



(11) **EP 4 252 557 A1**

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

(43) Date of publication:
04.10.2023 Bulletin 2023/40

(51) International Patent Classification (IPC):
A24D 3/04 (2006.01)

(21) Application number: **20963421.1**

(52) Cooperative Patent Classification (CPC):
A24D 3/04

(22) Date of filing: **24.11.2020**

(86) International application number:
PCT/JP2020/043584

(87) International publication number:
WO 2022/113156 (02.06.2022 Gazette 2022/22)

(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

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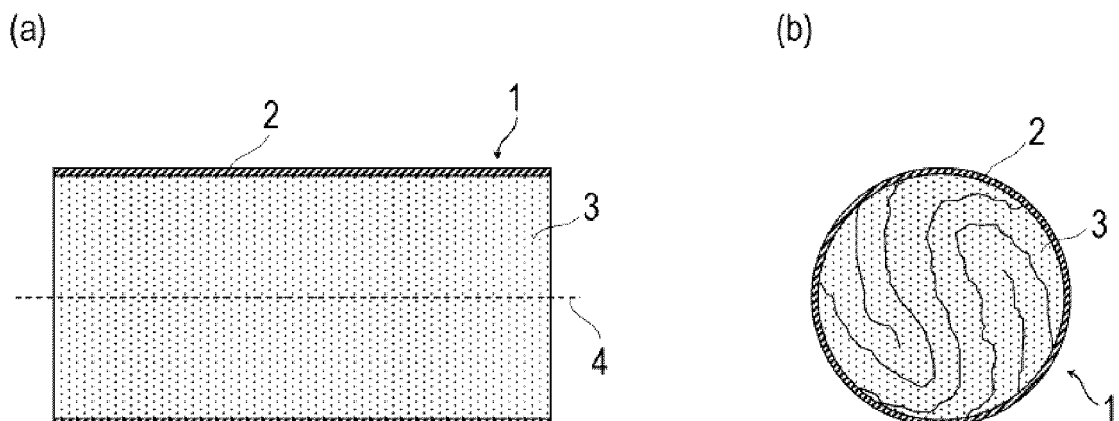
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(54) **FLAVOR INHALER FILTER-SEGMENT AND METHOD FOR MANUFACTURING THE SAME, AND FLAVOR INHALER**

(57) Provided is a flavor inhaler filter-segment that is environmentally friendly, has a good appearance, and has an aeration performance suitable for flavor inhaling. The flavor inhaler filter-segment comprises a tubular wrapper, and a non-woven fabric that includes natural

fibers and that is compressed and packed inside the wrapper, wherein the compression rate (A) of the non-woven fabric packed inside the wrapper, which is calculated by a prescribed method, is 20% or more but less than 100%.

Fig. 1



Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to a flavor inhaler filter segment, a method of manufacturing the flavor inhaler filter segment, and a flavor inhaler.

BACKGROUND ART

10 **[0002]** An acetate filter formed by packing cellulose acetate fibers serving as a filter medium inside a tubular wrapper is generally used as a filter for a flavor inhaler including a flavor component such as tobacco. However, since the cellulose acetate fibers are chemical synthetic fibers, their dispersibility and degradability when, for example, the flavor inhaler is disposed of, are low, so that their burden on the natural environment is large. Therefore, from the viewpoint of reducing the load on the environment, there is a need for the development of a filter using natural fibers.

15 **[0003]** Examples of the filter using natural fibers include: filters including, as the filter medium, paper formed from plant pulp; and filters including, as the filter medium, non-woven fabric formed from plant pulp (for example, PTL 1 to PTL 3).

CITATION LIST

20 PATENT LITERATURE

[0004]

PTL 1: Japanese Examined Patent Application Publication No. 45-10599
 25 PTL 2: Japanese Unexamined Patent Application Publication No. 48-85874
 PTL 3: Japanese Patent No. 3260059

SUMMARY OF INVENTION

30 TECHNICAL PROBLEM

[0005] However, when paper is used as the filter medium such that the amount of the paper packed satisfies the amount necessary to obtain draw resistance suitable for inhalation of the flavor component, gaps are formed between sheets of the paper, and the appearance of an axial end of the filter is poor. When the amount of the paper packed is increased in order to eliminate the gaps, the draw resistance increases, so that the flavor component cannot be easily inhaled. Although the density of non-woven fabric is lower than that of paper, the non-woven fabric has the same problem as the paper.

35 **[0006]** It is an object of the present invention to provide a flavor inhaler filter segment that is environmentally friendly and has a good appearance and aeration performance suitable for inhalation of the flavor component, to provide a method for manufacturing the flavor inhaler filter segment, and to provide a flavor inhaler including the filter segment.

SOLUTION TO PROBLEM

[0007] The present invention includes the following embodiment.

45 **[0008]** A flavor inhaler filter segment according to the present embodiment includes:

a tubular wrapper; and
 a non-woven fabric that contains natural fibers and is compressed and packed inside the wrapper,
 wherein a compression rate (A) of the non-woven fabric packed inside the wrapper is 20% or more and less than
 50 100%, the compression rate (A) being calculated by the following method:
 [Method for calculating compression rate (A)]

cross-sectional area (A1): a cross-sectional area of the non-woven fabric in a plane perpendicular to an axial
 direction of the filter segment, the cross-sectional area being measured with the wrapper of the filter segment
 55 detached and the non-woven fabric removed from the wrapper,
 cross-sectional area (A2): a cross-sectional area of a non-woven fabric portion of the filter segment in a plane
 perpendicular to the axial direction of the filter segment,
 compression rate (A) (%) = (cross-sectional area (A2) / cross-sectional area (A1)) × 100.

[0009] A flavor inhaler according to the present embodiment includes the flavor inhaler filter segment according to the present embodiment.

[0010] A method for manufacturing the flavor inhaler filter segment according to the present embodiment includes the step of compressing the non-woven fabric containing the natural fibers and packing the compressed non-woven fabric inside the wrapper.

ADVANTAGEOUS EFFECTS OF INVENTION

[0011] The present invention can provide a flavor inhaler filter segment that is environmentally friendly and has a good appearance and aeration performance suitable for inhalation of the flavor component and can also provide a method for manufacturing the flavor inhaler filter segment and a flavor inhaler including the filter segment.

BRIEF DESCRIPTION OF DRAWINGS

[0012]

[Fig. 1] (a) is a cross-sectional view of an example of a filter segment according to an embodiment in a plane parallel to the axial direction of the filter segment, and (b) is a side view of an axial end surface of the filter segment.

[Fig. 2] A schematic diagram showing an example of a filter segment manufacturing apparatus that can be used for a method for manufacturing the filter segment according to the present embodiment.

[Fig. 3] A schematic diagram showing an example of a non-woven fabric processing device in the filter segment manufacturing apparatus.

[Fig. 4] A cross-sectional view showing an example of a slit included in the non-woven fabric processing device.

[Fig. 5] A perspective view showing an example of vertical rollers included in the non-woven fabric processing device.

[Fig. 6] Cross-sectional views of an example of an S-shaped guide included in the non-woven fabric processing device. (a) is a cross-sectional view on the upstream side, and (b) is a cross-sectional view on the downstream side.

[Fig. 7] (a) is a perspective view showing an example of a rotor tube included in the non-woven fabric processing device, and (b) is a cross-sectional view of the rotor tube.

[Fig. 8] A cross-sectional view showing an example of hourglass rollers in a forming member included in the non-woven fabric processing device.

[Fig. 9] Cross-sectional views showing examples of a multifilter including the filter segment according to the present embodiment ((a) two filter segments and (b) three filter segments).

[Fig. 10] A cross-sectional view showing an example of a combustion-type flavor inhaler according to the present embodiment.

[Fig. 11] A cross-sectional view showing another example of the combustion-type flavor inhaler according to the present embodiment.

[Fig. 12] A cross-sectional view showing an example of a non-combustion heating-type flavor inhaler according to the present embodiment.

[Fig. 13] Cross-sectional views showing an example of a non-combustion heating-type flavor inhalation system according to the present embodiment. (a) shows a state before the non-combustion heating-type flavor inhaler is inserted into a heating device, and (b) shows a state in which the non-combustion heating-type flavor inhaler inserted into the heating device is heated.

[Fig. 14] A photograph showing end surfaces of filter segments Y and D.

DESCRIPTION OF EMBODIMENTS

[Flavor inhaler filter segment]

[0013] A flavor inhaler filter segment (hereinafter referred to also as a filter segment) according to an embodiment includes: a tubular wrapper; and a non-woven fabric that contains natural fibers and is compressed and packed inside the wrapper. The compression rate (A) of the non-woven fabric packed inside the wrapper is 20% or more and less than 100%, the compression rate (A) being calculated by the following method:

[Method for calculating compression rate (A)]

cross-sectional area (A1): the cross-sectional area of the non-woven fabric in a plane perpendicular to the axial direction of the filter segment, the cross-sectional area being measured with the wrapper of the filter segment detached and the non-woven fabric removed from the wrapper,

cross-sectional area (A2): the cross-sectional area of a non-woven fabric portion of the filter segment in a plane

perpendicular to the axial direction of the filter segment,

$$\text{compression rate (A)(\%)} = (\text{cross-sectional area (A2)} / \text{cross-sectional area (A1)}) \times 100.$$

[0014] In the filter segment according to the present embodiment, the non-woven fabric packed inside the wrapper as the filter medium contains the natural fibers. Therefore, the filter segment has high dispersibility and high degradability in the natural environment and is environmentally friendly. Since the compression rate (A) is less than 100%, no gaps are visually observed between adjacent portions of the non-woven fabric on an axial end surface of the filter segment, and a good appearance is obtained. Moreover, since the compression rate (A) is 20% or more, an increase in the draw resistance of the filter segment can be appropriately controlled, and the filter segment can have aeration performance suitable for inhalation of the flavor component. The present embodiment will next be described in detail, but the present embodiment is not limited thereto.

[0015] An example of the filter segment according to the present embodiment is shown in Fig. 1. Fig. 1(a) is a cross-sectional view in a plane parallel to an axial direction 4 of the filter segment 1, and Fig. 1(b) shows an end surface of the filter segment 1 in the axial direction 4. As shown in Fig. 1(b), in the filter segment 1, a plurality of sheets of the non-woven fabric 3 are stacked with their principal surfaces substantially parallel to the axial direction 4. The stacked sheets of the non-woven fabric 3 are folded into an S shape, compressed, and packed inside a circular tubular wrapper 2. Since the plurality of sheets of the non-woven fabric 3 are compressed and packed, the sheets of the non-woven fabric 3 are in close contact with each other. Therefore, as shown in Fig. 1(b), in the end surface of the filter segment 1 in the axial direction 4, no gaps are visually observed between the sheets of the non-woven fabric 3, and the filter segment 1 has a good appearance. In the filter segment 1 in Fig. 1, the plurality of sheets of the non-woven fabric 3 are stacked and packed, but the number of sheets of the non-woven fabric may be one. However, from the viewpoint of obtaining a good appearance and appropriate draw resistance, the number of sheets of the non-woven fabric is preferably from 1 to 7, but this depends on the thickness of the non-woven fabric 3. In the filter segment 1 in Fig. 1, the sheets of the non-woven fabric 3 are folded into an S shape, compressed, and packed. However, the sheets may have a shape other than the S shape such as a spiral shape, an accordion shape, or a gathered shape, and the sheets having such a shape may be compressed and packed.

[0016] From the viewpoint of obtaining suitable inhalation of the flavor component, the draw resistance of the filter segment in terms of a value converted to that of a filter segment with an axial length of 27.0 mm and a circumference of 24.1 mm is preferably 30 to 250 mmH₂O, more preferably 35 to 230 mmH₂O, and still more preferably 40 to 210 mmH₂O. The draw resistance of the filter segment is a value measured using a filter quality measurement apparatus (product name: SODIMAX manufactured by SODIM). The draw resistance of the filter segment is the pressure difference (mmH₂O) between the opposite end surfaces of the filter segment when the filter segment is covered with an air-impermeable rubber so that air does not enter the filter segment through its side surface and then air is inhaled from one end at a flow rate of 17.5 cm³/second. When the filter segment has, for example, a circular tubular shape and the original draw resistance of the filter segment having an axial length of B mm and a circumference of C mm is A mmH₂O, the conversion is performed using the following formula:

$$\text{Draw resistance (after conversion) (mmH}_2\text{O)} = A * (27.0 / B) * ((C / 24.1)^6)$$

[0017] The axial length of the filter segment can be 5 to 40 mm. The outer circumference (circumference) of the filter segment can be 15 to 30 mm.

[0018] The filter segment may further include, in addition to the non-woven fabric, for example, a capsule, an adsorbent, or an additive such as a flavoring agent or a flavoring, each of which is disposed inside the wrapper. A hollow space may be provided in part of a non-woven fabric-packed portion of the filter segment. The filter segment may be packed with two or more non-woven fabrics.

(Wrapper)

[0019] The filter segment according to the present embodiment includes the tubular wrapper. The material of the wrapper is, for example, paper, and paper with a basis weight of 20 to 120 gsm and a thickness of 30 to 150 μm may be used. When the basis weight is 20 gsm or more, the wrapper is unlikely to be stretched by the repulsive force of the non-woven fabric packed inside the tube, so that the circumference of the wrapper is unlikely to change. No particular limitation is imposed on the draw characteristics of the wrapper. For example, high-air permeability paper having an air permeability of 100 C.U. or more or low-air permeability paper having an air permeability of less than 100 C.U. may be used. Paper with a basis weight of 20 to 100 gsm and a thickness of 30 to 120 μm may be used. Examples of the paper

include, but not particularly limited to: LPWS-OLL (air permeability: 1300 C.U., basis weight: 26.5 gsm, thickness: 48 μm), P-10000C (air permeability: 10000 C.U., basis weight: 24.0 gsm, thickness: 60 μm), S-52-7000 (air permeability: 7000 C.U., basis weight: 52.0 gsm, thickness: 110 μm), and plain paper (air permeability: 0 C.U., basis weight: 24 gsm, thickness: 32 μm) that are manufactured by NIPPON PAPER PAPER CO., LTD. A plurality of stacked and wound wrappers may be used.

(Non-woven fabric)

[0020] The filter segment according to the present embodiment includes the non-woven fabric containing the natural fibers. The non-woven fabric is compressed and packed inside the tubular wrapper. The fibers forming the non-woven fabric may include only the natural fibers or may further include fibers other than the natural fibers (such as chemical synthetic fibers). Examples of the natural fibers include silk, wool, cotton, hemp, and plant pulp. One of them may be used, or a combination of two or more may be used. In particular, from the viewpoint of obtaining higher dispersibility and higher degradability in the natural environment and from the viewpoint of ease of adjustment to draw resistance suitable for inhalation of the flavor component, the natural fibers are preferably plant pulp.

[0021] From the viewpoint of obtaining the draw resistance suitable for the inhalation of the flavor component more easily, the coarseness of the plant pulp is preferably 0.15 to 0.25 mg/m, more preferably 0.16 to 0.24 mg/m, and still more preferably 0.18 to 0.22 mg/m. The coarseness is a value measured according to JIS P 8120:1998.

[0022] The non-woven fabric may further contain, as the fibers other than the natural fibers, chemical synthetic fibers. Examples of the chemical synthetic fibers include acetate fibers, rayon fibers, polyamide fibers, acrylic fibers, polyurethane fibers, polylactic acid fibers, polyethylene fibers, polypropylene fibers, polyester fibers, polyethylene terephthalate fibers, polyvinyl alcohol fibers, polyvinyl acetate fibers, and ethylene-vinyl acetate copolymer fibers. One of them may be used, or a combination of two or more may be used. When the non-woven fabric contains the chemical synthetic fibers, the content of the chemical synthetic fibers in the non-woven fabric is preferably 50% by mass or less and more preferably 30% by mass or less.

[0023] No particular limitation is imposed on the thickness of the non-woven fabric before packing. The thickness may be, for example, 0.5 to 1.5 mm. No particular limitation is imposed on the basis weight of the non-woven fabric before packing. The basis weight may be, for example, 35 to 60 g/m². The basis weight is a value measured according to JIS P 8124:2011. No particular limitation is imposed on the method of producing the non-woven fabric. The non-woven fabric can be produced, for example, by a method described later.

[0024] In the filter segment according to the present embodiment, the non-woven fabric is compressed and packed inside the tubular wrapper. The compression rate (A) of the non-woven fabric compressed and packed inside the tubular wrapper and calculated by the method described above is 20% or more and less than 100%, preferably 30 to 80%, and more preferably 45 to 70%. In the calculation of the compression rate (A), the cross-sectional area (A1) is measured by the following method. First, the filter segment is left to stand at 22°C and a relative humidity of 60% for 24 hours. Then the wrapper of the filter segment is detached, and the non-woven fabric is removed from the wrapper. Next, a microscope is used to take an image of a cross section of the non-woven fabric, and its vertical and horizontal lengths are evaluated on an operating monitor to thereby calculate the cross-sectional area of the non-woven fabric in a plane perpendicular to the axial direction of the filter segment. The image of the cross section of the non-woven fabric may be taken on any cross section obtained by cutting the filter segment at any axial position. The cross-sectional area (A2) is determined by measuring the outer circumference (circumference) of the filter segment using a filter circumference measurement apparatus (product name: SODIMAX manufactured by SODIM), measuring the thickness of the wrapper using a paper thickness measurement apparatus, and calculating the cross-sectional area (A2) using the measurements.

[0025] From the viewpoint of obtaining the draw resistance suitable for the inhalation of the flavor component more easily, the packing density of the non-woven fabric packed inside the wrapper is preferably 50 to 150 mg/cm³, more preferably 60 to 140 mg/cm³, and still more preferably 70 to 130 mg/cm³. When the filter segment has, for example, a tubular shape, the mass of the non-woven fabric is A mg/filter segment, the axial length of the filter segment is B mm, and its circumference is C mm, then the packing density of the non-woven fabric is calculated by the following formula.

$$\text{Packing density (mg/cm}^3\text{)} = A / ((B/10) * (((C/10/\pi/2)^2) * \pi))$$

[Method for manufacturing flavor inhaler filter segment]

[0026] A method for manufacturing the flavor inhaler filter segment according to the present embodiment may include the step of compressing the non-woven fabric containing the natural fibers and packing the compressed non-woven fabric inside the wrapper (this step may be hereinafter referred to also as a non-woven fabric packing step). Preferably, the method further includes the step of, before the non-woven fabric packing step, forming the non-woven fabric by a

dry method using a carding process or an airlaid process, a wet method, a spunbonding method, or a meltblowing method (this step may be hereinafter referred to as a non-woven fabric forming step). With the above method, the filter segment according to the present embodiment can be manufactured simply and efficiently. Each of the above steps will be described below. However, the method according to the present embodiment is not limited to embodiments of these steps.

(Non-woven fabric forming step)

[0027] In this step, the non-woven fabric can be formed by a dry method using a carding process or an airlaid process, a wet method, a spunbonding method, or a meltblowing method. In the formation of the non-woven fabric, fibers containing the natural fibers can be bonded by a thermal bonding method, a chemical bonding method, a needle punching method, a spunlacing (hydroentangling) method, a stitch bonding method, or a steam jet method.

[0028] In this step, it is particularly preferable that a dry method using an airlaid process is used to form the non-woven fabric and then a chemical bonding method is used to bond the fibers containing the natural fibers together. With the dry method using the airlaid process, a low-density fiber layer can be formed using an air flow. With the chemical bonding method, the fibers can be bonded together while a binder is blown onto the fibers to maintain the low density. Examples of the binder used in the chemical bonding method include starch, polyvinyl alcohol, polyvinyl acetate, ethylene-vinyl acetate copolymers, and vinyl acetate-acrylic copolymers. One of these binders may be used, or a combination of two or more may be used. When the non-woven fabric is formed using a spunbonding method or a meltblowing method or when the fibers including the natural fibers are bonded together using a thermal bonding method, the fibers may further include, in addition to the natural fibers, thermoplastic fibers.

(Non-woven fabric packing step)

[0029] In this step, the non-woven fabric containing the natural fibers is compressed and packed inside the wrapper. Preferably, this step includes the step of stacking a plurality of sheets of the non-woven fabric together, the step of folding the stacked sheets of the non-woven fabric into an S shape, and the step of compressing the sheets of the non-woven fabric folded into the S shape and packing the compressed sheets inside the wrapper.

[0030] When the non-woven fabric is compressed, a compression rate (B) calculated by a method described below is preferably 20% or more and less than 100%, more preferably 20 to 60%, and still more preferably 25 to 40%. When the compression rate (B) is 20% or more and less than 100%, the above-described compression rate (A) in the filter segment obtained tends to be 20% or more and less than 100%.

[Method for calculating compression rate (B)]

[0031] Cross-sectional area (B1): the cross-sectional area of the non-woven fabric immediately before compression in a plane perpendicular to the axial direction of the filter segment.

[0032] Cross-sectional area (B2): the cross-sectional area of the non-woven fabric portion of the filter segment in a plane perpendicular to the axial direction of the filter segment.

$$\text{Compression rate (B) (\%)} = (\text{cross-sectional area (B2)} / \text{cross-sectional area (B1)}) \times 100$$

[0033] The cross-sectional area (B1) is measured by using a microscope to take an image of a cross section of the non-woven fabric immediately before compression, evaluating its vertical and horizontal lengths on an operating monitor, and calculating the cross-sectional area of the non-woven fabric in the plane perpendicular to the axial direction of the filter segment. The cross-sectional area (B2) is determined by measuring the outer circumference (circumference) of the filter segment using a filter circumference measurement apparatus (product name: SODIMAX manufactured by SODIM), measuring the thickness of the wrapper using a paper thickness measurement apparatus, and calculating the cross-sectional area (B2) using the measurements.

[0034] This step can be performed using, for example, a filter segment manufacturing apparatus shown in Fig. 2. The filter segment manufacturing apparatus shown in Fig. 2 includes a non-woven fabric supply device 5, a non-woven fabric processing device 6, and a filter segment forming device 7. The non-woven fabric supply device 5 may be a device that supplies the non-woven fabric manufactured in the non-woven fabric forming step described above continuously to the non-woven fabric processing device 6.

[0035] The details of the non-woven fabric processing device 6 are shown in Fig. 3. The non-woven fabric processing device 6 shown in Fig. 3 includes a slit 8, a pass part 9, level adjusting rollers 10, vertical rollers 11, an S-shaped guide 12, a rotor tube 13, and a forming member 14. A sheet of the non-woven fabric 16 continuously supplied from the

non-woven fabric supply device 5 is cut in the flow direction into four sheets by the slit 8. Specifically, as shown in Fig. 4, the non-woven fabric 16 is cut evenly in the flow direction into four sheets by three slitting knives 15. In this device, the non-woven fabric is cut into four sheets, but no particular limitation is imposed on the number of cut sheets.

[0036] Next, the four sheets of the non-woven fabric 16 cut by the slit 8 are displaced in phase from each other by the pass part 9. Next, the heights of the sheets of the non-woven fabric 16 are adjusted by the level adjusting rollers 10, and the directions of the sheets of the non-woven fabric 16 are changed by the vertical rollers 11. Specifically, as shown in Fig. 5, when the sheets of the non-woven fabric 16 pass through the vertical rollers 11, the directions of the sheets are changed, and the sheets of the non-woven fabric 16 are stacked so as to be slightly displaced from each other. Next, the sheets of the non-woven fabric 16 pass through the S-shaped guide 12 and are thereby folded into an S shape. Specifically, as shown in Figs. 6(a) and 6(b), the S-shaped guide 12 changes its shape from the shape on the upstream side shown in Fig. 6(a) to the shape on the downstream side shown in Fig. 6(b), and the four displaced and stacked sheets of the non-woven fabric 16 are folded into a final S shape shown in Fig. 6(b).

[0037] Next, the sheets of the non-woven fabric 16 folded into the S shape are subjected to compression molding into a cylindrical shape by the rotor tube 13. Specifically, as shown in Fig. 7, the sheets of the non-woven fabric 16 folded into the S shape are inserted into the rotating rotor tube 13 (Fig. 7(b)) and shaped so as to have a cylindrical outer circumferential shape by the rotation of the rotor tube 13 while maintaining the S shape (Fig. 7(a)). Next, the sheets of the non-woven fabric 16 compression-molded into the cylindrical shape are further compressed by the forming member 14 while the S shape is more firmly maintained. As shown in Fig. 8, a plurality of rotating hourglass rollers 17 continuously disposed in the forming member 14 are driven by a forming tape. The hourglass rollers 17 may be continuously disposed such that their inside diameters gradually decrease in the flow direction of the non-woven fabric 16. As the non-woven fabric 16 passes between the hourglass rollers 17 in the forming unit, the non-woven fabric 16 can be further compression-molded while the S shape is more firmly maintained. The compression rate (B) can be adjusted within the above range by appropriately setting the length and rotation speed of the rotor tube 13, the inside diameters of the hourglass rollers 17 and their number, and the thickness and width of the forming tape.

[0038] The non-woven fabric compression-molded into the cylindrical shape is supplied to the filter segment forming device 7 shown in Fig. 2, and the wrapper is wound around the outer circumferential surface of the non-woven fabric in the filter segment forming device 7, glued, and cut to an appropriate length. A filter segment is thereby manufactured.

[Flavor inhaler]

[0039] A flavor inhaler according to the present embodiment may include the filter segment according to the present embodiment. Since the flavor inhaler includes the filter segment according to the present embodiment, the flavor inhaler is environmentally friendly and can have a good appearance and aeration performance suitable for inhalation of the flavor component. The flavor inhaler may be, for example, a combustion-type flavor inhaler (cigarette), a non-combustion heating-type flavor inhaler, etc.

[0040] The flavor inhaler may include a plurality of the filter segments according to the present embodiment. The flavor inhaler may further include an additional filter segment other than the filter segment according to the present embodiment. Examples of the additional filter segment include: a filter segment packed with chemical synthetic fibers such as acetate or polylactic acid; a segment packed with a film of acetate, polylactic acid, etc.; and a segment having a hollow structure. The filter segment may contain an adsorbent such as activated carbon, silica gel, or zeolite or may contain a liquid flavoring agent, a solid flavoring agent, or a flavoring agent supported on a carrier. The segment may contain a flavoring agent capsule having a core-shell structure in which a flavoring agent is wrapped in a shell such as gelatin, a polysaccharide, or a resin. When the flavor inhaler includes a plurality of filter segments, the plurality of filter segments may be disposed adjacent to each other. For example, the flavor inhaler may include a first multifilter 20 including a first filter segment 18 that is the filter segment according to the present embodiment and a second filter segment 19 that is an additional filter segment, as shown in Fig. 9(a). For example, the flavor inhaler may include a second multifilter 22 including a first filter segment 18 that is the filter segment according to the present embodiment and further including a second filter segment 19 and a third filter segment 21 that are additional filter segments, as shown in Fig. 9(b). As shown in Fig. 9, the outer circumferential surface of the plurality of filter segments is covered with a filter plug wrapper 23, and the plurality of filter segments are thereby connected to each other to form a multifilter.

(Combustion-type flavor inhaler)

[0041] Fig. 10 shows an example of a combustion-type flavor inhaler according to the present embodiment. As shown in Fig. 10, the combustion-type flavor inhaler 24 includes a tobacco-containing segment 25 and the filter segment 1 according to the present embodiment disposed adjacent to the tobacco-containing segment 25. The tobacco-containing segment 25 includes shredded tobacco 26 (shredded leaves, tobacco) and wrapping paper 27 wound around the shredded tobacco 26. The tobacco-containing segment 25 and the filter segment 1 are connected to each other using a tipping

paper member 28 wound around the tobacco-containing segment 25 and the filter segment 1. The tipping paper member 28 may have a vent hole (for adjusting the amount of tar) in part of its outer circumferential surface. The number of vent holes may be one or two or more. For example, the number of vent holes formed may be 10 to 40. When a plurality of vent holes are formed, the vent holes may be arranged, for example, in an annular row in an outer circumferential portion of the tipping paper member 28. The plurality of vent holes may be arranged at regular intervals. By providing the vent holes, air is introduced into the filter segment 1 through the vent holes during inhalation. The mainstream smoke is diluted with the outside air from the vent holes, and the product can be designed so as to have a desired tar value.

[0042] The user lights up the tip of the tobacco-containing segment 25, puts the inhalation port of the filter segment 1 in the mouth, inhales the tobacco smoke, and can thereby enjoy the tobacco flavor. In the combustion-type flavor inhaler 24 according to the present embodiment, the appearance of the end surface of the inhalation port of the filter segment 1 is good, and an appropriate amount of tobacco flavor can be inhaled with appropriate inhalation force.

[0043] The combustion-type flavor inhaler according to the present embodiment may further include, in addition to the filter segment according to the present embodiment, at least one of the additional filter segments described above. For example, a combustion-type flavor inhaler 24 shown in Fig. 11 includes a second filter segment 19 between the tobacco-containing segment 25 and the filter segment 1 according to the present embodiment. The filter segment 1 and the second filter segment 19 are connected to each other using a filter plug wrapper 29. The second filter segment 19 can have a function different from the function of the filter segment 1 according to the present embodiment, so that a plurality of functions can be imparted to the filter.

(Non-combustion heating-type flavor inhaler)

[0044] Fig. 12 shows an example of a non-combustion heating-type flavor inhaler according to the present embodiment. The non-combustion heating-type flavor inhaler 30 shown in Fig. 12 includes a tobacco-containing segment 31 and a mouthpiece segment 32. The mouthpiece segment 32 includes a cooling segment 33, a center hole segment 34, and the filter segment 1 according to the present embodiment. During inhalation, the tobacco-containing segment 31 is heated, and the inhalation is performed from one end of the filter segment 1.

[0045] The tobacco-containing segment 31 includes: a tobacco filler 35 including tobacco and an aerosol-source material; and a tubular wrapper 36 that covers the tobacco filler 35. The tobacco filler 35 may further include a volatile flavoring component and water. No particular limitation is imposed on the size of the tobacco used as the filler and the method for preparing the tobacco. For example, dry tobacco leaves shredded to a width of 0.8 to 1.2 mm may be used. When the dry tobacco leaves are shredded to the above-described width, the length of the shreds is about 5 mm to about 20 mm. Alternatively, shreds prepared by uniformly pulverizing dry tobacco leaves to an average grain size of about 20 μm to about 200 μm may be formed into sheets. Then the sheets may be shredded to a width of 0.8 to 1.2 mm, and the resulting shreds may be used. When the sheets are shredded to the above-described width, the length of the shreds is about 5 mm to about 20 mm. Alternatively, the above sheets may be gathered without shredding and used as the filler. A plurality of sheets formed into a cylindrical shape may be arranged concentrically. Even when shredded dry tobacco leaves are used or when dry tobacco leaves uniformly pulverized and formed into sheets are used, various types of tobacco may be used as the tobacco included in the tobacco filler. Any of various types of tobacco such as flue cured type, burley type, oriental type, native species, other *Nicotiana tabacum* varieties, and other *Nicotiana rustica* varieties may be appropriately blended and used so as to obtain an intended taste. The details of the varieties of tobacco are disclosed in "Tobacco no Jiten (Dictionary of Tobacco), Tobacco Academic Studies Center, March 31, 2009."

[0046] There are a plurality of conventional methods for pulverizing tobacco and forming the pulverized product into a uniform sheet. One example of such a sheet is a sheet made through a paper making process. Another example is a cast sheet made by uniformly mixing the pulverized product and a suitable solvent such as water, casting the obtained uniform mixture thinly on a metallic sheet or a metallic sheet belt, and drying the mixture, and still another example is a rolled sheet formed by extruding a uniform mixture of the pulverized product and a suitable solvent such as water into a sheet shape. The details of the types of uniformized sheets are disclosed in "Tobacco no Jiten (Dictionary of Tobacco), Tobacco Academic Studies Center, March 31, 2009."

[0047] No particular limitation is imposed on the packing density of the tobacco filler 35. From the viewpoint of ensuring the performance of the non-combustion heating-type flavor inhaler 30 and imparting a good flavor, the packing density is typically 250 mg/cm^3 or more and preferably 320 mg/cm^3 or more and is typically 520 mg/cm^3 or less and preferably 420 mg/cm^3 or less. Specifically, when the tobacco-containing segment 31 has a circumference of 22 mm and a length of 20 mm, the range of the content of the tobacco filler 35 in the tobacco-containing segment 31 is 200 to 450 mg and preferably 280 to 400 mg per tobacco-containing segment 31.

[0048] The aerosol-source material is a material that can generate an aerosol upon heating, and no particular limitation is imposed on the aerosol-source material. Examples of the aerosol-source material include glycerin, propylene glycol (PG), triethyl citrate (TEC), triacetin, and 1,3-butanediol. One of these materials may be used, or a combination or two or more may be used.

[0049] No particular limitation is imposed on the type of volatile flavoring component. Examples of the volatile flavoring component include, from the viewpoint of imparting a good flavor, acetanisole, acetophenone, acetylpyrazine, 2-acetylthiazole, alfalfa extract, amyl alcohol, amyl butyrate, trans-anethole, star anise oil, apple juice, Peru balsam oil, beeswax absolute, benzaldehyde, benzoin resinoid, benzyl alcohol, benzyl benzoate, benzyl phenylacetate, benzyl propionate, 2,3-butanedione, 2-butanol, butyl butyrate, butyric acid, caramel, cardamom oil, carob absolute, β -carotene, carrot juice, L-carvone, β -caryophyllene, cassia bark oil, cedarwood oil, celery seed oil, chamomile oil, cinnamaldehyde, cinnamic acid, cinnamyl alcohol, cinnamyl cinnamate, citronella oil, DL-citronellol, clary sage extract, cocoa, coffee, cognac oil, coriander oil, cuminaldehyde, davana oil, δ -decalactone, γ -decalactone, decanoic acid, dill herb oil, 3,4-dimethyl-1,2-cyclopentanedione, 4,5-dimethyl-3-hydroxy-2,5-dihydrofuran-2-one, 3,7-dimethyl-6-octenoic acid, 2,3-dimethylpyrazine, 2,5-dimethylpyrazine, 2,6-dimethylpyrazine, ethyl 2-methylbutyrate, ethyl acetate, ethyl butyrate, ethyl hexanoate, ethyl isovalerate, ethyl lactate, ethyl laurate, ethyl levulinate, ethyl maltol, ethyl octanoate, ethyl oleate, ethyl palmitate, ethyl phenylacetate, ethyl propionate, ethyl stearate, ethyl valerate, ethyl vanillin, ethyl vanillin glucoside, 2-ethyl-3,(5 or 6)-dimethylpyrazine, 5-ethyl-3-hydroxy-4-methyl-2(5H)-furanone, 2-ethyl-3-methylpyrazine, eucalyptol, fenugreek absolute, genet absolute, gentian root infusion, geraniol, geranyl acetate, grape juice, guaiacol, guava extract, γ -heptalactone, γ -hexalactone, hexanoic acid, cis-3-hexen-1-ol, hexyl acetate, hexyl alcohol, hexyl phenylacetate, honey, 4-hydroxy-3-pentenoic acid lactone, 4-hydroxy-4-(3-hydroxy-1-butenyl)-3,5,5-trimethyl-2-cyclohexen-1-one, 4-(p-hydroxyphenyl)-2-butanone, sodium 4-hydroxyundecanoate, immortelle absolute, β -ionone, isoamyl acetate, isoamyl butyrate, isoamyl phenylacetate, isobutyl acetate, isobutyl phenylacetate, jasmine absolute, kola nut tincture, labdanum oil, terpeneless lemon oil, licorice extract, linalool, linalyl acetate, lovage root oil, maltol, maple syrup, menthol, menthone, L-menthyl acetate, p-methoxybenzaldehyde, methyl 2-pyrrolyl ketone, methyl anthranilate, methyl phenylacetate, methyl salicylate, 4'-methylacetophenone, methylcyclopentenolone, 3-methylvaleric acid, mimosa absolute, molasses, myristic acid, nerol, nerolidol, γ -nonalactone, nutmeg oil, δ -octalactone, octanal, octanoic acid, orange flower oil, orange oil, orris root oil, palmitic acid, ω -pentadecalactone, peppermint oil, petitgrain paraguay oil, phenethyl alcohol, phenethyl phenylacetate, phenylacetic acid, piperonal, plum extract, propenylguaethol, propyl acetate, 3-propylidenephthalide, prune juice, pyruvic acid, raisin extract, rose oil, rum, sage oil, sandalwood oil, spearmint oil, styrax absolute, marigold oil, tea distillate, α -terpineol, terpinyl acetate, 5,6,7,8-tetrahydroquinoxaline, 1,5,5,9-tetramethyl-13-oxacyclo[8.3.0.0.(4.9)]tridecane, 2,3,5,6-tetramethylpyrazine, thyme oil, tomato extract, 2-tridecanone, triethyl citrate, 4-(2,6,6-trimethyl-1-cyclohexenyl)-2-buten-4-one, 2,6,6-trimethyl-2-cyclohexene-1,4-dione, 4-(2,6,6-trimethyl-1,3-cyclohexadienyl)-2-buten-4-one, 2,3,5-trimethylpyrazine, γ -undecalactone, γ -valerolactone, vanilla extract, vanillin, veratraldehyde, violet leaf absolute, and extracts of tobacco plants (tobacco leaves, tobacco stems, tobacco flowers, tobacco roots, and tobacco seeds). Particularly preferably, the volatile flavoring component is menthol. One of these volatile flavoring components may be used alone, or a combination of two or more may be used.

[0050] No particular limitation is imposed on the content of the aerosol-source material in the tobacco filler 35. From the viewpoint of generating the aerosol sufficiently and imparting a good flavor, the content of the aerosol-source material is generally 5 to 50% by mass and preferably 10 to 20% by mass. When the tobacco filler 35 contains a volatile flavoring component, no particular limitation is imposed on the content of the volatile flavoring component in the tobacco filler. From the viewpoint of imparting a good flavor, the content of the volatile flavoring component with respect to the mass of the tobacco filler is generally 100 ppm or more, preferably 10000 ppm or more, and more preferably 25000 ppm or more and is generally 100000 ppm or less, preferably 50000 ppm or less, and more preferably 33000 ppm or less.

[0051] No particular limitation is imposed on the method for packing the tobacco filler 35 inside the wrapper 36. For example, the tobacco filler 35 may be wrapped with the wrapper 36, or the tobacco filler 35 may be packed inside the tubular wrapper 36. When the tobacco shreds have a shape having a longitudinal direction such as a rectangular shape, the tobacco shreds may be packed inside the wrapper 36 such that their longitudinal directions are oriented randomly or may be packed inside the wrapper 36 so as to be arranged in the axial direction of the tobacco-containing segment 31 or a direction perpendicular to the axial direction. When the tobacco-containing segment 31 is heated, the tobacco component, the aerosol-source material, and water that are contained in the tobacco filler 35 are vaporized. When sucked, they are transferred to the mouthpiece segment 32.

[0052] The cooling segment 33 includes a tubular member 37. The tubular member 37 may be, for example, a paper tube formed by shaping a thick paper sheet into a cylindrical shape. A perforation 38 is formed in the tubular member 37 and mouthpiece lining paper 42 described later so as to pass therethrough. The presence of the perforation 38 allows the outside air to be introduced into the cooling segment 33 during inhalation. In this case, the vaporized aerosol component generated by heating the tobacco-containing segment 31 comes into contact with the outside air. The temperature of the vaporized aerosol component is thereby lowered, and the vaporized aerosol component is liquefied, so that an aerosol is formed. No particular limitation is imposed on the diameter (distance across) of the perforation 38, but the diameter may be, for example, 0.5 to 1.5 mm. No particular limitation is imposed on the number of perforations 38, and the number may be one or two or more. For example, a plurality of perforations 38 may be provided on the circumferential surface of the cooling segment 33.

[0053] The center hole segment 34 includes a packed layer 39 having a hollow portion and an inner plug wrapper 40

that covers the packed layer 39. The center hole segment 34 has the function of increasing the strength of the mouthpiece segment 32. The packed layer 39 may be, for example, a rod having an inside diameter of $\Phi 5.0$ to $\Phi 1.0$ mm and formed by curing densely packed cellulose acetate fibers containing a triacetin-containing plasticizer in an amount of 6 to 20% by mass with respect to the mass of the cellulose acetate. Since the packing density of the fibers in the packed layer 39 is high, air and the aerosol flow only through the hollow portion during inhalation and can barely flow inside the packed layer 39. To decrease the reduction in the amount of the aerosol component by filtration in the filter segment 1, reducing the length of the filter segment 1 and replacing it with the center hole segment 34 are effective because the amount of the aerosol component delivered is increased. Since the packed layer 39 inside the center hole segment 34 is a fiber-packed layer, the feel of the center hole segment 34 when it is touched from the outside during use is good.

[0054] The center hole segment 34 and the filter segment 1 are connected to each other using an outer plug wrapper 41. The outer plug wrapper 41 may be, for example, a tubular paper sheet. The tobacco-containing segment 31, the cooling segment 33, and the segment including the center hole segment 34 and the filter segment 1 connected together are connected using the mouthpiece lining paper 42. They are connected, for example, by applying a glue such as a vinyl acetate-based glue to the inner surface of the mouthpiece lining paper 42 and wrapping the mouthpiece lining paper 42 around the above three segments.

[0055] No particular limitation is imposed on the axial length of the non-combustion heating-type flavor inhaler according to the present embodiment, i.e., its length in the horizontal direction in Fig. 12, but the axial length is preferably 40 to 90 mm, more preferably 50 to 75 mm, and still more preferably 50 to 60 mm. The circumferential length of the non-combustion heating-type flavor inhaler is preferably 16 to 25 mm, more preferably 20 to 24 mm, and still more preferably 21 to 23 mm. In one exemplary embodiment, the length of the tobacco-containing segment 31 is 20 mm; the length of the cooling segment 33 is 20 mm; the length of the center hole segment 34 is 8 mm; and the length of the filter segment 1 is 7 mm. The lengths of these segments can be appropriately changed according to manufacturing suitability, required quality, etc. Only the filter segment 1 may be disposed downstream of the cooling segment 33 without using the center hole segment 34. In the non-combustion heating-type flavor inhaler according to the present embodiment, the appearance of the end surface of the inhalation port of the filter segment is good, and an appropriate amount of the tobacco flavor can be inhaled with appropriate inhalation force.

[0056] In the filter segment in the present embodiment, the natural fibers are used as the main component. Therefore, the heat resistance of the filter segment tends to be higher than that when general chemical fibers such as cellulose acetate or polylactic acid are used. The filter segment in the present embodiment is superior because a shape change such as melting of the fibers by heat does not occur even when the cooling function of the cooling segment is low.

[Non-combustion heating-type flavor inhalation system]

[0057] Preferably, a non-combustion heating-type flavor inhalation system according to the present embodiment includes: the non-combustion heating-type flavor inhaler according to the present embodiment; and a heating device that heats the non-combustion heating-type flavor inhaler. The non-combustion heating-type flavor inhalation system according to the present embodiment may include an additional component different from the non-combustion heating-type flavor inhaler according to the present embodiment and the heating device.

[0058] Fig. 13 shows an example of the non-combustion heating-type flavor inhalation system according to the present embodiment. The non-combustion heating-type flavor inhalation system shown in Fig. 13 includes the non-combustion heating-type flavor inhaler 30 according to the present embodiment and a heating device 43 that heats the tobacco-containing segment of the non-combustion heating-type flavor inhaler 30 from its outer side. Fig. 13(a) shows a state before the non-combustion heating-type flavor inhaler 30 is inserted into the heating device 43, and Fig. 13(b) shows a state in which the non-combustion heating-type flavor inhaler 30 inserted into the heating device 43 is heated. The heating device 43 shown in Fig. 13 includes a body 44, a heater 45, a metal tube 46, a battery unit 47, and a control unit 48. The body 44 has a tubular recess 49, and the heater 45 and the metal tube 46 are disposed on the inner side surface of the recess 49 at a position corresponding to the tobacco-containing segment of the non-combustion heating-type flavor inhaler 30 that is to be inserted into the recess 49. The heater 45 may be an electric resistance heater and generates heat when electric power is supplied from the battery unit 47 in response to an instruction from the control unit 48 for temperature control. The heat generated by the heater 45 is transferred through the high-thermal conductivity metal tube 46 to the tobacco-containing segment of the non-combustion heating-type flavor inhaler 30.

[0059] Since Fig. 13(b) is a schematic illustration, a gap is present between the outer circumferential surface of the non-combustion heating-type flavor inhaler 30 and the inner circumferential surface of the metal tube 46. However, in practice, it is preferable that no gap is present between the outer circumferential surface of the non-combustion heating-type flavor inhaler 30 and the inner circumferential surface of the metal tube 46 in order to transfer the heat efficiently. The heating device 43 heats the tobacco-containing segment of the non-combustion heating-type flavor inhaler 30 from its outer side but may heat it from its inner side. When the heating device 43 heats the tobacco-containing segment from its inner side, it is preferable to use a rigid heater having a plate, blade, or pillar shape without using the metal tube 46.

Examples of such a heater include a ceramic heater prepared by disposing molybdenum, tungsten, etc. on a ceramic substrate.

[0060] No particular limitation is imposed on the heating temperature of the heating device, but the heating temperature is preferably 400°C or lower, more preferably 150°C or more and 400°C or less, and still more preferably 200°C or more and 350°C or less. The heating temperature is the temperature of the heater of the heating device.

EXAMPLES

[0061] The present invention will be described in more detail by way of Examples, but the invention is not limited to these Examples.

[EXAMPLE 1] (A to L)

(Production of filter segments A to L)

(1) Manufacturing of non-woven fabric

[0062] A non-woven fabric was manufactured by a dry method using an airlaid process. Specifically, first, wood pulp used as a raw material was separated into single fibers using a primary crusher and a defibrating apparatus. The resulting pulp was dropped from a web forming apparatus onto an absorption surface of an endless wire net and transferred while a web was formed. A binder solution containing polyvinyl alcohol and a polyvinyl acetate-acrylic copolymer was sprayed onto the web and dried. The binder solution was further sprayed onto the web and dried to thereby obtain a non-woven fabric with a width of 240 cm (a chemical bonding method). The obtained non-woven fabric was wound into a roll using a take-up apparatus to produce a jumbo roll. The non-woven fabric was unwound from the jumbo roll, slit to a width of 13 cm, and wound into a roll. For filter segments A to F, the wood pulp used as the raw material was wood pulp with a coarseness of 0.22 mg/m (product name: NB416 manufactured by Weyerhaeuser). For filter segments G to L, the wood pulp used as the raw material was wood pulp with a coarseness of 0.18 mg/m (product name: BioBright manufactured by UPM Raumanacell). The basis weight of the non-woven fabric used for the filter segments A to L was adjusted appropriately.

(2) Manufacturing of filter segments A to L

[0063] Each of the filter segments A to L was manufactured using a tobacco filter manufacturing apparatus. Specifically, one of the non-woven fabrics manufactured using the method described in (1) was cut into four sheets using a slitter, and the four sheets were stacked and compressed into a cylindrical shape with an S-shaped cross section. Next, the cylindrical non-woven fabric was wrapped with a wrapper, and a lap portion was glued. Then the resulting product was cut into a predetermined length. The filter segments A to L were thereby obtained. Each of the non-woven fabrics had a width of 13 cm before slitting. The non-woven fabric was slit at regular intervals into four sheets each having a width of 32 mm. A slight loss occurred during slitting.

[0064] The filter segments A to L shown in Table 1 were manufactured in the manner described above. The axial length of each of the filter segments A to L was 27.0 mm, and the circumference was 24.1 mm. For all the non-woven fabrics A to L packed inside the filter segments, four sheets each having a width of 32 mm × a length of 27 mm were used.

[Table 1]

Filter segment	Coarseness of plant pulp (mg/m)	Packing density of non-woven fabric (mg/cm ³)	Compression rate (A) (%)	Draw resistance of filter segment converted to that of filter segment with length of 27.0 mm and circumference of 24.1 mm (mmHzO)	Gaps between sheets of non-woven fabric on end surface
A	0.22	71.2	67.9	46.1	No
B		86.6	58.4	76.9	No
C		88.0	57.6	73.0	No
D		89.9	60.2	71.8	No
E		100.3	51.9	104.2	No
F		110.4	51.1	109.9	No
G	0.18	90.1	66.1	99.9	No
H		98.9	60.2	121.2	No
I		100.2	59.4	115.0	No
J		107.7	55.3	145.7	No
K		116.5	51.1	153.3	No
L		125.3	47.5	202.8	No

(Production of flavor inhalers A to L)

[0065] One of the filter segments A to L was used to produce the combustion-type flavor inhaler shown in Fig. 10. The tobacco-containing segment 25 used was a tobacco-containing segment having an axial length of 57.0 mm, a circumference of 24.5 mm, and a tobacco content of 675 mg. The tobacco-containing segment 25 and the filter segment 1 (one of the filter segments A to L) were connected using a tipping paper member 28 having a length of 32.0 mm to thereby produce one of the flavor inhalers A to L. The above-described vent holes for adjusting the tar value were not formed in the tipping paper member 28.

(Evaluation)

[0066] For each of the flavor inhalers A to L, the filtration rates of tar and nicotine during inhalation were measured and evaluated using the following methods.

(1) Measurement of amount of tar and amount of nicotine generated from tobacco-containing segment

[0067] An RM20 automatic smoking machine (manufactured by Borgwaldt KC Inc.) was used to automatically smoke only the tobacco-containing segment according to ISO 4387 (flow rate: 17.5 mL/sec, smoking time: 2 sec/puff, smoking frequency: 1 puff/minute). Crude tar was collected using a Cambridge filter CM-133 (manufactured by Borgwaldt KC Inc.). The Cambridge filter was shaken and extracted with 10 mL of methanol. Then the amount of nicotine was analyzed by GC-FID, and the amount of water was analyzed by GC-TCD. Agilent 7890 (Agilent Technologies Inc.) was used for the GC. The amount of water and the amount of nicotine were subtracted from the amount of crude tar obtained to determine the amount of tar. The same tobacco-containing segment was used for each of all the flavor inhalers A to L. The amount of tar and the amount of nicotine generated from the tobacco-containing segment can be translated into the amount of tar and the amount of nicotine before passage through the filter segment in the flavor inhaler including the filter segment. The results are shown in Table 2.

(2) Measurement of amount of tar and amount of nicotine generated from flavor inhaler

[0068] The amount of tar and the amount of nicotine generated from one of the flavor inhalers A to L were measured using the same method as the method in (1) except that the one of the flavor inhalers A to L was automatically smoked instead of the tobacco-containing segment. The amount of tar and the amount of nicotine generated from each flavor

inhaler can be translated into the amount of tar and the amount of nicotine after passage through the corresponding filter segment. The results are shown in Table 2.

(3) Evaluation of filtration rates of tar and nicotine

[0069] The amount of tar and the amount of nicotine generated from the tobacco-containing segment are denoted by T_Tobacco (mg) and N_Tobacco (mg), respectively. The amount of tar and the amount of nicotine generated from a flavor inhaler are denoted by T_Whole Rod (mg) and N_Whole Rod (mg), respectively. The filtration rate of tar and the filtration rate of nicotine are represented by the following formulas. The results are shown in Table 2.

$$\text{Filtration rate of tar (\%)} = \{1 - (T_{\text{Whole Rod}} / T_{\text{Tobacco}})\} \times 100$$

$$\text{Filtration rate of nicotine (\%)} = \{1 - (N_{\text{Whole Rod}} / N_{\text{Tobacco}})\} \times 100$$

[Table 2]

Flavor inhaler	Before passage through filter segment		After passage through filter segment		Filtration rate	
	Tar (mg)	Nicotine (mg)	Tar (mg)	Nicotine (mg)	Tar (%)	Nicotine (%)
A	25.2	2.27	19.1	1.61	24.2	29.2
B			16.2	1.36	35.6	40.4
C			16.6	1.39	34.0	39.0
D			16.8	1.40	33.5	38.6
E			13.7	1.16	45.5	49.0
F			13.3	1.12	47.4	50.7
G			14.1	1.19	44.0	47.7
H			12.4	1.05	50.9	53.8
I			12.9	1.09	49.0	52.1
J			10.6	0.91	57.7	59.8
K			10.2	0.87	59.7	61.5
L			7.5	0.66	70.2	71.1

[0070] In the flavor inhalers A to L, the filtration rate of tar was 24.2 to 70.2%, and the filtration rate of nicotine was 29.2 to 71.1%. These filtration rates are appropriate for inhalation of the flavor component. This may be because the filter segments A to L had appropriate draw resistance and filtered appropriate amounts of tar and nicotine during inhalation. Since the filtration rate of tar and the filtration rate of nicotine are in the above ranges, the amount of tar and the amount of nicotine generated from a combustion-type flavor inhaler can be largely changed. On each of the end surfaces of the filter segments of the flavor inhalers A to L, no gaps were found between the sheets of the non-woven fabric, and the end surface had a good appearance.

[EXAMPLE 2] (N, P, and R)

(1) Production of filter segments N, P, and R

[0071] Filter segments N, P, and R were produced in the same manner as for the filter segments A to F in Example 1 except that the compression rate was changed.

(2) Production and evaluation of flavor inhalers N, P, and R

[0072] Flavor inhalers N, P, and R were produced using the filter segments N, P, and R, respectively, in the same manner as in Example 1. In the flavor inhalers N and P, the above-described vent holes for adjusting the tar value were not formed in the tipping paper member 28. In the flavor inhaler R, vent holes (perforations) for adjusting the tar value were provided at positions 12 mm from the end surface of the inhalation port of the flavor inhaler. The rate of dilution with the outside air introduced through the vent holes was 22.4%. For each of the flavor inhalers N, P, and R, the amount of tar and the amount of nicotine after passage through the filter segment were measured using the same method as in Example 1. The results are shown in Table 3.

[COMPARATIVE EXAMPLE 1] (M, O, and Q)

(1) Production of filter segments M, O, and Q

[0073] Filter segments M, O, and Q were manufactured using a tobacco filter manufacturing apparatus. An acetate long-fiber bundle (single fiber denier: 3.0 g/9000 m, total fiber denier: 36000 g/9000 m) was used as a filter medium, and triacetin used as a plasticizer was sprayed in an amount of 6% based on the mass of the fibers. The acetate long-fiber bundle was wrapped with a wrapper, and a lap portion was glued. Then the resulting product was cut into a predetermined length using a cutter. The filter segments M, O, and Q were thereby obtained.

(2) Production and evaluation of flavor inhalers M, O, and Q

[0074] Flavor inhalers M, O, and Q were produced using the filter segments M, O, and Q, respectively, in the same manner as in Example 1. In the flavor inhalers M and O, the above-described vent holes for adjusting the tar value were not formed in the tipping paper member 28. In the flavor inhaler Q, vent holes (perforations) for adjusting the tar value were provided at positions 12 mm from the end surface of the inhalation port of the flavor inhaler. The rate of dilution with the outside air introduced through the vent holes was 24.2%. For each of the flavor inhalers M, O, and Q, the amount of tar and the amount of nicotine after passage through the filter segment were measured using the same method as in Example 1. The results are shown in Table 3.

[Table 3]

Flavor inhaler	Filter segment material	Compression rate (A) (%)	Draw resistance of filter segment converted to that of filter segment with length of 27 mm and circumference of 24.1 mm (mmHzO)	Dilution rate (%)	After passage through filter segment		Gaps between sheets of non-woven fabric on end surface
					Tar (mg)	Nicotine (mg)	
M	Acetate Plant pulp non-woven fabric	----	76.4	0.0	17.4	1.4	----
N		62.7	71.8	0.0	16.8	1.4	No
O	Acetate Plant pulp non-woven fabric	----	70.0	0.0	15.7	1.2	----
P		63.7	70.0	0.0	15.4	1.1	No
Q	Acetate Plant pulp non-woven fabric	----	109.9	24.2	9.9	0.7	----
R		53.2	109.9	22.4	10.1	0.7	No

[0075] Even when the filter segments N, P, and R in the present embodiment were used, the draw resistance obtained was comparable to that of the filter segments M, O, and Q packed with the acetate fibers used for filter segments of conventional flavor inhalers. It was found that, even with the flavor inhalers N, P, and R, as with the flavor inhalers M,

O, and Q using the filter segments M, O, and Q packed with the acetate fibers, the amount of tar generated and the amount of nicotine generated can be largely changed. The end surfaces of the filter segments of the flavor inhalers N, P, and R each had a good appearance.

5 [EXAMPLE 3] (T and V)

(1) Production of dual segment filters T and V

10 **[0076]** Filter segments packed with the plant pulp non-woven fabric were produced in the same manner as for the filter segments A to F in Example 1 except that the compression rate was changed. Filter segments packed with the acetate fibers were produced using the same method as for the filter segments M, O, and Q in Comparative Example 1. One of the filter segments packed with the plant pulp non-woven fabric and one of the filter segments packed with the acetate fibers were connected using a filter segment combiner (product name: ND-5 manufactured by SANJO MACHINE WORKS, LTD.). Dual segment filters T and V were thereby obtained. In each of the dual segment filters T and V, the length of the filter segment packed with the plant pulp non-woven fabric was 12 mm, and the length of the filter segment packed with the acetate fibers was 15 mm.

(2) Production and evaluation of flavor inhalers T and V

20 **[0077]** The dual segment filters T and V were used to produce combustion-type flavor inhalers similar to that shown in Fig. 11. The tobacco-containing segment 25 used was a tobacco-containing segment having an axial length of 57.0 mm, a circumference of 24.5 mm, and a tobacco content of 675 mg. The tobacco-containing segment 25 and the filter segments 19 and 1 (the dual segment filter T or V) were connected using a tipping paper member 28 having a length of 32.0 mm to thereby produce a flavor inhaler T or V. In the tipping paper member 28, vent holes (perforations) for adjusting the tar value were provided at positions 12 mm from the end surface of the inhalation port of the flavor inhaler. The rate of dilution with the outside air introduced through the vent holes was 53.7% or 73.7%. For each of the flavor inhalers T and V, the amount of tar and the amount of nicotine after passage through the filter segment were measured using the same method as in Example 1. The results are shown in Table 4.

30 [Comparative Example 2] (S and U)

(1) Production of dual segment filters Sand U

35 **[0078]** Two filter segments packed with respective types of acetate fibers having different draw resistances were produced using the same method as for the filter segments M, O, and Q in Comparative Example 1. One of dual segment filters Sand U was produced in the same manner as in Example 3 except that the two filter segments were used.

(2) Production and evaluation of flavor inhalers Sand U

40 **[0079]** Flavor inhalers S and U were produced using the dual segment filters S and U, respectively, in the same manner as in Example 3. In the tipping paper member 28 of each flavor inhaler, vent holes (perforations) for adjusting the tar value were provided at positions 12 mm from the end surface of the inhalation port of the flavor inhaler. The rate of dilution with the outside air introduced through the vent holes was 55.4% or 78.2%. For each of the flavor inhalers Sand U, the amount of tar and the amount of nicotine after passage through the filter segment were measured using the same method as in Example 1. The results are shown in Table 4.

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[Table 4]

Flavor inhaler	Filter segment material		Compression rate (A) (%)	Draw resistance of filter segment converted to that of filter segment with length of 27 mm and circumference of 24.1 mm (mmHzO)			Dilution rate (%)	After passage through filter segment		Gaps between sheets of non-woven fabric on end surface
	Mouthpiece side	Tobacco side	Tobacco side	Mouthpiece side	Tobacco side	Total		Tar (mg)	Nicotine (mg)	
S	Acetate	Acetate Plant pulp non-woven fabric	-----	134.7	152.9	142.8	55.4	3.1	0.30	-----
T	Acetate		54.4	145.2	150.0	147.3	53.7	3.0	0.30	No
U	Acetate	Acetate Plant pulp non-woven fabric	-----	138.6	155.1	145.9	78.2	1.0	0.11	-----
V	Acetate		52.9	116.8	212.5	159.3	73.7	1.1	0.12	No

5 [0080] Even when the filter segments T and V in the present embodiment were used, the draw resistance obtained was comparable to that of the dual segment filters Sand U packed with the acetate fibers used for filter segments of conventional flavor inhalers. It was found that, even with the flavor inhalers T and V, as with the flavor inhalers S and U, the amount of tar generated and the amount of nicotine generated can be largely changed. When a filter segment packed with the plant pulp non-woven fabric is used as at least part of a filter packed with the conventionally used acetate fibers, dispersibility and degradability are improved.

[EXAMPLE 4] (X)

10 (1) Production of dual segment filter X

15 [0081] Two filter segments packed with respective plant pulp non-woven fabrics having different draw resistances were produced in the same manner as that for the filter segments A to F in Example 1 except that the compression rate was changed. A dual segment filter X was produced in the same manner as in Example 3 except that these two filter segments were used.

(2) Production and evaluation of flavor inhaler X

20 [0082] The combustion-type flavor inhaler shown in Fig. 11 was produced using the dual segment filter X. The tobacco-containing segment 25 used was a tobacco-containing segment having an axial length of 57.0 mm, a circumference of 24.5 mm, and a tobacco content of 675 mg. The tobacco-containing segment 25 and the filter segments 19 and 1 (the dual segment filter X) were connected using a tipping paper member 28 having a length of 32.0 mm to thereby produce a flavor inhaler X. In the tipping paper member 28, vent holes (perforations) for adjusting the tar value were provided at positions 12 mm from the end surface of the inhalation port of the flavor inhaler. The rate of dilution with the outside air introduced through the vent holes was 46.3%. For the flavor inhaler X, the amount of tar and the amount of nicotine after passage through the filter segment were measured using the same method as in Example 1. The results are shown in Table 5.

30 [COMPARATIVE EXAMPLE 3] (W)

(1) Production of dual segment filter W

35 [0083] Two filter segments packed with respective types of acetate fibers having different draw resistances were produced using the same method as for the filter segments M, O, and Q in Comparative Example 1. A dual segment filter W was produced in the same manner as in Example 3 except that these two filter segments were used.

(2) Production and evaluation of flavor inhaler W

40 [0084] A flavor inhaler W was produced using the dual segment filter W in the same manner as in Example 4. In the tipping paper member 28, vent holes (perforations) for adjusting the tar value were provided at positions 12 mm from the end surface of the inhalation port of the flavor inhaler. The rate of dilution with the outside air introduced through the vent holes was 47.4%. For the flavor inhaler W, the amount of tar and the amount of nicotine after passage through the filter segment were measured using the same method as in Example 1. The results are shown in Table 5.

[Table 5]

Flavor inhaler	Filter segment material		Compression rate (A) (%)		Draw resistance of filter segment converted to that of filter segment with length of 27 mm and circumference of 24.1 mm (mmHzO)			Dilution rate (%)	After passage through filter segment		Gaps between sheets of non- woven fabric on end surface
	Mouthpiece side	Tobacco side	Mouthpiece side	Tobacco side	Mouthpiece side	Tobacco side	Total		Tar (mg)	Nicotine (mg)	
W	Acetate Plant pulp non- woven fabric	Acetate Plant pulp non-woven fabric	-----	-----	110.5	113.0	111.5	47.4	5.8	0.47	-----
X			63.3	58.9	90.7	116.7	106.3	46.3	5.9	0.49	No

[0085] Even when the filter segment X in the present embodiment was used, the draw resistance obtained was comparable to that of the dual segment filter W packed with the acetate fibers used for filter segments of conventional flavor inhalers. It was found that, even with the flavor inhaler X, as with the flavor inhaler W, the amount of tar generated and the amount of nicotine generated can be largely changed. When a filter segment packed with the plant pulp non-woven fabric is used as at least part of a filter packed with the conventionally used acetate fibers, dispersibility and degradability are improved. In the flavor inhaler X, the end surface of the filter segment had a good appearance.

[COMPARATIVE EXAMPLE 4] (Y)

(1) Manufacturing of filter segment Y

[0086] A filter segment Y, i.e., a paper filter segment, was produced using a tobacco filter manufacturing apparatus. Paper used as a filter medium (main raw material wood pulp, basis weight: 30 g/m², thickness: 60 μm, paper width: 30 cm) was subjected to creping at 1 mm intervals in a direction parallel to the longitudinal direction of the filter segment to corrugate the paper and then gathered randomly. The resulting product was wrapped with a wrapper into a tubular shape, and a lap portion was glued. Then the resulting product was cut into a predetermined length to thereby obtain a filter segment Y. The draw resistance of the filter segment Y was 70 mmH₂O/a length of 27 mm.

(2) Appearance evaluation

[0087] A photograph of an end surface of the filter segment Y and an end surface of the filter segment D in Example 1 is shown in Fig. 14. Although the draw resistances of the filter segments Y and D are similar to each other, they largely differ in gaps on their end surfaces. No gaps are found in the filter segment D, and its end surface is neater.

REFERENCE SIGNS LIST

[0088]

- 1 filter segment
- 2 wrapper
- 3 non-woven fabric
- 4 axial direction

Claims

1. A flavor inhaler filter segment comprising:

a tubular wrapper; and

a non-woven fabric that contains natural fibers and is compressed and packed inside the wrapper, wherein a compression rate (A) of the non-woven fabric packed inside the wrapper is 20% or more and less than 100%, the compression rate (A) being calculated by the following method:

[Method for calculating compression rate (A)]

cross-sectional area (A1): a cross-sectional area of the non-woven fabric in a plane perpendicular to an axial direction of the filter segment, the cross-sectional area being measured with the wrapper of the filter segment detached and the non-woven fabric removed from the wrapper,

cross-sectional area (A2): a cross-sectional area of a non-woven fabric portion of the filter segment in a plane perpendicular to the axial direction of the filter segment,

$$\text{compression rate (A) (\%)} = (\text{cross-sectional area (A2)} / \text{cross-sectional area (A1)}) \times 100.$$

2. The flavor inhaler filter segment according to claim 1, wherein a plurality of sheets of the non-woven fabric are stacked together and folded into an S shape, and the folded sheets are compressed and packed inside the wrapper.

3. The flavor inhaler filter segment according to claim 1 or 2, wherein no gap is visually observed between adjacent portions of the non-woven fabric on an axial end surface of the filter segment.

4. The flavor inhaler filter segment according to any one of claims 1 to 3, wherein the natural fibers are at least one type of fibers selected from the group consisting of silk, wool, cotton, hemp, and plant pulp.
5. The flavor inhaler filter segment according to claim 4, wherein the natural fibers are plant pulp.
6. The flavor inhaler filter segment according to claim 4 or 5, wherein the plant pulp has a coarseness of 0.15 to 0.25 mg/m.
7. The flavor inhaler filter segment according to any one of claims 1 to 6, wherein the non-woven fabric further contains chemical synthetic fibers.
8. The flavor inhaler filter segment according to claim 7, wherein the chemical synthetic fibers are at least one type of fibers selected from the group consisting of acetate fibers, rayon fibers, polyamide fibers, acrylic fibers, polyurethane fibers, polylactic acid fibers, polyethylene fibers, polypropylene fibers, polyester fibers, polyethylene terephthalate fibers, polyvinyl alcohol fibers, polyvinyl acetate fibers, and ethylene-vinyl acetate copolymer fibers.
9. The flavor inhaler filter segment according to any one of claims 1 to 8, wherein the non-woven fabric packed inside the wrapper has a packing density of 50 to 150 mg/cm³.
10. The flavor inhaler filter segment according to any one of claims 1 to 9, wherein the filter segment has a draw resistance of 30 to 250 mmH₂O, the draw resistance being a value converted to the draw resistance of a filter segment with an axial length of 27.0 mm and a circumference of 24.1 mm.
11. A flavor inhaler comprising the flavor inhaler filter segment according to any one of claims 1 to 10.
12. The flavor inhaler according to claim 11, further comprising a filter segment other than the flavor inhaler filter segment.
13. The flavor inhaler according to claim 11 or 12, wherein the flavor inhaler is a combustion-type flavor inhaler.
14. The flavor inhaler according to claim 11 or 12, wherein the flavor inhaler is a non-combustion heating-type flavor inhaler.
15. A method for manufacturing the flavor inhaler filter segment according to any one of claims 1 to 10, the method comprising:
the step of compressing the non-woven fabric containing the natural fibers and packing the compressed non-woven fabric inside the wrapper.
16. The method for manufacturing the flavor inhaler filter segment according to claim 15, wherein the step of compressing the non-woven fabric and packing the compressed non-woven fabric inside the wrapper includes:
the step of stacking a plurality of sheets of the non-woven fabric together;
the step of folding the stacked sheets of the non-woven fabric into an S shape; and
the step of compressing the sheets of the non-woven fabric folded into the S shape and packing the compressed sheets into the wrapper.
17. The method for manufacturing the flavor inhaler filter segment according to claim 15 or 16, wherein a compression rate (B) when the non-woven fabric is compressed is 20% or more and less than 100%, the compression rate (B) being calculated using the following method:
[Method for calculating compression rate (B)]
cross-sectional area (B1): a cross-sectional area of the non-woven fabric immediately before compression in a plane perpendicular to the axial direction of the filter segment,
cross-sectional area (B2): a cross-sectional area of the non-woven fabric portion of the filter segment in a plane perpendicular to the axial direction of the filter segment,

$$\text{compression rate (B) (\%)} = (\text{cross-sectional area (B2)} / \text{cross-sectional area (B1)}) \times 100.$$

18. The method for manufacturing the flavor inhaler filter segment according to any one of claims 15 to 17, the method further comprising the step of forming the non-woven fabric using a dry method using a carding process or an airlaid process, a wet method, a spunbonding method, or a meltblowing method .

5 **19.** The method for manufacturing the flavor inhaler filter segment according to claim 18, wherein, in the step of forming the non-woven fabric, the fibers containing the natural fibers are bonded using a thermal bonding method, a chemical bonding method, a needle punching method, a spunlacing (hydroentangling) method, a stitch bonding method, or a steam jet method.

10 **20.** The method for manufacturing the flavor inhaler filter segment according to claim 19, the method further comprising the step of forming the non-woven fabric using the dry method using the airlaid process, wherein, in the step of forming the non-woven fabric, the fibers containing the natural fibers are bonded using the chemical bonding method.

15 **21.** The method for manufacturing the flavor inhaler filter segment according to claim 19 or 20, wherein a binder used in the chemical bonding method is at least one binder selected from the group consisting of starch, polyvinyl alcohol, polyvinyl acetate, polyvinyl acetate-acrylic copolymers, and ethylene-vinyl acetate copolymers.

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Fig. 1

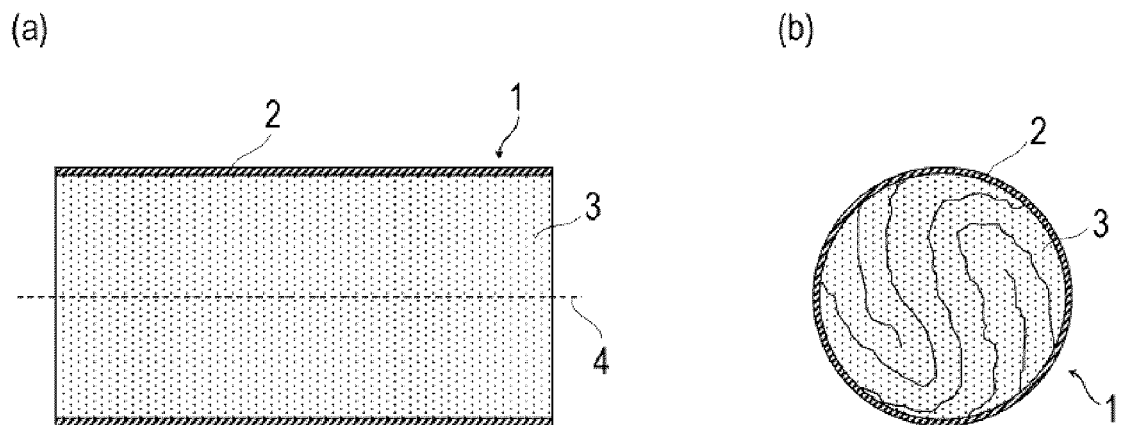


Fig. 2

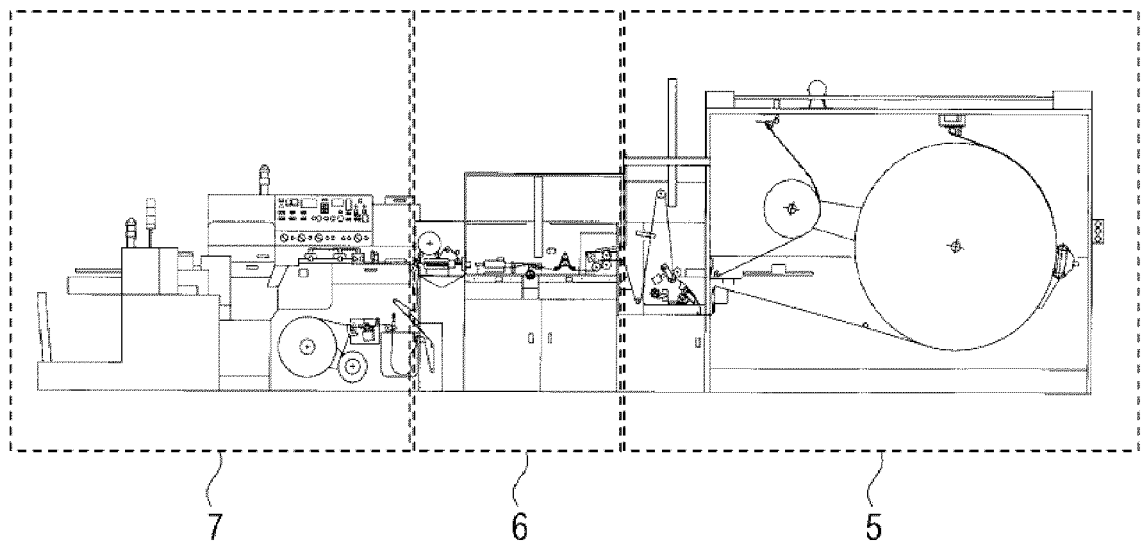


Fig. 3

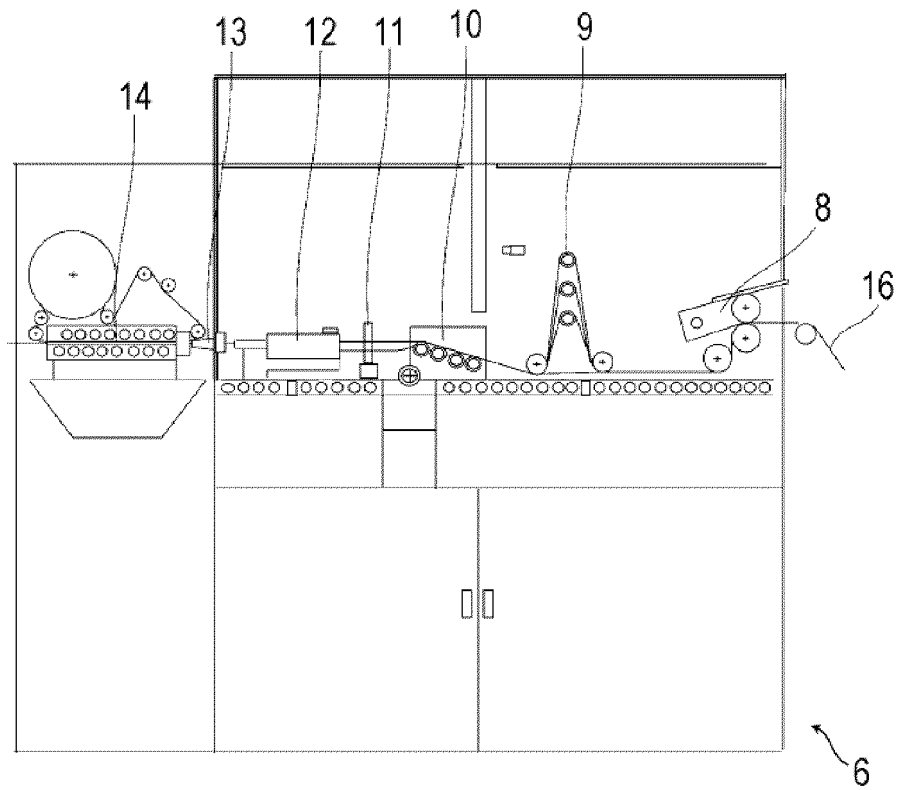


Fig. 4

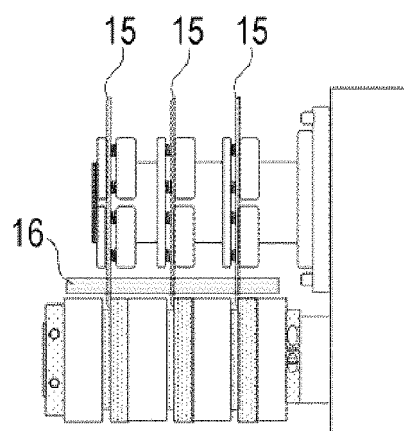


Fig. 5

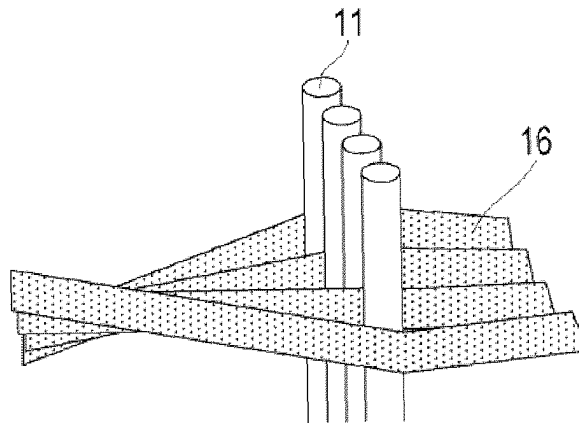


Fig. 6

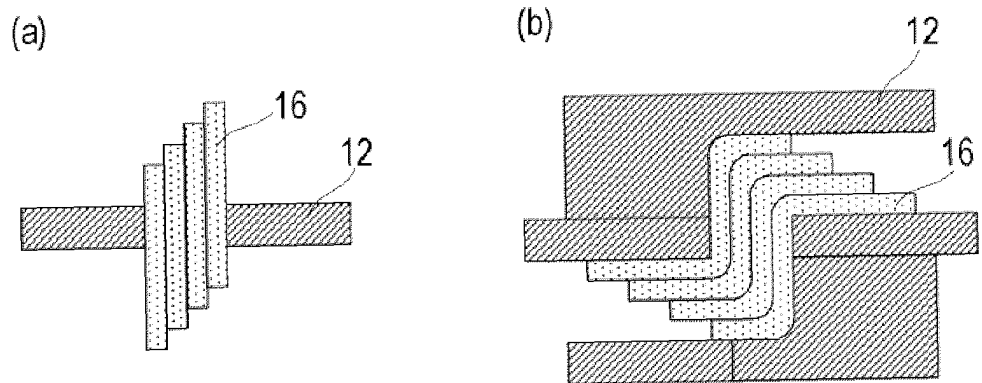


Fig. 7

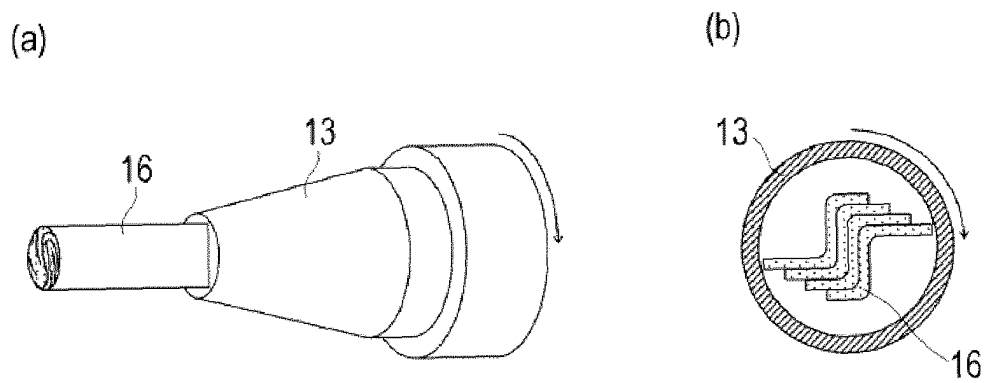


Fig. 8

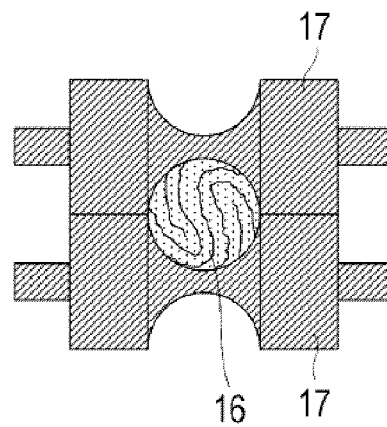


Fig. 9

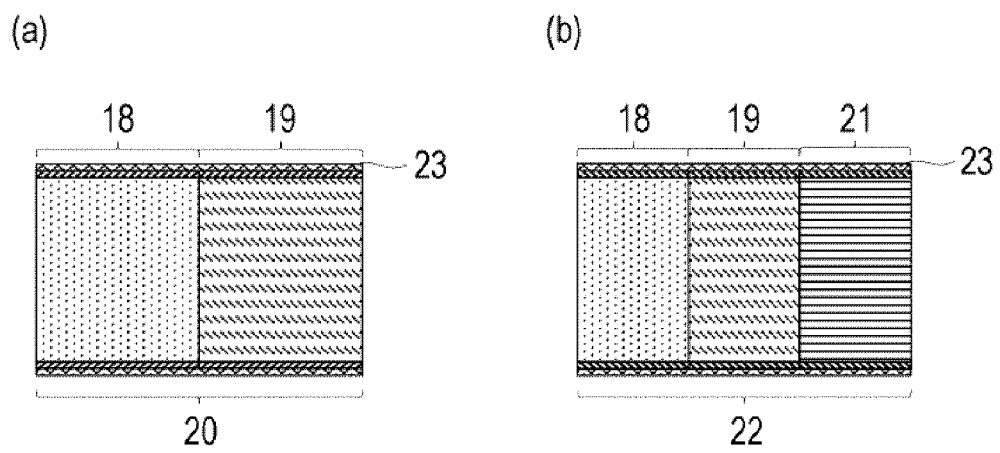


Fig. 10

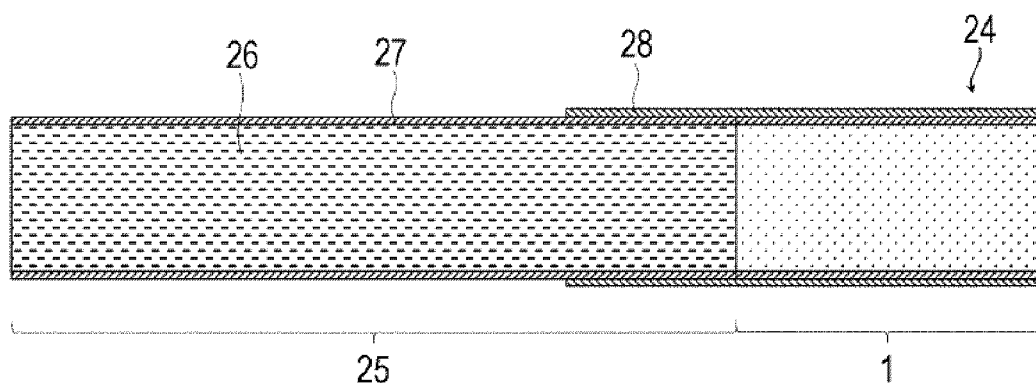


Fig. 11

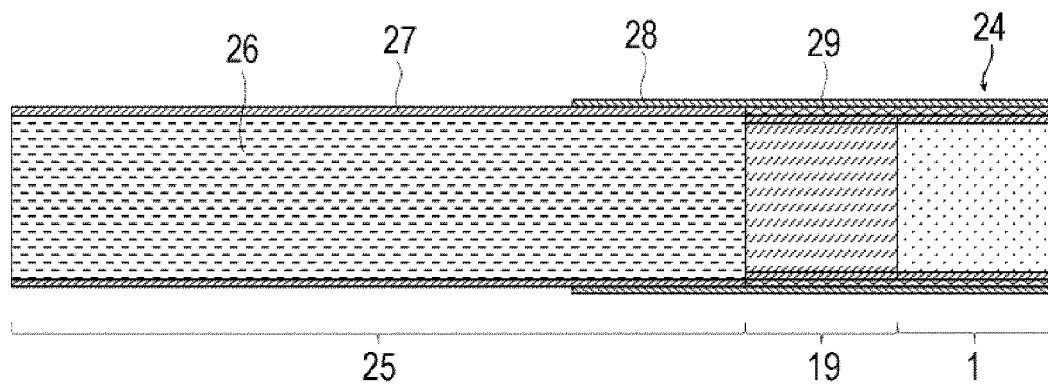


Fig. 12

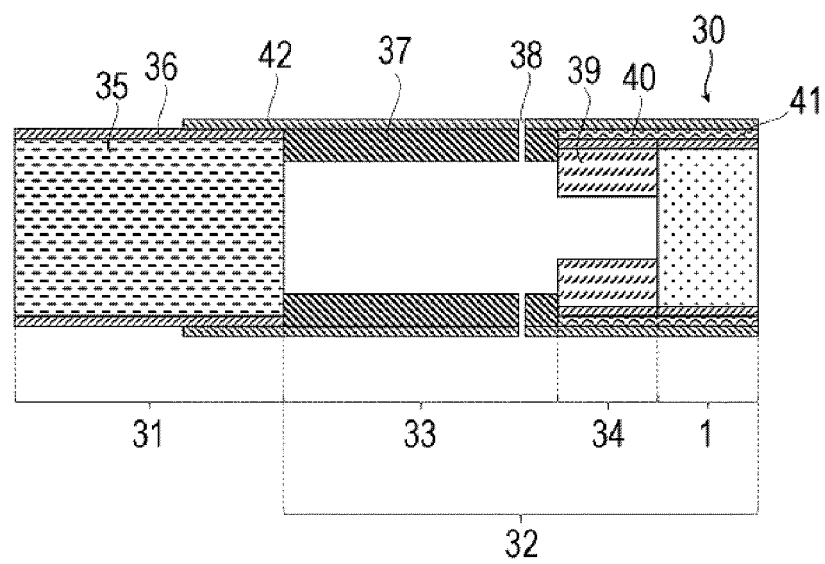


Fig. 13

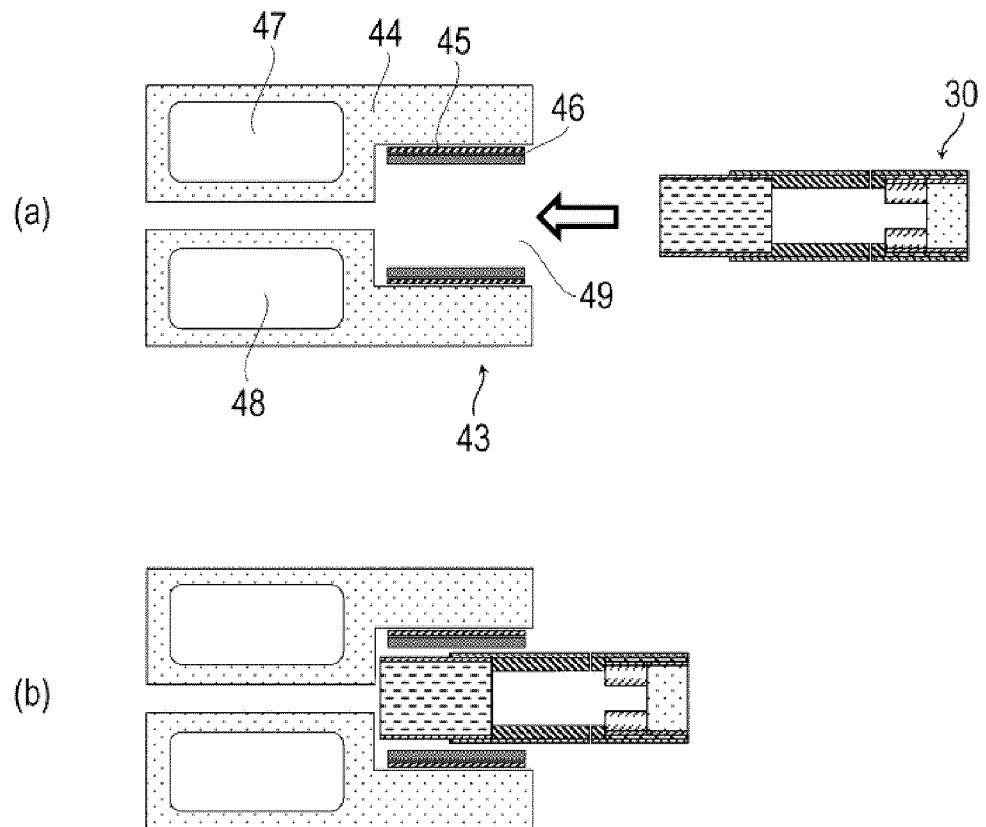
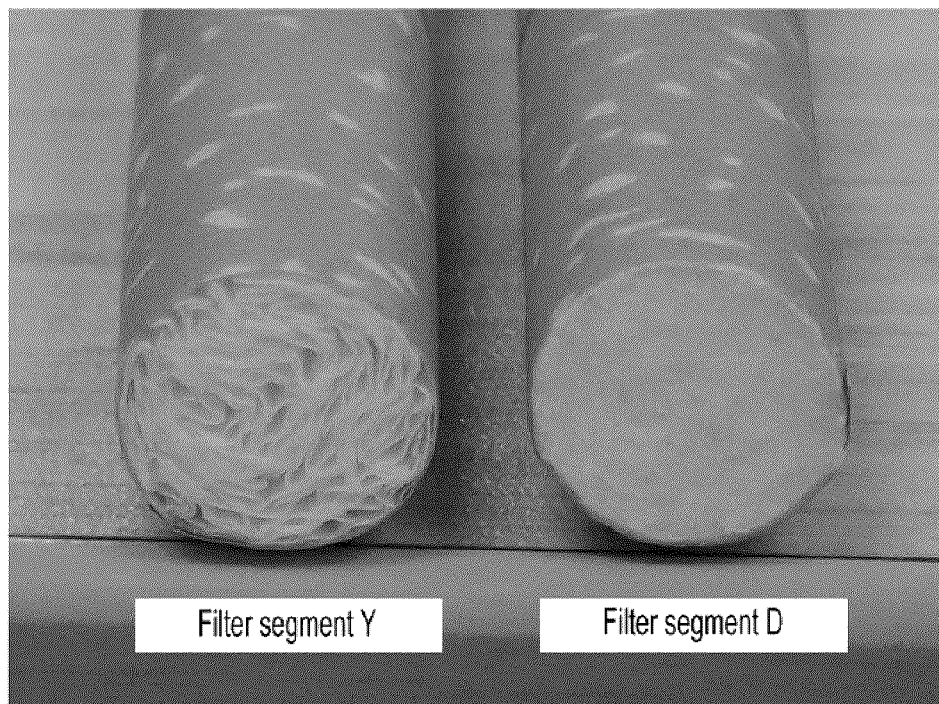


Fig. 14



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/043584

A. CLASSIFICATION OF SUBJECT MATTER A24D 3/04 (2006.01) i FI: 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) A24D3/04		
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 1971-2021 Registered utility model specifications of Japan 1996-2021 Published registered utility model applications of Japan 1994-2021		
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.
Y	JP 06-319512 A (THE NIPPON SYNTHETIC CHEMICAL INDUSTRY CO., LTD.) 22 November 1994 (1994-11-22) paragraphs [0002], [0005]-[0013]	1-21
Y	JP 44-18796 B1 (HONSHU PAPER CO., LTD.) 15 August 1969 (1969-08-15) column 2, line 21 to column 4, line 10, fig. 1-4	1-21
Y	WO 2018/235761 A1 (JAPAN TOBACCO INC.) 27 December 2018 (2018-12-27) paragraphs [0081]-[0082]	12-21
Y	WO 2017/122291 A1 (JAPAN TOBACCO INC.) 20 July 2017 (2017-07-20) paragraph [0015]	18-21
A	JP 2014-515933 A (R.J. REYNOLDS TOBACCO COMPANY) 07 July 2014 (2014-07-07) entire text, all drawings	1-21
☐ Further documents are listed in the continuation of Box C.	☒ See patent family annex.	
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Date of the actual completion of the international search 22 January 2021 (22.01.2021)	Date of mailing of the international search report 02 February 2021 (02.02.2021)	
Name and mailing address of the ISA/ Japan Patent Office 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/JP2020/043584

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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REFERENCES CITED IN THE DESCRIPTION

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