0020] For a fifth aspect of the present invention, in the fourth aspect, the positioning glue is applied in a straight line parallel to the axial direction.

[0021] According to the fifth aspect of the present invention, since the positioning adhesive layer has an adhesive pattern of the positioning glue applied in two or more straight lines parallel to the axial direction, the amount of adhesive applied can be reduced as compared with the case where the positioning adhesive layer is provided on the entire surface.

[0022] For a sixth aspect of the present invention, in the fourth aspect, the positioning glue is applied in a straight line perpendicular to the axial direction.

[0023] According to the sixth aspect of the present invention, since the positioning adhesive layer has an adhesive pattern of the positioning glue applied in two or more lines perpendicular to the axial direction, the amount of adhesive applied can be reduced as compared with the case where the positioning adhesive layer is provided on the entire surface.

[0024] For a seventh aspect of the present invention, in the second aspect, the positioning glue is applied spirally along the axial direction.

[0025] According to the seventh aspect of the present invention, since the positioning adhesive layer has an adhesive pattern of the positioning glue applied spirally along the axial direction, the amount of adhesive applied can be reduced as compared with the case where the positioning adhesive layer is provided on the entire surface.

[0026] For an eighth aspect of the present invention, in any one of the first to seventh aspects, each of the first sheet material and the second sheet material is paper.

[0027] According to the eighth aspect of the present invention, the first sheet material and second sheet material made of paper can improve processability of the tubular body.

[0028] For a ninth aspect of the present invention, in any one of the first to eighth aspects, the number of vent holes in the plurality of vent holes is 12 or more and 30 or less.

[0029] According to the ninth aspect of the present invention, by setting the number of the vent holes in the plurality of vent holes to 12 or more and 30 or less, the probability of forming the vent hole at the spot provided with the adhesive layer can be reduced, and combustion ash of the adhesive can be inhibited from closing the vent holes, while introducing sufficient air into an interior.

[0030] For a tenth aspect of the present invention, in the ninth aspect, the number of vent holes in the plurality of vent holes is 21 or less.

[0031] According to the tenth aspect of the present invention, by setting the number of the vent holes in the plurality of vent holes to 12 or more and 21 or less, the probability of forming the vent hole at the spot provided with the adhesive layer can be reduced, and the combustion ash of the adhesive can be inhibited from closing the vent holes, while introducing sufficient air into the interior.

[0032] For an eleventh aspect of the present invention, in any one of the first to tenth aspects, the number of vent holes in the first vent holes is 6 or less.

[0033] According to the eleventh aspect of the present invention, by setting the number of the vent holes in the first vent holes to 6 or less, the probability of forming the vent hole at the spot provided with the adhesive layer can be reduced, and the combustion ash of the adhesive can be inhibited from closing the vent holes, while introducing sufficient air into the interior.

[0034] For a twelfth aspect of the present invention, in any one of the first to eleventh aspects, a ratio of the number of vent holes in the first vent holes to the total number of vent holes in the plurality of vent holes is less than 1/4.

[0035] According to the twelfth aspect of the present invention, by setting the ratio of the number of the vent holes in the first vent holes to the total number of the vent holes in the plurality of vent holes to less than 1/4, the probability of forming the vent hole at the spot provided with the adhesive layer can be reduced, and the combustion ash of the adhesive can be inhibited from closing the vent holes, while introducing sufficient air into the interior.

[0036] For a thirteenth aspect of the present invention, in any one of the first to twelfth aspects, the plurality of vent holes is formed in two or more rows along the axial direction.

[0037] According to the thirteenth aspect of the present invention, by forming the plurality of vent holes in two or more rows along the axial direction, more air can be introduced into the interior as compared with a case where the plurality of vent holes is formed in one row.

BRIEF DESCRIPTION OF DRAWINGS

[0038]

Fig. 1 is a cross-sectional view showing a flavor generating article to which a tubular body according to one embodiment of the present invention is applied.

Fig. 2 is a perspective view showing a tubular body according to one embodiment of the present invention.

Fig. 3 is a cross-sectional view of the tubular body along arrows I-I shown in Fig. 2.

Fig. 4 is a cross-sectional view showing the tubular body of Fig. 3 developed in a circumferential direction.

Fig. 5 is a developed view showing a second sheet material of a tubular body according to one embodiment of the present invention.

Fig. 6 is another developed view showing a second sheet material of a tubular body according to one embodiment of the present invention.

Fig. 7 is still another developed view showing a second sheet material of a tubular body according to one embodiment of the present invention.

Fig. 8 is a further developed view showing a second sheet material of a tubular body according to one embodiment of the present invention.

Fig. 9 is a configuration diagram showing a tubular body manufacturing apparatus according to one embodiment of the present invention.

Fig. 10 is an explanatory diagram showing experimental results of humidification conditions in a tubular body manufacturing apparatus according to one embodiment of the present invention.

Fig. 11 is an explanatory diagram showing humidification conditions for each adhesive pattern in a tubular body manufacturing apparatus according to one embodiment of the present invention.

Fig. 12 is an explanatory diagram showing an amount of adhesive applied in a tubular body according to one embodiment of the present invention in comparison with a conventional product.

Fig. 13 is an explanatory diagram showing various physical properties of a tubular body according to one embodiment of the present invention in comparison of a standard product with the conventional product.

DESCRIPTION OF EMBODIMENTS

[0039] Hereinafter, embodiments of the present invention will be described with reference to the drawings. In the drawings described below, identical, or corresponding components are denoted with the same signs and duplicate descriptions are omitted. A tubular body according to the present invention may be applied, for example, to a flavor generating article for use in a non-combustible flavor inhaler for inhaling flavor or the like without combusting any material. The tubular body according to the present invention may be applied to a combustible smoking article.

[0040] Fig. 1 is a cross-sectional view showing a flavor generating article to which a tubular body according to one embodiment of the present invention is applied. As shown in Fig. 1, a flavor generating article 10 includes a tobacco-containing segment 11 and a mouthpiece segment 12. The mouthpiece segment 12 includes a cooling segment 13, a center hole segment 14, and a filter segment 15.

[0041] In use, the tobacco-containing segment 11 is heated and inhaled from an end of the filter segment 15. Note that a position of the center hole segment 14 is not limited to a position shown in Fig. 1 and, for example, the position of the center hole segment 14 may be replaced with that of the filter segment 15. Furthermore, in the flavor generating article 10 shown in Fig. 1, the center hole segment 14 may be omitted.

[0042] The tobacco-containing segment 11 includes a tobacco filler 210 containing tobacco and an aerosol source, and a tubular wrapper 220 wrapping the tobacco filler 210. The tobacco filler 210 may further contain a volatile flavoring ingredient, water, and the like. A size of tobacco for use as a filler or a method of preparing the tobacco is not particularly limited.

[0043] The cooling segment 13 includes a tubular body 100. In the tubular body 100 and mouthpiece lining paper 400 described later, a plurality of vent holes 140 extending through walls of both the tubular body and the mouthpiece lining paper is formed concentrically in a circumferential direction of the tubular body 100. Each vent hole 140 is a hole for promoting inflow of air from outside by user's inhalation, and the inflow of air cools aerosol

generated in the tobacco filler 210 and reduces aerosol concentration. A diameter (delivery length) of the vent hole 140 is not particularly limited, but may be, for example, from 0.5 mm to 1.5 mm.

[0044] The center hole segment 14 includes a filling layer 310 having a hollow portion and a first inner plug wrapper 320 wrapping the filling layer 310. The filling layer 310 can be, for example, a rod into which cellulose acetate fibers are highly densely filled and a plasticizer containing triacetin is added and cured.

[0045] The hollow portion has a diameter that is not particularly limited and that may be, for example, from 1.0 mm to 5.0 mm. Since the filling layer 310 has a high fiber filling density, air, and aerosol flow only through the hollow portion during inhaling, and barely flow in the filling layer 310. Since the filling layer 310 includes the hollow portion, an amount of aerosol to be filtered can be reduced, the aerosol containing flavor ingredients generated by heating the flavor generating article 10.

[0046] The filter segment 15 includes a filter medium 330, and a tubular second inner plug wrapper 340 wrapping the filter medium 330. The filter medium 330 may be a solid plug filled with a porous material. Since the filter segment 15 includes the solid plug, a delivery amount of aerosol can be appropriately adjusted by filtering the aerosol containing the flavor ingredients generated by heating the flavor generating article 10.

[0047] The center hole segment 14 and the filter segment 15 are connected to each other with an outer plug wrapper 350. The outer plug wrapper 350 may be, for example, cylindrical paper. Furthermore, the tobacco-containing segment 11, the cooling segment 13, and the connected center hole segment 14 and filter segment 15 are wrapped in the mouthpiece lining paper 400 and mutually connected, the mouthpiece lining paper having an inner surface with a glue such as vinyl acetate glue applied thereto.

[0048] Hereinafter, the tubular body 100 shown in Fig. 1 will be described in detail. Fig. 2 is a perspective view showing a tubular body according to one embodiment of the present invention. Fig. 3 is a cross-sectional view of the tubular body along arrows I-I shown in Fig. 2. Fig. 4 is a cross-sectional view of the tubular body of Fig. 3 developed in the circumferential direction.

[0049] As shown in Figs. 2 to 4, the tubular body 100 includes a first sheet material 110, a second sheet material 120, an adhesive layer 130, and vent holes 140. The first sheet material 110 and the second sheet material 120 have a circular cross-sectional shape perpendicular to an axial direction. The second sheet material 120 is provided on an outer circumference of the first sheet material 110. The adhesive layer 130 is provided between the first sheet material 110 and the second sheet material 120, to bond the first sheet material 110 and the second sheet material 120 to each other.

[0050] Each of the first sheet material 110 and the second sheet material 120 may be made of paper or cardboard. Therefore, processability of the tubular body 100 can be improved. Note that the first sheet material 110 and the second sheet material 120 may have an elliptical cross-sectional shape perpendicular to the axial direction.

[0051] Here, the first sheet material 110 and the second sheet material 120 are positioned to be shifted from each other and stacked such that ends of the materials in the circumferential direction do not overlap each other. The first sheet material 110 includes a first body portion 111, and a first extending portion 112 extending from the first body portion 111 in the circumferential direction with respect to the opposing second sheet material 120. The first body portion 111 is a portion opposing the second sheet material 120 in Fig. 4.

[0052] The second sheet material 120 includes a second body portion 121 and a second extending portion 122 extending from the second body portion 121 in the circumferential direction to the opposing first sheet material 110. The second body portion 121 is a portion opposing the first sheet material 110 in Fig. 4.

[0053] The adhesive layer 130 includes a positioning adhesive layer 131 and a first joint adhesive layer 132 that bond the first body portion 111 and the second body portion 121 to each other, and a second joint adhesive layer 133 (joint adhesive layer) that bonds the first extending portion 112 and the second extending portion 122 to each other. The first joint adhesive layer 132 does not necessarily need to be provided, and the positioning adhesive layer 131 may function as the first joint adhesive layer 132.

[0054] The positioning adhesive layer 131, the first joint adhesive layer 132 and the second joint adhesive layer 133 may be made of a kneaded material of modified starch, vinyl acetate or ethylene vinyl acetate, which is an organic polymer, alcohols, and water. The positioning adhesive layer 131, the first joint adhesive layer 132 and the second joint adhesive layer 133 are not limited to the above and may be made of another adhesive.

[0055] The tubular body 100 is formed by applying the positioning adhesive layer 131, the first joint adhesive layer 132 and the second joint adhesive layer 133 onto the second sheet material 120, stacking the first sheet material 110 and molding a tubular shape. Here, the positioning adhesive layer 131 applied to the second sheet material 120 has an adhesive pattern of a positioning glue (adhesive) applied linearly. Additionally, the positioning adhesive layer 131, the first joint adhesive layer 132 and the second joint adhesive layer 133 may be applied to the first sheet material 110 in place of the second sheet material 120.

[0056] A plurality of vent holes 140 is formed in the circumferential direction of the tubular body 100 through the first sheet material 110 and the second sheet material 120. Here, since the positioning adhesive layer 131 applied to the second sheet material 120 has an adhesive pattern of the positioning glue (adhesive) applied linearly, the plurality of vent holes 140 includes a first vent hole 141 in which the adhesive layer 130 is exposed to a hole

inner surface of a vent hole 140, and a second vent hole 142 in which the adhesive layer 130 is not exposed to the hole inner surface of the vent hole 140.

[0057] Specifically, the first vent hole 141 is formed through the first sheet material 110 and the second sheet material 120, together with any of the positioning adhesive layer 131, the first joint adhesive layer 132 and the second joint adhesive layer 133. Furthermore, the second vent hole 142 is formed through the first sheet material 110 and the second sheet material 120 at a spot that is not provided with any of the positioning adhesive layer 131, the first joint adhesive layer 132 and the second joint adhesive layer 133.

[0058] As described above, the plurality of vent holes 140 includes at least one first vent hole 141 in which the adhesive layer 130 is exposed to the hole inner surface of the vent hole 140, and at least one second vent hole 142 in which the adhesive layer 130 is not exposed to the hole inner surface of the vent hole 140, so that probability of forming the vent hole 140 at a spot provided with the adhesive layer 130 can be reduced, and combustion ash of an adhesive can be inhibited from closing the vent hole 140. As a result, the flavor generating article 10 to which the tubular body 100 is applied can be inhibited from deteriorating in quality.

[0059] Fig. 5 is a developed view showing a second sheet material of a tubular body according to one embodiment of the present invention. As shown in Fig. 5, the second sheet material 120 includes a positioning adhesive layer 131 to which a positioning glue is applied in two straight lines parallel to the axial direction.

[0060] Thus, since the positioning adhesive layer 131 has an adhesive pattern of the positioning glue applied in two straight lines parallel to the axial direction, an amount of adhesive applied can be reduced as compared with a case where the positioning adhesive layer is provided on the entire surface. Furthermore, the probability of forming the vent hole 140 at the spot provided with the adhesive layer 130 can be reduced, and the combustion ash of the adhesive can be inhibited from closing the vent hole 140.

[0061] Note that the adhesive pattern of the positioning adhesive layer 131 is not limited to that shown in Fig. 5. Fig. 6 is another developed view showing a second sheet material of a tubular body according to one embodiment of the present invention. As shown in Fig. 6, a second sheet material 120 includes a positioning adhesive layer 131 of a positioning glue applied spirally along an axial direction.

[0062] Thus, since the positioning adhesive layer 131 has an adhesive pattern of the positioning glue applied spirally along the axial direction, an amount of adhesive applied can be reduced as compared with the case where the positioning adhesive layer is provided on the entire surface. Furthermore, the probability of forming the vent hole 140 at the spot provided with the adhesive layer 130 can be reduced, and the combustion ash of the adhesive can be inhibited from closing the vent hole 140.

[0063] Fig. 7 is another developed view showing a second sheet material of a tubular body according to one embodiment of the present invention. As shown in Fig. 7, a second sheet material 120 includes a positioning adhesive layer 131 to which a positioning glue is applied in three straight lines parallel to an axial direction.

[0064] Thus, since the positioning adhesive layer 131 has an adhesive pattern of the positioning glue applied in three straight lines parallel to the axial direction, the amount of adhesive applied can be reduced as compared with the case where the positioning adhesive layer is provided on the entire surface. Furthermore, the probability of forming the vent hole 140 at the spot provided with the adhesive layer 130 can be reduced, and the combustion ash of the adhesive can be inhibited from closing the vent hole 140.

[0065] Fig. 8 is another developed view showing a second sheet material of a tubular body according to one embodiment of the present invention. As shown in Fig. 8, a second sheet material 120 includes a positioning adhesive layer 131 to which a positioning glue is applied in three straight lines perpendicular to an axial direction. The positioning glue may be applied in two lines, or four or more lines.

[0066] Thus, since the positioning adhesive layer 131 has an adhesive pattern of the positioning glue applied in three straight lines perpendicular to an axial direction, the amount of adhesive applied can be reduced as compared with the case where the positioning adhesive layer is provided on the entire surface. Furthermore, the probability of forming the vent hole 140 at the spot provided with the adhesive layer 130 can be reduced, and the combustion ash of the adhesive can be inhibited from closing the vent hole 140.

[0067] Here, the number of vent holes 140 in a plurality of vent holes 140 is preferably 12 or more and 30 or less, more preferably 21 or less. By setting the number of the vent holes 140 in the plurality of vent holes 140 to 12 or more and 30 or less, more preferably 21 or less, the probability of forming the vent hole 140 at the spot provided with the adhesive layer 130 can be reduced, and the combustion ash of the adhesive can be inhibited from closing the vent hole 140, while introducing sufficient air into an interior.

[0068] It is also preferable that the number of first vent holes 141 is 6 or less. By setting the number of the first vent holes 141 to 6 or less, the probability of forming the vent hole 140 at the spot provided with the adhesive layer 130 can be reduced, and the combustion ash of the adhesive can be inhibited from closing the vent hole 140, while introducing sufficient air into the interior.

[0069] Furthermore, a ratio of the number of the first vent holes 141 to the total number of the plurality of vent holes 140 is preferably less than 1/4. By setting the ratio of the number of the first vent holes 141 to the total number of the plurality of vent holes 140 to less than 1/4, the probability of forming the vent hole 140 at the spot provided with the adhesive layer 130 can be reduced, and the combustion ash of the adhesive can be inhibited from

closing the vent hole 140, while introducing sufficient air into the interior.

[0070] Note that the plurality of vent holes 140 may be formed in two or more rows along the axial direction. By forming the plurality of vent holes 140 in two or more rows along the axial direction, more air can be introduced into the interior as compared with a case where the plurality of vent holes 140 are formed in one row.

[0071] Furthermore, by reducing the amount of adhesive applied by use of the second sheet materials 120 shown in Figs. 5 to 8, adhesive ingredients generated by heating or combusting from the tubular body 100 applied to a flavor generating article or a smoking article are reduced, and flavor of the flavor generating article or smoking taste of the smoking article is inhibited from deteriorating.

[0072] In addition, reduction in amount of adhesive applied also reduces cost. Furthermore, the reduction in amount of adhesive applied reduces glue residue of the adhesive adhering to a manufacturing apparatus of the tubular body 100 and also reduces risk of stopping the manufacturing apparatus, so that a time for removing the glue residue can be shortened, and productivity of the tubular body 100 can be improved.

[0073] Next, a method for manufacturing the tubular body 100 will be described. Fig. 9 is a configuration diagram showing a tubular body manufacturing apparatus according to one embodiment of the present invention. In a tubular body manufacturing apparatus 1 shown in Fig. 9, a sheet material 24 having an appropriate width is drawn from a bobbin (not shown) of a sheet material feeding device 22 in a conveying direction 34 and conveyed in a longitudinal direction via a plurality of direction changing rollers 41.

[0074] The sheet material 24 is cut out in the longitudinal direction in a cutting-out part 23. Specifically, the sheet material 24 is cut out into the first sheet material 110 having a first width and the second sheet material 120 having a second width. The cut-out first sheet material 110 and second sheet material 120 are conveyed in parallel via the direction changing rollers 41 and separated from each other with a lateral conveying roller 32.

[0075] After the direction changing rollers 41 change a direction of the second sheet material 120, a gluing part 25 applies the positioning adhesive layer 131, the first joint adhesive layer 132 and the second joint adhesive layer 133 (see Fig. 4) over an entire length in the longitudinal direction (applying step). Here, the positioning adhesive layer 131 has an adhesive pattern of a positioning glue (adhesive) applied linearly (see Figs. 5 to 8).

[0076] Subsequently, a humidification nozzle 26 humidifies the second sheet material 120 (humidification step). The humidification nozzle 26 injects water onto the surface of the second sheet material 120 with the positioning adhesive layer 131 applied thereto. Note that the humidification nozzle 26 may inject alcohol onto the second sheet material 120 in place of water or spray steam onto the second sheet material 120.

[0077] Thus, spots of the second sheet material 120 with the positioning adhesive layer 131, the first joint adhesive layer 132 and the second joint adhesive layer 133 applied thereto and the other spots have an equivalent humidity. In a subsequent step of molding the second sheet material 120 into a tubular shape, the material can be uniformly deformed, and the tubular body 100 having a high roundness can therefore be obtained.

[0078] In contrast, the first sheet material 110, separated from the second sheet material 120, is conveyed and positioned to be shifted in a lateral direction with respect to the conveying direction by a position shifting section 29. Afterward, a pair of tensile rollers 28 integrates the first sheet material 110 and the second sheet material 120 (bonding step).

[0079] Consequently, the first sheet material 110 and the second sheet material 120 are shifted from each other and bonded such that ends of the materials in a width direction perpendicular to the longitudinal direction do not overlap each other. Specifically, the positioning adhesive layer 131 and the first joint adhesive layer 132, applied to the second sheet material 120, bond the first body portion 111 and the second body portion 121 to each other (see Fig. 4).

[0080] Note that the tubular body manufacturing apparatus 1 may include a sensor that detects the ends of the first sheet material 110 and second sheet material 120 in the width direction, and a control mechanism for controlling an amount of position shift between the first sheet material 110 and the second sheet material 120.

[0081] Next, the first sheet material 110 and second sheet material 120, shifted from each other and bonded, are conveyed to a molding device 30. In the molding device 30, an endless molding belt 43 is guided endlessly via a plurality of direction changing rollers 41. The first sheet material 110 and the second sheet material 120 conveyed to the molding device 30 are pressed onto the molding belt 43 by a pressing part 44.

[0082] Afterward, the molding device 30 molds the first sheet material 110 and the second sheet material 120 into a tubular continuous body 31, for example, by a known method described in Japanese Patent Laid-Open No. 2018-121628 (molding step). In this step, the second joint adhesive layer 133 applied to the second sheet material 120 bonds the first extending portion 112 and the second extending portion 122 to each other (see Fig. 4).

[0083] Subsequently, the first sheet material 110 and second sheet material 120 molded into the tubular continuous body 31 are heated by a heating part 37, to thereby cure the positioning adhesive layer 131, the first joint adhesive layer 132 and the second joint adhesive layer 133. Furthermore, the second sheet material 120 humidified by the humidification nozzle 26 is also dried in the heating part 37.

[0084] Next, a cutting part 38 cuts, to a predetermined length, the first sheet material 110 and second sheet material 120 molded into the tubular continuous body

31 (cutting step), to form the tubular body 100. In the tubular body manufacturing apparatus 1, the first sheet material 110 and the second sheet material 120 may be replaced with each other.

[0085] Subsequently, the tubular body 100 is incorporated into a semi-finished product of the flavor generating article or the smoking article and then irradiated with laser beams from an outer circumference toward an inner circumference of the tubular body 100, and the materials at irradiated spots are combusted, to form a plurality of vent holes 140 extending through the tubular body 100 intermittently over an entire circumference in the circumferential direction.

[0086] Next, results of various experiments performed by use of the tubular body manufacturing apparatus 1 will be described. First, an experiment was performed to find out appropriate humidification conditions by the humidification nozzle 26. Fig. 10 is an explanatory diagram showing experimental results of humidification conditions in a tubular body manufacturing apparatus according to one embodiment of the present invention. Such an experiment was performed by changing the humidification conditions when the positioning glue was applied, onto the second sheet material 120, in three straight lines parallel to the axial direction (see Fig. 7).

[0087] As shown in Fig. 10, when the tubular body 100 was manufactured while changing the humidification conditions from level 1 to level 9 for a water content, an injection pressure, and a distance from the humidification nozzle 26 to the second sheet material 120 (humidification nozzle distance), it was confirmed that level 6 (water content of 6.34 mg/line, injection pressure of 0.05 MPa, humidification nozzle distance of 17 mm) was appropriate in roundness and circumferential length.

[0088] Subsequently, according to the level 6 shown in Fig. 10, when manufacturing the tubular body 100 (see Fig. 6) with the positioning glue applied, onto the second sheet material 120, spirally along the axial direction, bonding of the first extending portion 112 and the second extending portion 122 by the second joint adhesive layer 133 (see Fig. 4) was not appropriately performed.

[0089] Then, an experiment was performed on the tubular body 100 (see Fig. 6) with a positioning glue applied spirally along the axial direction to the second sheet material 120, while changing the water content. As a result, it was confirmed that a water content of 28.20 mg/line is appropriate for the tubular body 100 with the positioning glue applied spirally. Fig. 11 shows humidification conditions for each adhesive pattern in the tubular body manufacturing apparatus 1.

[0090] Next, an experiment was performed while changing an application amount of the positioning adhesive layer 131, for the tubular body 100 (see Fig. 6) with the positioning glue applied, to the second sheet material 120, spirally along the axial direction, and the tubular body 100 (see Fig. 5) with the positioning glue applied, to the second sheet material 120, in two straight lines parallel to the axial direction.

[0091] As a result, it was confirmed that an application amount of 20 g/500 m (4.8 mg/line) is appropriate for the tubular body 100 with the positioning glue applied spirally, and 25 g/500 m (3.0 mg/line $\times$ 2) is appropriate for the tubular body 100 with the positioning glue applied in two lines. Fig. 12 shows the result of comparison with a conventional product in terms of the application amount of the positioning adhesive layer 131 in the tubular body 100.

[0092] As shown in Fig. 12, in the tubular body 100 to which the positioning glue is applied spirally, the application amount of the positioning adhesive layer 131 can be reduced by 80% as compared with the conventional product (application amount of 100 g/500 m (24 mg/line)). Furthermore, in the tubular body 100 to which the positioning glue is applied in two lines, the application amount of the positioning adhesive layer 131 can be reduced by 75% as compared with the conventional product.

[0093] Subsequently, on the humidification conditions and with the application amount of the positioning adhesive layer 131 as shown in Figs. 11 and 12, the tubular body 100 (see Fig. 6) with the positioning glue applied, to the second sheet material 120, spirally along the axial direction and a tubular body 100 (see Fig. 5) with the positioning glue applied, to the second sheet material 120, in two straight lines parallel to the axial direction were manufactured and measured for various physical properties. Fig. 13 shows results of comparison of the standard product with the conventional product in terms of various physical properties of the tubular body 100.

[0094] Here, the physical properties of the tubular body 100 immediately after the formation of the tubular body 100 and after 24 hours were measured in consideration of influence of humidification by the humidification nozzle 26, for the tubular body 100 with the positioning glue applied spirally and the tubular body 100 with the positioning glue applied in two lines. In addition, moisture was measured after one week.

[0095] As shown in Fig. 13, it was confirmed that the tubular body 100 has a weight equivalent to that of the conventional product immediately after formed and tends to be lighter in weight due to decrease in moisture with elapse of time. It was also confirmed that a circumference length and hardness have a value varying with the decrease in moisture with elapse of time.

[0096] It was also confirmed that both the tubular body 100 with the positioning glue applied spirally and the tubular body 100 with the positioning glue applied in two lines have roundness equivalent to that of the standard product. Furthermore, both the tubular body 100 with the positioning glue applied spirally and the tubular body 100 with the positioning glue applied in two lines have the same structure of a joint portion between the first extending portion 112 and the second extending portion 122 as in the conventional product and therefore indicate a value of joint peel strength equal to that of the conventional product.

[0097] In addition, by setting an area of the positioning

adhesive layer 131 to 10% or more and 50% or less of an area of an overlapping portion between the first body portion and the second body portion, a tubular body capable of suppressing an adhering defect between the first sheet material 110 and the second sheet material 120 and having excellent roundness and less influence on flavor and smoking taste can be obtained.

[0098] As described above, embodiments of the present invention have been described, and the embodiments of the above-described invention are for facilitating understanding of the present invention and are not intended to limit the present invention. The present invention may be modified or improved without departing from its gist, and the present invention includes equivalents thereto. Furthermore, respective components described in the claims and the specification can be combined or omitted to such an extent that at least some of the above-described issues can be solved or at least some of effects are achieved.

REFERENCE SIGNS LIST

[0099]

1 tubular body manufacturing apparatus
10 flavor generating article
11 tobacco-containing segment
12 mouthpiece segment
13 cooling segment
14 center hole segment
15 filter segment
22 sheet material feeding device
23 cutting-out part
24 sheet material
25 gluing part
26 humidification nozzle
28 pair of tensile rollers
29 position shifting section
30 molding device
31 tubular continuous body
32 lateral conveying roller
34 conveying direction
37 heating part
38 cutting part
41 direction changing rollers
43 molding belt
44 pressing part
100 tubular body
110 first sheet material
111 first body portion
112 first extending portion
120 second sheet material
121 second body portion
122 second extending portion
130 adhesive layer
131 positioning adhesive layer
132 first joint adhesive layer
133 second joint adhesive layer
140 vent hole
141 first vent hole
142 second vent hole
210 tobacco filler
220 wrapper
310 filling layer
320 first inner plug wrapper
330 filter medium
340 second inner plug wrapper
350 outer plug wrapper
400 mouthpiece lining paper

Claims

1. A tubular body comprising:

a first sheet material that has a circular or elliptical cross-sectional shape perpendicular to an axial direction,
a second sheet material that is provided on an outer circumference of the first sheet material and that has a circular or elliptical cross-sectional shape perpendicular to the axial direction,
an adhesive layer that is provided between the first sheet material and the second sheet material and that bonds the first sheet material and the second sheet material to each other, and
a plurality of vent holes formed in a circumferential direction of the tubular body through the first sheet material and the second sheet material,
wherein the plurality of vent holes including at least one first vent hole in which the adhesive layer is exposed to a hole inner surface of the vent hole, and at least one second vent hole in which the adhesive layer is not exposed to the hole inner surface of the vent hole.

2. The tubular body according to claim 1, wherein the first sheet material and the second sheet material are shifted from each other and stacked such that ends of the first and second sheet materials in the circumferential direction do not overlap each other,

the first sheet material includes a first body portion, and a first extending portion extending from the first body portion in the circumferential direction with respect to the opposing second sheet material,
the second sheet material includes a second body portion, and a second extending portion extending from the second body portion in the circumferential direction with respect to the opposing first sheet material,
the adhesive layer includes a positioning adhesive layer that bonds the first body portion and the second body portion to each other, and a joint adhesive layer that bonds the first extend-

ing portion and the second extending portion to each other, and
the positioning adhesive layer has an adhesive pattern of a positioning glue applied linearly.

3. The tubular body according to claim 2, wherein the positioning glue is applied linearly in two or more lines.

4. The tubular body according to claim 3, wherein the positioning glue is applied in a straight line.

5. The tubular body according to claim 4, wherein the positioning glue is applied in a straight line parallel to the axial direction.

6. The tubular body according to claim 4, wherein the positioning glue is applied in a straight line perpendicular to the axial direction.

7. The tubular body according to claim 2, wherein the positioning glue is applied spirally along the axial direction.

8. The tubular body according to any one of claims 1 to 7, wherein each of the first sheet material and the second sheet material is paper.

9. The tubular body according to any one of claims 1 to 8, wherein the number of vent holes in the plurality of vent holes is 12 or more and 30 or less.

10. The tubular body according to claim 9, wherein the number of vent holes in the plurality of vent holes is 21 or less.

11. The tubular body according to any one of claims 1 to 10, wherein the number of vent holes in the first vent holes is 6 or less.

12. The tubular body according to any one of claims 1 to 11, wherein a ratio of the number of vent holes in the first vent holes to the total number of vent holes in the plurality of vent holes is less than 1/4.

13. The tubular body according to any one of claims 1 to 12, wherein the plurality of vent holes is formed in two or more rows along the axial direction.

Fig. 1

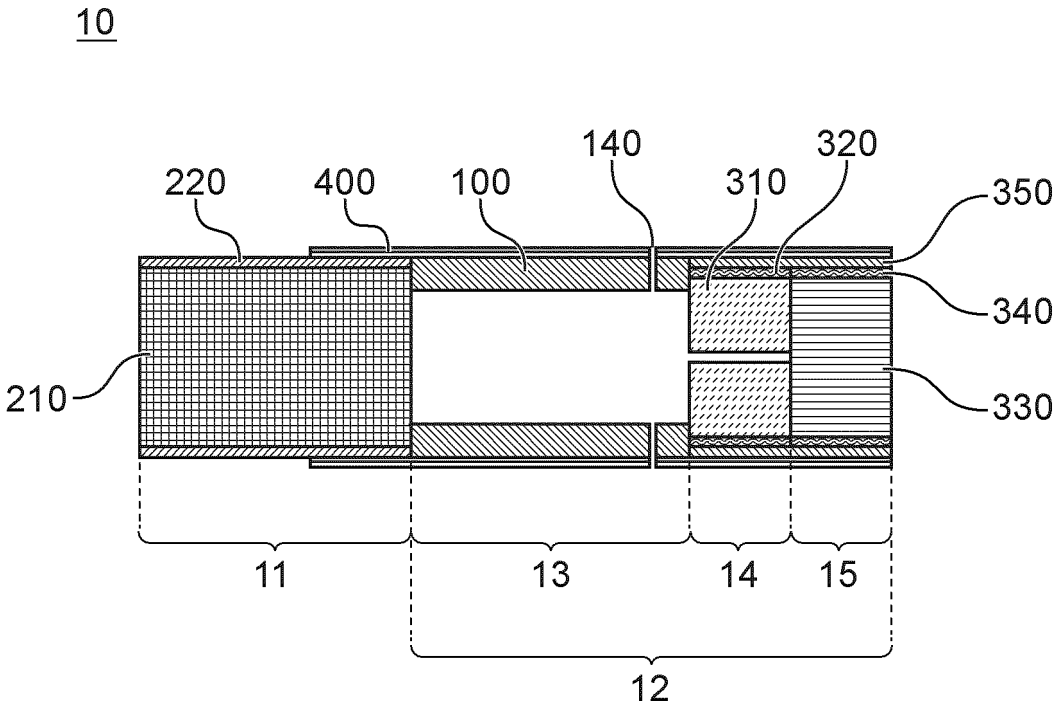

Fig. 2

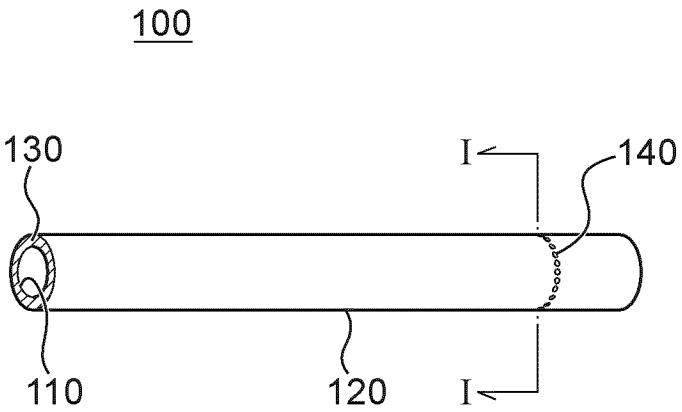

Fig. 3

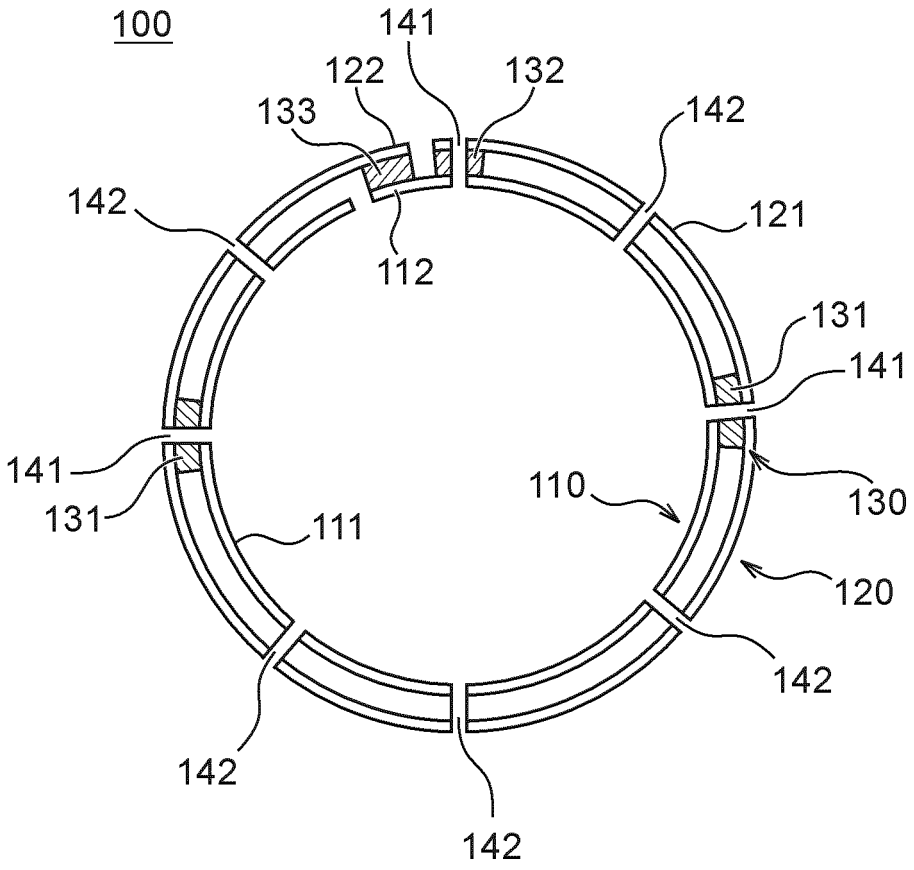
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Fig. 4

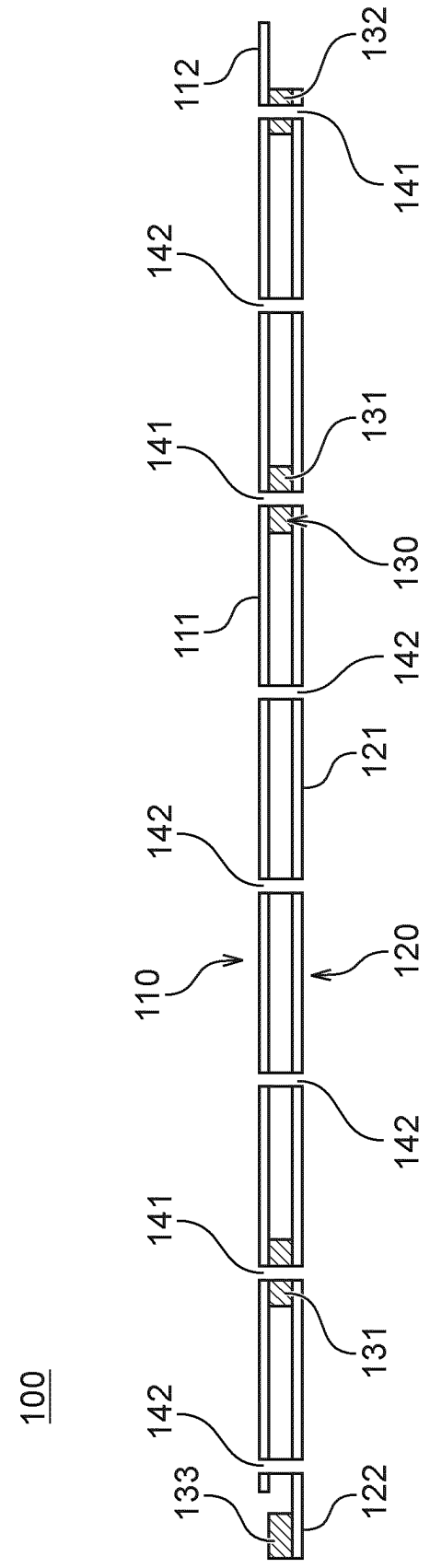

Fig. 5

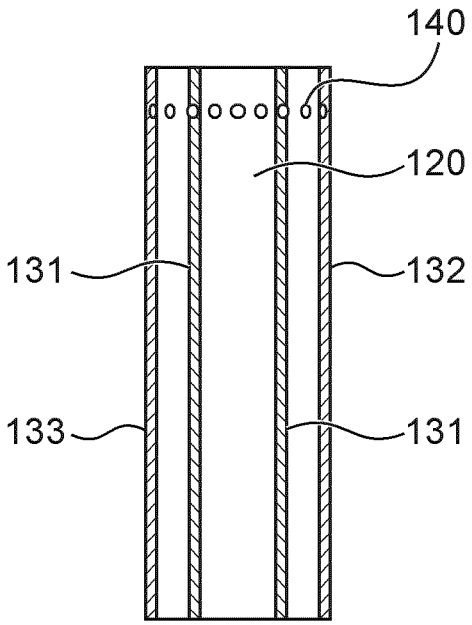

Fig. 6

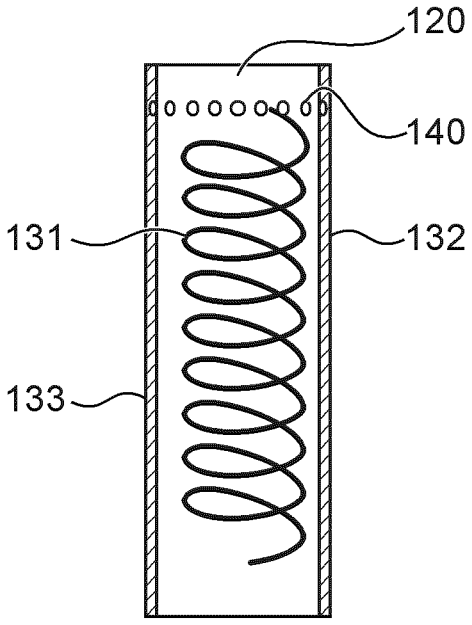

Fig. 7

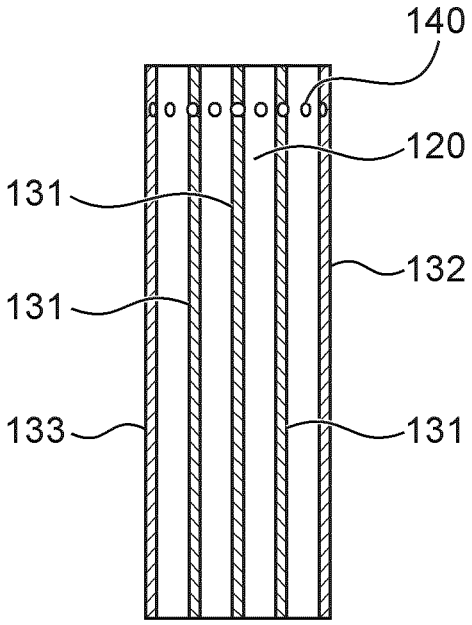

Fig. 8

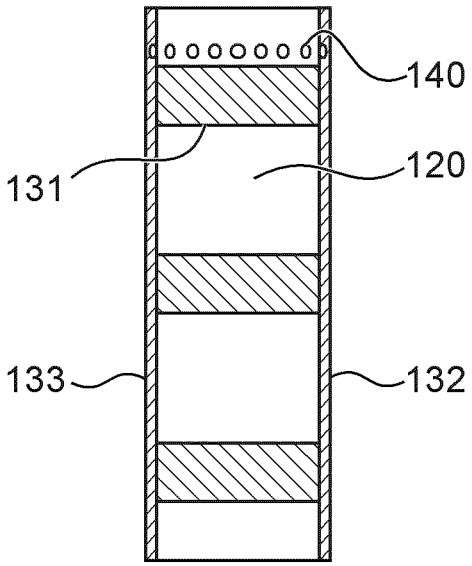

Fig. 9

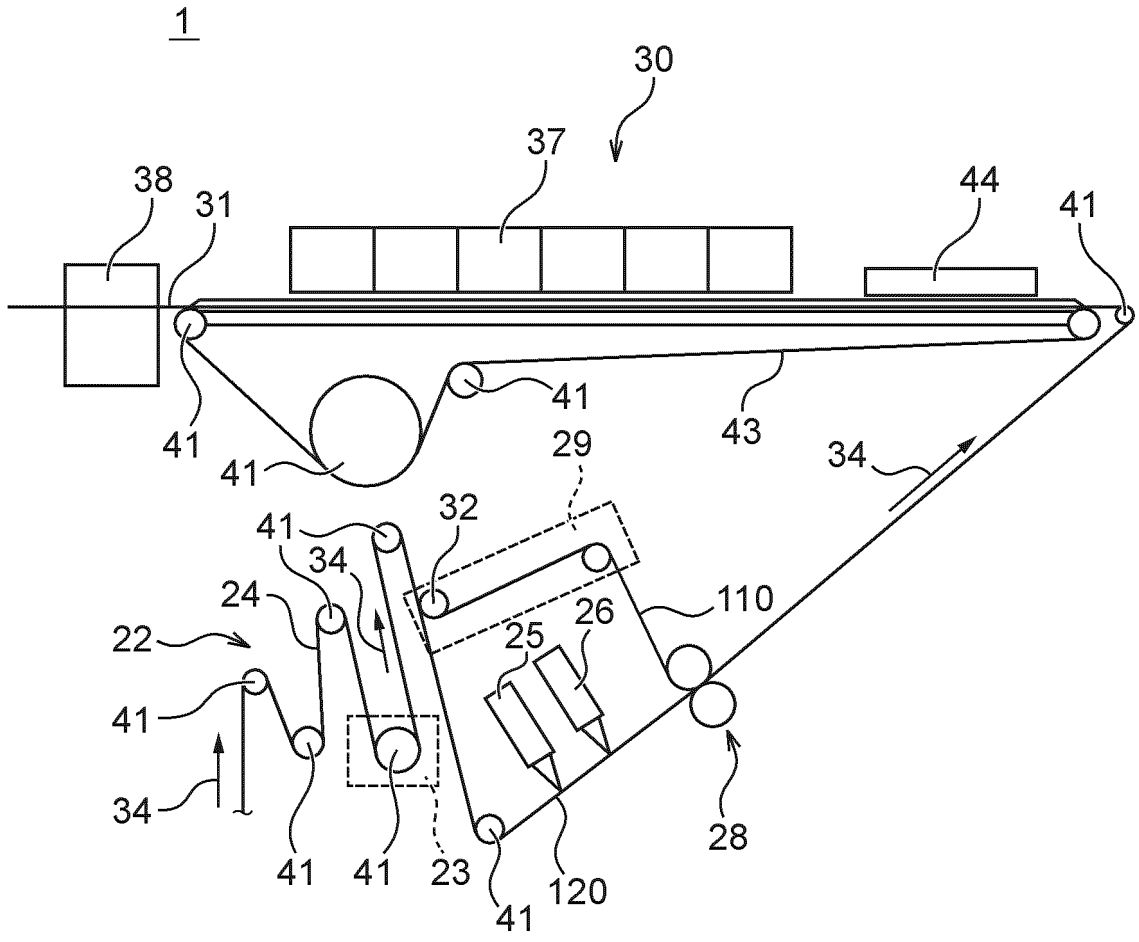
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Fig. 10

Level	Water content (mg/line)	Injection pressure (MPa)	Humidification nozzle distance (mm)	Roundness (current standard: 90.5% or more)	Circumference (current standard: 21.75 ± 0.1 mm)	Result	Remarks
①	2.52	0.1	12	92.38	21.754	OK	
②	2.52	0.05	12	93.79	21.721	OK	
③	6.34	0.1	12	92.10	21.754	OK	
④	6.34	0.05	12	92.99	21.748	OK	Optimal water content and pressure
⑤	6.34	0.05	6	89.87	21.771	NG	
⑥	6.34	0.05	17	93.61	21.736	OK	Optimal distance
⑦	6.34	0.05	25	93.80	21.702	OK	
⑧	6.34	0.01	17	91.49	21.708	NG	
⑨	6.34	0.03	17	92.90	21.718	OK	

Fig. 11

Adhesive Pattern	Water content (mg/line)	Injection pressure (MPa)	Humidification nozzle distance (mm)
3 lines (straight lines parallel to axial direction)	6.34	0.05	17
2 lines (straight lines parallel to axial direction)	6.34	0.05	17
Spiral	28.20	0.05	17

Fig. 12

Adhesive layer type	Adhesive pattern	Application amount	Remarks
First joint adhesive layer and second joint adhesive layer	Common	80g/500m (9.6 mg/line × 2)	Same application amount as conventional product
Positioning adhesive layer	Conventional product	100g/500m (24 mg/line)	-
	Spiral	20g/500m (4.8 mg/line)	Application amount of 80% down from conventional product
	2 lines (straight lines parallel to axial direction)	25g/500m (3.0 mg/line × 2)	Application amount of 75% down from conventional product

Fig. 13

	Measurement timing	Circumference (mm)		Roundness (%)		Weight (%)		Hardness (%)		Moisture (%)	Joint portion peel strength (g)
		Average value	CV value (%)	Average value	CV value (%)	Average value	CV value (%)	Average value	CV value (%)		
Standard value	-	21.75±0.1	-	90.5 or more	-	0.457±0.026	-	82.0 or more	-	8.0 or less	-
Conventional product	-	21.78	-	96.5	-	0.450	-	94.2	-	7.5	87.64
Spiral	Immediately after	21.802	0.131	88.7	1.175	0.447	0.884	85.6	4.791	-	66.1
	after 24h	21.757	0.098	88.0	1.155	0.438	0.795	87.4	4.706	6.4 (measured after 1 week after)	68.3
2 lines (straight lines parallel to axial direction)	Immediately after	21.789	0.092	94.6	0.865	0.442	0.640	84.2	3.372	-	-
	after 24h	21.764	0.100	94.2	1.16	0.435	0.705	85.8	2.861	5.8 (measured after 1 week after)	59.0

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/016387

A. CLASSIFICATION OF SUBJECT MATTER

A24C 5/46(2006.01)i; ***A24D 3/02***(2006.01)i; ***A24D 3/04***(2006.01)i
FI: A24C5/46; A24D3/02; A24D3/04

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)

A24C5/46; A24D3/02; A24D3/04, B32B1/08

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2020/071089 A1 (JAPAN TOBACCO INC.) 09 April 2020 (2020-04-09) paragraphs [0017], [0032], fig. 1	1-13
A	WO 2020/230577 A1 (JAPAN TOBACCO INC.) 19 November 2020 (2020-11-19) paragraph [0025], fig. 2	1-13
A	JP 2018-093867 A (HAUNI MASCHINENBAU GESELLSCHAFT MIT BESCHRANKTER HAFTUNG) 21 June 2018 (2018-06-21) abstract	1-13

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 May 2022	**07 June 2022**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/016387

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
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		TW 202021484 A	
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- JP 2018093867 A **[0004]**
- JP 2018121628 A **[0082]**