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(71) Applicant: **Japan Tobacco Inc.**
Tokyo 105-6927 (JP)

(72) Inventor: **MOTODAMARI, Tetsuya**
Tokyo 130-8603 (JP)

(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

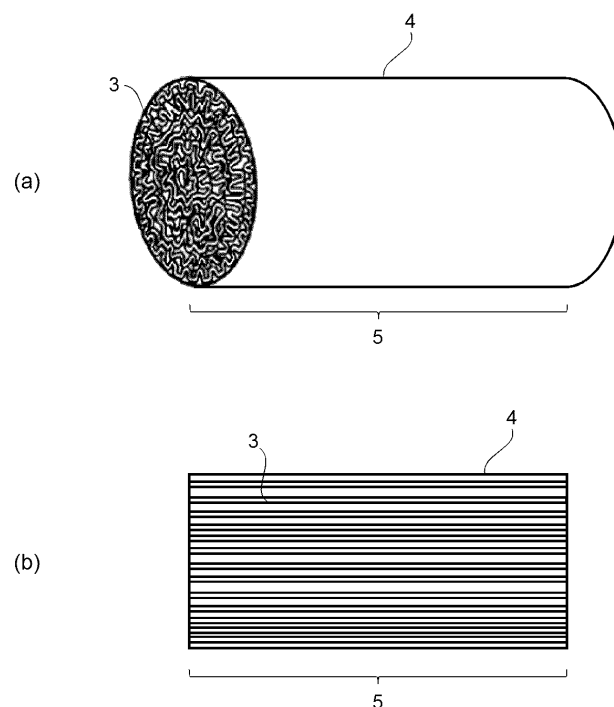
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(54) **COOLING SEGMENT AND METHOD FOR PRODUCING SAME, NONCOMBUSTIBLE HEATING-SMOKING ARTICLE AND NONCOMBUSTIBLE HEATING-SMOKING SYSTEM**

(57) Provided is a cooling segment that exhibits high cooling performance of a vaporized aerosol component and low filtration properties of an aerosol. The cooling segment for a heat-not-burn smoking article, contains a

polymer-coated paper including a paper and a polymer layer that contains a polymer and that is provided on the paper.

Fig.3



Description

TECHNICAL FIELD

[0001] The present invention relates to a cooling segment, a manufacturing method therefor, a heat-not-burn smoking article, and a heat-not-burn smoking system.

BACKGROUND ART

[0002] A common combustion smoking article (cigarette) for smoking through combustion includes a tobacco-containing segment, in which a tobacco filler of dry tobacco leaves shredded into a width of about 1 mm and added with a flavor, a humectant, an appropriate amount of moisture, and so forth is wrapped cylindrically in a paper wrapper; and a mouthpiece segment, in which a corrugated paper or fibers of cellulose acetate or the like are wrapped cylindrically in a paper wrapper. The tobacco-containing segment and the mouthpiece segment are joined with a lining paper. A user smokes by igniting the end of the tobacco-containing segment with a lighter or the like and inhaling from the end of the mouthpiece segment. The leading end of the tobacco-containing segment burns at a temperature exceeding 800°C.

[0003] As a substitute for such a common combustion smoking article, a heat-not-burn smoking article and a heat-not-burn smoking system, which utilize heating in place of combustion, have been developed (Patent Literature (PTL) 1 to 6, for example). The heating temperature is lower than the burning temperature in a combustion smoking article and is 400°C or lower, for example. In a heat-not-burn smoking article, a tobacco filler of a tobacco-containing segment contains an aerosol former, such as glycerol, propylene glycol (PG), triethyl citrate (TEC), or triacetin. Such an aerosol former is vaporized upon heating, moved to a cooling segment within a mouthpiece segment through inhalation, and cooled to generate an aerosol further reliably. Since the aerosol is inhaled together during inhalation, it is possible to ensure the satisfactory sensation of a user.

[0004] A heat-not-burn smoking system typically includes a cylindrical heat-not-burn smoking article having a shape similar to a common combustion smoking article; and a heating device equipped with a battery, a controller, a heater, and so forth. Exemplary heaters include an electric resistance heater and an induction heater. Exemplary heating methods by an electric resistance heater include a method of heating a heat-not-burn smoking article with a heater from the outside and a method of heating by inserting a needle-like or blade-like heater from the leading end of a heat-not-burn smoking article into a tobacco-containing segment that includes a tobacco filler.

CITATION LIST

PATENT LITERATURE

[0005]

PTL 1: Japanese Patent No. 5292410

PTL 2: Japanese Patent No. 5771338

PTL 3: Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2013-507906

PTL 4: WO 2017/198838

PTL 5: Japanese Patent No. 5877618

PTL 6: Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2016-506729

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0006] As mentioned above, an aerosol former vaporized upon heating (hereinafter, also referred to as "vaporized aerosol component") cools primarily in a cooling segment and condenses from the vapor into particles, thereby forming an aerosol. Here, to ensure the filtering function of smoke components or the hardness of a mouthpiece, a filter segment filled with a large amount of fibers or paper as in a common combustion smoking article is used as it is as a cooling segment in some cases. In such a case, a vaporized aerosol component is fully cooled but the resulting aerosol is filtered due to the high filling density. Consequently, it is impossible to sufficiently ensure the satisfactory sensation of a user. Further, when a volatile flavor component is contained in a tobacco-containing segment, the amount of the volatile flavor component volatilized is small in some cases since a heating temperature is low in a heat-not-burn smoking article. In addition, when the filling density of fibers or paper is similarly high, the volatile flavor component is filtered as well and delivered in an insufficient amount.

[0007] As a cooling segment for a heat-not-burn smoking article, for example, PTL 2 discloses a feature that includes a low resistance support element of a gathered or differently processed polymer sheet, such as a polylactic acid sheet. Moreover, PTL 4 discloses a feature in which perforations are provided on the outer perimeter of a hollow cylindrical part to introduce external air therefrom during inhalation and to cool a vaporized aerosol component through contact with external air. Meanwhile, the development of a cooling segment for a heat-not-burn smoking article that can better achieve both high cooling performance of a vaporized aerosol component and low filtration properties of an aerosol has been hoped for.

[0008] An object of the present invention is to provide a cooling segment that exhibits high cooling performance of a vaporized aerosol component and low filtration prop-

erties of an aerosol as well as to provide a heat-not-burn smoking article and a heat-not-burn smoking system including the cooling segment.

SOLUTION TO PROBLEM

[0009] A cooling segment according to the present invention is a cooling segment for a heat-not-burn smoking article, containing a polymer-coated paper including a paper and a polymer layer that contains a polymer and that is provided on the paper.

[0010] A heat-not-burn smoking article according to the present invention includes a tobacco-containing segment and the cooling segment according to the present invention.

[0011] A heat-not-burn smoking system according to the present invention includes the heat-not-burn smoking article according to the present invention and a heating device for heating the tobacco-containing segment.

[0012] A method of manufacturing the cooling segment according to the present invention, includes producing the polymer-coated paper by applying a coating liquid containing the polymer to the paper.

ADVANTAGEOUS EFFECTS OF INVENTION

[0013] According to the present invention, it is possible to provide a cooling segment that exhibits high cooling performance of a vaporized aerosol component and low filtration properties of an aerosol as well as to provide a heat-not-burn smoking article and a heat-not-burn smoking system including the cooling segment.

BRIEF DESCRIPTION OF DRAWINGS

[0014]

Fig. 1 is a cross-sectional view of an exemplary polymer-coated paper according to the present invention.

Fig. 2 is an SEM image for the cross-section of an exemplary polymer layer having a porous structure according to the present invention.

Fig. 3 illustrates an example of a first embodiment of a cooling segment according to the present invention in (a) the perspective view and in (b) the cross-sectional view.

Fig. 4 illustrates another example of the first embodiment of the cooling segment according to the present invention in (a) the perspective view and in (b) the cross-sectional view.

Fig. 5 illustrates a second embodiment of the cooling segment according to the present invention in (a) the perspective view and in (b) the cross-sectional view.

Fig. 6 illustrates a third embodiment of the cooling segment according to the present invention in (a) the perspective view and in (b) the cross-sectional view.

Fig. 7 is a cross-sectional view of an exemplary first

embodiment of a heat-not-burn smoking article according to the present invention.

Fig. 8 is a schematic view of an exemplary heat-not-burn smoking system according to the present invention in (a) the state before inserting a heat-not-burn smoking article into a heating device and in (b) the state of heating the heat-not-burn smoking article inserted into the heating device.

Fig. 9 is a graph showing the amount of glycerol per puff in Example 1 and in Comparative Example 1.

Fig. 10 is a graph showing the amount of menthol per puff in Example 1 and in Comparative Example 1.

Fig. 11 is a cross-sectional view of an exemplary second embodiment of the heat-not-burn smoking article according to the present invention.

Fig. 12 is a graph showing the highest vapor temperature in Examples 2 and 3 and in Comparative Examples 2 to 4.

Fig. 13 is a graph showing the amount of glycerol per puff in Examples 2 and 3 and in Comparative Examples 3 and 4.

Fig. 14 is a graph showing the amount of nicotine per puff in Examples 2 and 3 and in Comparative Examples 3 and 4.

DESCRIPTION OF EMBODIMENTS

[Cooling Segment]

[0015] A cooling segment according to the present invention is a cooling segment for a heat-not-burn smoking article, containing a polymer-coated paper. The polymer-coated paper includes a paper and a polymer layer that contains a polymer and that is provided on the paper. The cooling segment herein means a segment, in a heat-not-burn smoking article, that is located on the mouth end side of a tobacco-containing segment and that cools a vaporized aerosol component.

[0016] In the present invention, the cooling segment contains a polymer-coated paper including a paper and a polymer layer provided on the paper, where the polymer-coated paper has better formability than a polymer sheet. Specifically, different from a polymer sheet (film), the polymer-coated paper even in a small amount can be folded into a desirable shape since the polymer layer is formed on a paper base having predetermined hardness and thickness. For this reason, even when the polymer-coated paper is held together through gathering or the like and disposed inside the cooling segment, the high porosity can be retained inside the cooling segment. Consequently, low filtration properties of an aerosol can be realized. Moreover, since the polymer-coated paper has satisfactory formability, it is possible to form, inside the cooling segment, a structure that enhances the cooling efficiency of a vaporized aerosol component. Further, since a polymer in the polymer layer of the polymer-coated paper undergoes the phase transition upon contact with a vaporized aerosol component to absorb heat, the

cooling effect per unit area is high. Furthermore, even a material that is excellent in heat absorption but cannot be formed into a sheet (film) by itself is usable by thinly applying to a paper. Consequently, it is possible to enhance the cooling effect and correspondingly reduce the amount of sheet to be used, thereby realizing the low filtration properties of an aerosol. Hereinafter, the details of the present invention will be described.

(Polymer-coated Paper)

[0017] A polymer-coated paper according to the present invention includes a paper and a polymer layer that contains a polymer and that is provided on the paper. Fig. 1 illustrates an exemplary polymer-coated paper according to the present invention. In the polymer-coated paper 3 illustrated in Fig. 1, a polymer layer 2 is provided on a paper 1. Although the polymer layer is provided only on either surface of the polymer-coated paper in Fig. 1, the polymer layer may be provided on both surfaces of the polymer-coated paper.

[0018] The paper is not particularly limited provided that the paper functions as a support. However, in view of feasibility of filter wrapping, the basis weight of the paper is preferably 35 g/m² or more and more preferably 35 to 70 g/m². Moreover, the paper preferably has a low air permeability and more preferably has an air permeability of zero. The thickness of the paper is not particularly limited and may be 30 to 70 μ m, for example.

[0019] The polymer layer contains a polymer. The types of the polymer are not particularly limited but are preferably biodegradable polymers or edible polymers. From a viewpoint of allowing the polymer to undergo the phase transition and to absorb heat at a temperature inside the cooling segment, the polymer has a glass transition temperature (T_g) of preferably 400°C or lower, more preferably 200°C or lower, and further preferably 100°C or lower. The lower limit of T_g of the polymer is not particularly limited and may be 40°C or higher, for example. Herein, the T_g of a polymer is specifically a value measured with a differential scanning calorimeter (trade name: "DSC7000" from Hitachi High-Tech Science Corporation). Specific examples of the polymer include polyvinyl alcohol (PVA), cellulose acetate, trehalose, maltose, sucrose, maltitol, glucose, waxes, and hardened oils. These may be used alone or in combination. Among these, PVA or polyvinyl alcohol-acrylic acid-methyl methacrylate copolymer (POVACOAT) is preferable as a polymer in view of satisfactory coating properties of paper. Particularly by PVA, heat absorbing effects through phase transition are readily obtained due to its low T_g. In addition, cooling effects are also readily obtained through adsorption of water vapor in an aerosol due to its high affinity with water.

[0020] When the polymer is PVA, the PVA preferably has an average degree of polymerization of 1,500 or less. When PVA has an average degree of polymerization of 1,500 or less, it is possible to improve coating properties

of paper and uniformly form a polymer layer on paper. The average degree of polymerization of PVA is more preferably 100 or more and 1,300 or less, further preferably 300 or more and 1,200 or less, and particularly preferably 500 or more and 1,000 or less. Herein, the average degree of polymerization of PVA is a value measured in accordance with the testing methods for polyvinyl alcohol in JIS K 6726-1994.

[0021] Moreover, when the polymer is PVA, the PVA preferably has a degree of saponification of 70 mol% or more and 99 mol% or less. As describe hereinafter, when the polymer layer contains a volatile component, PVA having a degree of saponification of 99 mol% or less improves solubility in water, thereby enhancing the release performance of the volatile component. The degree of saponification of PVA is more preferably 75 mol% or more and 99 mol% or less and further preferably 80 mol% or more and 99 mol% or less. Herein, the degree of saponification of PVA is a value measured in accordance with the testing methods for polyvinyl alcohol in JIS K 6726-1994.

[0022] The polymer layer preferably further contains at least one of a volatile flavor component and an aerosol former (hereinafter, also referred to as "volatile component"). In a common combustion smoking article, a high-temperature burning portion moves as burning progresses. Consequently, only a tobacco-containing segment near the burning portion is heated and a volatile component present in such a portion is volatilized and inhaled by a user. In other words, a volatile component present in the longitudinal direction of the tobacco-containing segment of a combustion smoking article is almost uniformly volatilized and delivered throughout inhalation. In a heat-not-burn smoking article, in contrast, the entire longitudinal direction of its tobacco-containing segment is heated by a heater. Consequently, much of a volatile component contained in the tobacco-containing segment is volatilized in the former half of inhalation in some cases. Meanwhile, when a volatile component is incorporated into a cooling segment next to the tobacco-containing segment, the volatile component is likely to be released outside through volatilization before use.

[0023] By incorporating a volatile component into a polymer layer of the polymer-coated paper disposed inside a cooling segment, it is possible to suppress volatilization of the volatile component before use since the volatile component is held within the polymer layer. Moreover, the polymer layer partially becomes rubbery or dissolved when a vaporized aerosol component is cooled, thereby gradually releasing the volatile component from the polymer layer. Consequently, it is possible to deliver the volatile component in a stable manner throughout inhalation. Further, the volatile component contained inside the cooling segment is expected to exert cooling effects by absorbing heat in smoke through vaporization, sublimation, or the like.

[0024] The volatile flavor component is not particularly limited and examples include, from a viewpoint of impart-

ing a satisfactory smoking 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 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 γ -lactone, 4-hydroxy-4-(3-hydroxy-1-butenyl)-3,5,5-trimethyl-2-cyclohexen-1-one, 4-(p-hydroxyphenyl)-2-butanone, 4-hydroxyundecanoic acid sodium salt, 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, methyl cyclopentenolone, 3-methylvaleric acid, mimosa absolute, molasses, myristic acid, nerol, nerolidol, γ -nonalactone, nutmeg oil, δ -octalactone, octanal, octanoic acid, orange flower oil, orange oil, oris root oil, palmitic acid, ω -pentadecalactone, peppermint oil, petitgrain Paraguay oil, phenethyl alcohol, phenethyl phenylacetate, phenylacetic acid, piperonal, plum extract, propenylguaethol, propyl acetate, 3-propylenephthalide, 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-oxatricyclo[8.3.0.0.(4.9)]tridecane, 2,3,5,6-tetramethylpyrazine, thyme oil, tomato extract, 2-tridecanone, triethyl citrate, 4-(2,6,6-trimethylcyclohex-1-enyl)but-2-en-4-one, 2,6,6-trimethylcyclohex-2-ene-1,4-dione, 4-(2,6,6-trimethylcyclohexa-1,3-dienyl)but-2-

en-4-one, 2,3,5-trimethylpyrazine, γ -undecalactone, γ -valerolactone, vanilla extract, vanillin, veratraldehyde, violet leaf absolute, and extracts of tobacco plants (tobacco leaf, tobacco stem, tobacco flower, tobacco root, and tobacco seed). Among these, menthol is particularly preferable. These volatile flavor components may be used alone or in combination. Meanwhile, the aerosol former is a material that can generate an aerosol upon heating. Examples include, but are not particularly limited to, glycerol, propylene glycol (PG), triethyl citrate (TEC), triacetin, and 1,3-butanediol. These may be used alone or in combination.

[0025] The content of a volatile component in the polymer layer is preferably 20 mass% or more and 60 mass% or less based on 100 mass% of the polymer layer. When the content is 20 mass% or more, it is possible to deliver the volatile component in a further stable manner throughout inhalation. Meanwhile, when the content is 60 mass% or less, it is possible to satisfactorily suppress bleeding of the volatile component from the polymer layer. The content is more preferably 10 mass% or more and 60 mass% or less and further preferably 10 mass% or more and 30 mass% or less.

[0026] The polymer layer preferably has a thickness of 30 μm or less. When the thickness of the polymer layer is 30 μm or less, a volatile component is readily released, thereby enabling further stable delivery of the volatile component throughout inhalation. The thickness of the polymer layer is more preferably 5 μm or more and 25 μm or less and further preferably 10 μm or more and 25 μm or less.

[0027] The polymer layer preferably has a porous structure. For example, a volatile component existing inside pores of the porous structure is gradually released as the porous structure is partially broken by heating. As a result, it is possible to uniformly deliver the volatile component throughout inhalation. Fig. 2 is an SEM image at 1,500 $\times$ for the cross-section of an exemplary polymer layer having a porous structure according to the present invention. In Fig. 2, the polymer layer 2 formed on the paper 1 has a plurality of fine pores, inside which a volatile component exists.

[0028] When the polymer layer has a porous structure, the average pore size is preferably 0.5 μm or more and 20 μm or less and more preferably 1 μm or more and 10 μm or less. Herein, the average pore size of a porous structure is a value measured by a CD-SEM.

[0029] A method of forming a porous structure is not particularly limited. For example, as described hereinafter, it is possible to form a micelle-derived porous structure by emulsifying a polymer and a volatile component using an emulsifier to form micelles during preparation of a coating liquid for a polymer layer. In this case, the average pore size and porosity of a porous structure can be adjusted by the amount of the emulsifier to be used.

(Configuration of Cooling Segment)

[0030] A cooling segment according to the present invention is not particularly limited provided that the above-described polymer-coated paper according to the present invention is included. Hereinafter, specific embodiments will be described. However, the cooling segment according to the present invention is not limited to these embodiments.

[0031] Figs. 3 and 4 respectively illustrate one and another examples of a first embodiment of the cooling segment according to the present invention in (a) the perspective view and in (b) the cross-sectional view. The cooling segment 5 illustrated in Figs. 3 and 4 includes a polymer-coated paper 3 and a wrapper 4 that wraps the polymer-coated paper 3. The polymer-coated paper 3 includes a paper and a polymer layer that contains a polymer and that is provided on the paper; and is gathered and disposed within the wrapper 4 of the cooling segment 5. Grooves formed through gathering extend in the axial direction of the cooling segment 5, in other words, the horizontal direction in Figs. 3 and 4. Since the polymer-coated paper 3 has such a configuration inside the cooling segment 5, it is possible to increase the surface area of the polymer-coated paper 3 while maintaining passing properties of an aerosol in the axial direction of the cooling segment 5. Consequently, filtration properties of an aerosol are lowered while enhancing cooling performance of a vaporized aerosol component. Here, the number of grooves formed through gathering is not particularly limited. In Fig. 3, a plurality of folds (also referred to as crimps or crepes) are provided in advance in the axial direction of the cooling segment 5 before the polymer-coated paper 3 is gathered and disposed within the wrapper 4 of the cooling segment 5. Meanwhile, such folds are not provided on the polymer-coated paper 3 in Fig. 4. In comparison with the polymer-coated paper 3 in Fig. 4, the polymer-coated paper 3 in Fig. 3 has sharp bends since a plurality of folds are provided in the axial direction of the cooling segment 5.

[0032] In the first embodiment, the polymer layer-formed surface of the polymer-coated paper 3 preferably has a surface area of 100 to 280 mm² per 1 mm of the cooling segment 5 in the axial direction. When the surface area of the polymer layer-formed surface falls within this range, it is possible to enhance cooling efficiency of a vaporized aerosol component while maintaining low filtration properties of an aerosol. Herein, the surface area of the polymer layer-formed surface of the polymer-coated paper 3 per 1 mm of the cooling segment 5 in the axial direction is a value of the surface area (mm²) of the polymer layer-formed surface of the polymer-coated paper 3 disposed inside the cooling segment 5 divided by the length (mm) of the cooling segment 5 in the axial direction.

[0033] The polymer layer may be formed on only either surface or on both surfaces of the polymer-coated paper 3. When the polymer layer is formed on only either sur-

face of the polymer-coated paper 3, the surface area falls preferably within the range of 100 to 150 mm², more preferably within the range of 120 to 150 mm², and further preferably within the range of 130 to 150 mm². Meanwhile, when the polymer layer is formed on both surfaces of the polymer-coated paper 3, the surface area falls preferably within the range of 200 to 300 mm², more preferably within the range of 240 to 300 mm², and further preferably within the range of 260 to 300 mm².

[0034] Fig. 5 illustrates a second embodiment of the cooling segment according to the present invention in (a) the perspective view and in (b) the cross-sectional view. In Fig. 5, a plurality of rectangular polymer-coated papers 3 are disposed within a wrapper 4 of a cooling segment 5. The length of the polymer-coated paper 3 in the longitudinal direction is longer than the diameter of the cooling segment 5 (diameter on the cross-section perpendicular to the axial direction of the cooling segment 5). Moreover, the polymer-coated papers 3 are disposed with the longitudinal direction aligned almost parallel to the axial direction of the cooling segment 5, in other words, the horizontal direction in Fig. 5. Herein, the expression "almost parallel" means a direction within $\pm 10^\circ$ of a target direction. When the polymer-coated papers 3 have such a configuration inside the cooling segment 5, it is possible to increase the surface area of the polymer-coated papers 3 while maintaining the passing properties of an aerosol in the axial direction of the cooling segment 5. Consequently, cooling performance of a vaporized aerosol component is enhanced while lowering filtration properties of an aerosol. The length (width) of the polymer-coated papers 3 in the transverse direction is not particularly limited but is preferably 0.2 mm or more and 5 mm or less and more preferably 0.5 mm or more and 3 mm or less.

[0035] Fig. 6 illustrates a third embodiment of the cooling segment according to the present invention in (a) the perspective view and in (b) the cross-sectional view. In Fig. 6, a plurality of strand-shaped (string-shaped) polymer-coated papers 3 are disposed within a wrapper 4 of a cooling segment 5. These polymer-coated papers 3 are packed inside the cooling segment 5. The longitudinal direction of the polymer-coated papers 3 is not particularly limited and may be randomly aligned relative to the axial direction of the cooling segment 5 as illustrated in Fig. 6 (b). When the polymer-coated papers 3 have such a configuration inside the cooling segment 5, it is possible, due to the short length of the polymer-coated papers 3, to increase the surface area of the polymer-coated papers 3 while maintaining passing properties of an aerosol. Consequently, cooling performance of a vaporized aerosol component is enhanced while lowering filtration properties of an aerosol. The length of the polymer-coated papers 3 in the longitudinal direction is not particularly limited but may be shorter than the diameter of the cooling segment 5. For example, the length may be 1 mm or more and 10 mm or less. Moreover, the length of the polymer-coated papers 3 in the transverse direction is

not particularly limited and may be 0.5 mm or more and 2 mm or less, for example.

[0036] The shape of the cooling segment is not particularly limited and may be columnar, for example. When the cooling segment is columnar, the perimeter length of the cooling segment is preferably 16 to 25 mm, more preferably 20 to 24 mm, and further preferably 21 to 23 mm. Further, the length of the cooling segment in the axial direction is preferably 5 to 70 mm, more preferably 5 to 50 mm, and further preferably 5 to 30 mm. The cross-sectional shape of the cooling segment is not particularly limited and may be circular, elliptic, or polygonal, for example. Further, the cooling segment may be perforated.

[Method of Manufacturing Cooling Segment]

[0037] A method of manufacturing the cooling segment according to the present invention, includes producing a polymer-coated paper by applying a coating liquid containing a polymer to a paper. According to the method, the cooling segment according to the present invention can be manufactured suitably.

[0038] A method of preparing the coating liquid is not particularly limited, and the coating liquid may be prepared, for example, as a dispersion in which a polymer and a volatile component added as necessary are dispersed in an aqueous dispersion medium. When a component that is solid at room temperature, such as menthol, is used as a volatile flavor component, it is preferable to dissolve the solid component in ethanol or the like in advance. Specifically, for example, the solid component is dissolved in ethanol and added to water in which a polymer has been dispersed in advance. It is also possible to prepare a dispersion by adding, as necessary, an emulsifier, an aerosol former, such as glycerol, and so forth. Exemplary emulsifiers include glycerol fatty acid esters, sucrose fatty acid esters, and lecithins. These emulsifiers may be used alone or in combination.

[0039] In the dispersion, the solid component is dissolved in ethanol and the dissolution product and the polymer are dispersed in the dispersion (ethanol aqueous solution). When the dispersion is applied and dried, ethanol and water are removed through volatilization while leaving, as pores, the portions where ethanol and water have existed. As a result, the formed polymer layer presumably has a porous structure in which the solid component exists inside pores. Moreover, when an emulsifier is used, micelles containing ethanol, the emulsifier, and the solid component are formed. When ethanol and water are removed, pores are formed in micelle portions while leaving the solid component inside the pores. As a result, the formed polymer layer presumably has a porous structure in which the solid component exists inside the pores. The pore size of the porous structure can be adjusted, for example, by the amount of an emulsifier to be used. For example, as the amount of an emulsifier to be used decreases, the pore size increases. From a viewpoint of sufficiently holding a volatile component within

pores and gradually releasing the volatile component upon heating, the pore size is preferably larger. In other words, the amount of an emulsifier to be used is preferably less. The concentration of an emulsifier in the dispersion is preferably 0 mass% or more and 10 mass% or less. Moreover, the concentration of a polymer in the dispersion is preferably 10 mass% or more and 30 mass% or less. When ethanol is used, the concentration of ethanol in the dispersion is preferably 5 mass% or more and 15 mass% or less. The concentration of a volatile component in the dispersion is preferably 5 mass% or more and 20 mass% or less.

[0040] Next, the coating liquid may be applied to a paper and dried. The amount of the coating liquid applied to a paper may be appropriately selected according to the thickness of a polymer layer to be formed. The temperature during drying may be 60°C or higher and 200°C or lower, for example. Through this step, a polymer-coated paper in which a polymer layer is formed on a paper is obtained.

[0041] The obtained polymer-coated paper may be disposed within a wrapper. The shape and the configuration within the wrapper of the polymer-coated paper are not particularly limited, and examples include the shape and the configuration of each polymer-coated paper in the cooling segments of the above-described first to the third embodiments.

[0042] In the first embodiment, a polymer-coated paper can be formed into a desirable shape, for example, by corrugating through processing, such as creping. Specifically, a polymer-coated paper is creped with a crepe roll and gathered initially with a transport jet then with a tongs into a finish cylindrical size. Subsequently, the polymer-coated paper is wrapped in a wrapper, and the wrapper end (the portion to be overlapped in wrapping) is coated with a hot-melt glue using a wrapping glue gun and cooled with a cooler bar. Finally, by cutting into a predetermined length with a cutter, a cooling segment is obtained. When crepes are not formed, creping with a crepe roll can be omitted.

[0043] In the second embodiment, a cooling segment can be obtained by cutting a polymer-coated paper into strips; and disposing a plurality of polymer-coated paper strips within a tubular wrapper or wrapping a plurality of polymer-coated paper strips in a wrapper.

[0044] In the third embodiment, a cooling segment can be obtained by cutting a polymer-coated paper into strands (strings); and disposing a plurality of strand-shaped polymer-coated papers within a tubular wrapper or wrapping a plurality of strand-shaped polymer-coated papers in a wrapper.

[Heat-not-burn Smoking Article]

[0045] A heat-not-burn smoking article according to the present invention includes a tobacco-containing segment and the cooling segment according to the present invention. Since the cooling segment according to the

present invention is included, the heat-not-burn smoking article exhibits high cooling performance of a vaporized aerosol component and low filtration properties of an aerosol. The heat-not-burn smoking article according to the present invention may further include other segments, in addition to the tobacco-containing segment and the cooling segment.

(First Embodiment)

[0046] Fig. 7 illustrates an exemplary first embodiment of the heat-not-burn smoking article according to the present invention. The heat-not-burn smoking article 30 illustrated in Fig. 7 includes a tobacco-containing segment 10 and a mouthpiece segment 11. The mouthpiece segment 11 includes a cooling segment 5 according to the present invention, a center hole segment 12, and a filter segment 13. During smoking, the tobacco-containing segment 10 is heated and inhalation takes place at the end of the filter segment 13. The position of the cooling segment 5 is not limited to the position illustrated in Fig. 7 and may be anywhere in the mouthpiece segment 11.

[0047] The tobacco-containing segment 10 includes a tobacco filler 14 containing tobacco and an aerosol former; and a tubular wrapper 15 that covers the tobacco filler 14. The tobacco filler 14 may further contain a volatile flavor component, water, and so forth. The size of tobacco used as a filler or a preparation method therefor is not particularly limited. For example, dry tobacco leaves shredded into a width of 0.8 to 1.2 mm may be used. In this case, the shreds have a length of about 5 to 20 mm. Moreover, those prepared by uniformly pulverizing dry tobacco leaves into an average particle size of about 20 to 200 μm , forming into sheets, and shredding the sheets into a width of 0.8 to 1.2 mm may also be used. In this case, the shreds have a length of about 5 to 20 mm. Further, the above-mentioned formed sheets may be gathered without shredding and used as a filler. In either case of using dry tobacco leaves as shreds or as sheets formed after uniform pulverization, various types of tobacco may be employed for a tobacco filler. Flue-cured, burley, oriental, and domestic, regardless of *Nicotiana tabacum* varieties or *Nicotiana rustica* varieties, may be blended as appropriate for an intended taste and used. The details of the varieties of tobacco are disclosed in "Tobacco no Jiten (Dictionary of Tobacco), Tobacco Academic Studies Center, March 31, 2009." There are a plurality of conventional methods for pulverizing tobacco and forming into uniform sheets. Such sheets include a sheet made by a paper making process; a cast sheet made by uniformly mixing with a suitable solvent, such as water, thinly casting the resulting uniform mixture on a metal sheet or a metal sheet belt, and drying; and a rolled sheet formed by extruding a uniform mixture with a suitable solvent, such as water, into a sheet shape. The details of the types of uniform sheets are disclosed in "Tobacco no Jiten (Dictionary of Tobacco), Tobacco

Academic Studies Center, March 31, 2009." The filling density of the tobacco filler 14 is not particularly limited but is typically 250 mg/cm^3 or more, preferably 320 mg/cm^3 or more and typically 520 mg/cm^3 or less, preferably 420 mg/cm^3 or less from a viewpoint of ensuring the performance of the heat-not-burn smoking article 30 and imparting a satisfactory smoking flavor. Specifically, in the case of the tobacco-containing segment 10 of 22 mm in circumference and 20 mm in length, the content range of the tobacco filler 14 in the tobacco-containing segment 10 is 200 to 400 mg and preferably from 250 to 320 mg per tobacco-containing segment 10. An aerosol former and a volatile flavor component the same as or different from a volatile component that may be contained in a polymer layer of the polymer-coated paper according to the present invention may be used. The amount of an aerosol former contained in the tobacco filler 14 may be, for example, 10 to 30 mass% based on 100 mass% of the tobacco filler 14.

[0048] A method of packing the tobacco filler 14 within the wrapper 15 is not particularly limited. For example, the tobacco filler 14 may be wrapped in the wrapper 15 or the tubular wrapper 15 may be filled with the tobacco filler 14. When the shape of tobacco has a longitudinal direction as in a rectangle, tobacco may be packed with the longitudinal direction randomly aligned within the wrapper 15 or may be packed with the longitudinal direction aligned with the axial direction or the direction perpendicular to the axial direction of the tobacco-containing segment 10. A tobacco component and an aerosol former contained in the tobacco filler 14 are vaporized by heating the tobacco-containing segment 10 and moved to the mouthpiece segment 11 through inhalation.

[0049] The center hole segment comprises a filling layer having one or a plurality of hollow portions and an inner plug wrapper that covers the filling layer. For example, the center hole segment 12 comprises a first filling layer 16 having a hollow portion and a first inner plug wrapper 17 that covers the first filling layer 16. The center hole segment 12 acts to increase the strength of the mouthpiece segment 11. The first filling layer 16 may be, for example, a rod of $\phi 5.0$ to $\phi 1.0$ mm in inner diameter formed by hardening highly densely packed cellulose acetate fibers added with 6 to 20 mass%, based on the mass of cellulose acetate, of a plasticizer including triacetin. Since the first filling layer 16 has a high filling density of fibers, air and an aerosol flow only through the hollow portion and hardly flow within the first filling layer 16 during inhalation. When an aerosol component reduction through filtration in the filter segment 13 is desirably suppressed in the heat-not-burn smoking article 30, it is effective to reduce the length of the filter segment 13 and replace it with the center hole segment 12 for the purpose of increasing the amount of the aerosol component to be delivered. Since the first filling layer 16 inside the center hole segment 12 is a fiber-filled layer, a user rarely feels odd by touch from the outside during use.

[0050] The filter segment 13 comprises a second filling

layer 18 and a second inner plug wrapper 19 that covers the second filling layer 18. Since the second filling layer 18 is present all the way up to the mouth end in the filter segment 13, the mouth end exhibits an appearance similar to a common combustion smoking article. During inhalation, air and an aerosol pass through the second filling layer 18 and part of the aerosol is filtered. The second filling layer 18 may be a filling layer of cellulose acetate fibers, for example.

[0051] The center hole segment 12 and the filter segment 13 are joined with an outer plug wrapper 20. The outer plug wrapper 20 may be a cylindrical paper, for example. Moreover, the tobacco-containing segment 10, the cooling segment 5, and the connected center hole segment 12 and filter segment 13 are joined with a mouthpiece lining paper 21. These three segments may be joined, for example, by applying a glue, such as a vinyl acetate-based glue, to the inner surface of the mouthpiece lining paper 21 and wrapping the lining paper around these segments.

[0052] The length of the first embodiment of the heat-not-burn smoking article according to the present invention in the axial direction, in other words, the horizontal direction in Fig. 7 is not particularly limited but is preferably 40 mm to 90 mm, more preferably 50 mm to 75 mm, and further preferably 50 mm to 60 mm. The perimeter length of the heat-not-burn smoking article is preferably 16 mm to 25 mm, more preferably 20 mm to 24 mm, and further preferably 21 mm to 23 mm. In an exemplary embodiment, the length of the tobacco-containing segment 10 is 20 mm, the length of the cooling segment 5 is 20 mm, the length of the center hole segment 12 is 8 mm, and the length of the filter segment 13 is 7 mm. The length of these individual segments may be changed appropriately depending on manufacturing feasibility, required quality, and so forth. Further, even an article in which only the filter segment 13 is disposed on the downstream side of the cooling segment 5 without using the center hole segment 12 can also act as the heat-not-burn smoking article 30. Moreover, the order of the cooling segment 5 and the center hole segment 12 may be switched. Further, in view of filtration properties of an aerosol, a center hole segment may be provided in place of the filter segment 13.

(Second Embodiment)

[0053] Fig. 11 illustrates an exemplary second embodiment of the heat-not-burn smoking article according to the present invention. The heat-not-burn smoking article 30 illustrated in Fig. 11 includes a tobacco-containing segment 10 and a mouthpiece segment 11. The mouthpiece segment 11 includes a first cooling segment 22, a second cooling segment 5 according to the present invention, and a center hole segment 12. In the present embodiment, it is possible to further lower filtration properties of an aerosol since a filter segment without a hollow portion (filter segment 13 in the first embodiment) is ab-

sent. The tobacco-containing segment 10 and the center hole segment 12 may be the same as the tobacco-containing segment and the center hole segment in the first embodiment.

[0054] The first cooling segment 22 comprises a tubular member 23. The tubular member 23 may be a paper tube of cylindrically processed cardboard, for example. The tubular member 23 and a mouthpiece lining paper 21 are provided with a perforation 24 passing there-through. Due to the presence of the perforation 24, external air is introduced inside the first cooling segment 22 during inhalation. Consequently, a volatile component vaporized through heating of the tobacco-containing segment 10 comes into contact with external air to allow lowering in temperature. The size (diameter) of the perforation 24 is not particularly limited and may be 0.5 to 1.5 mm, for example. The number of the perforation 24 is also not particularly limited and may be one or two or more. For example, a plurality of perforations 24 may be provided on the perimeter of the first cooling segment 22.

[0055] The length of the second embodiment of the heat-not-burn smoking article according to the present invention in the axial direction, in other words, the horizontal direction in Fig. 11 is not particularly limited but is preferably 40 mm to 90 mm, more preferably 50 mm to 75 mm, and further preferably 50 mm to 60 mm. The perimeter length of the heat-not-burn smoking article is preferably 16 mm to 25 mm, more preferably 20 mm to 24 mm, and further preferably 21 mm to 23 mm. In an exemplary embodiment, the length of the tobacco-containing segment 10 is 20 mm, the length of the first cooling segment 22 is 20 mm, the length of the second cooling segment 5 is 8 mm, and the length of the center hole segment 12 is 7 mm. The length of these individual segments may be changed appropriately depending on manufacturing feasibility, required quality, and so forth.

[Heat-not-burn Smoking System]

[0056] A heat-not-burn smoking system according to the present invention includes the heat-not-burn smoking article according to the present invention and a heating device for heating a tobacco-containing segment. Since the heat-not-burn smoking article according to the present invention is included, the heat-not-burn smoking system exhibits high cooling performance of a vaporized aerosol component and low filtration properties of an aerosol. The heat-not-burn smoking system according to the present invention is not particularly limited provided that the heat-not-burn smoking article according to the present invention and the heating device are included and may have other configurations.

[0057] Fig. 8 illustrates an exemplary heat-not-burn smoking system according to the present invention. The heat-not-burn smoking system illustrated in Fig. 8 includes the heat-not-burn smoking article 30 according to the first embodiment of the present invention and a heating device 31 for heating a tobacco-containing segment

of the heat-not-burn smoking article 30 from the outside. Fig. 8 (a) illustrates the state before inserting the heat-not-burn smoking article 30 into the heating device 31, and Fig. 8 (b) illustrates the state of heating the heat-not-burn smoking article 30 inserted into the heating device 31. The heating device 31 illustrated in Fig. 8 includes a body 32, a heater 33, a metal tube 34, a battery unit 35, and a control unit 36. The body 32 has a tubular recess 37, and the heater 33 and the metal tube 34 are arranged on the inner side surface of the recess 37 at a position corresponding to the tobacco-containing segment of the heat-not-burn smoking article 30 inserted into the recess 37. The heater 33 may be an electric resistance heater, and heating by the heater 33 is performed by supplying power from the battery unit 35 in accordance with instructions from the control unit 36, which controls temperature. Heat generated by the heater 33 is transferred to the tobacco-containing segment of the heat-not-burn smoking article 30 through the metal tube 34 having a high thermal conductivity. In the schematic view of Fig. 8 (b), a gap exists between the outer perimeter of the heat-not-burn smoking article 30 and the inner perimeter of the metal tube 34. However, such a gap between the outer perimeter of the heat-not-burn smoking article 30 and the inner perimeter of the metal tube 34 is actually and desirably absent for the purpose of efficient heat transfer. Although the heating device 31 heats the tobacco-containing segment of the heat-not-burn smoking article 30 from the outside, the heating device may be a heating device for heating from the inside.

[0058] The heating temperature by the heating device is not particularly limited but is preferably 400°C or lower, more preferably 150°C or higher and 400°C or lower, and further preferably 200°C or higher and 350°C or lower. Herein, the heating temperature means the temperature of the heater in the heating device.

EXAMPLES

[0059] Hereinafter, the present invention will be described further specifically by means of working examples. However, the present invention is by no means limited by these working examples.

[Example 1]

(Preparation of Polymer-coated Paper)

[0060] A solution (hereinafter, referred to as solution A) was prepared by dissolving 21 g of menthol in 9 g of ethanol. PVA (Tg: 58°C, average degree of polymerization: 500, degree of saponification: 85 to 89 mol%) of 45 g was dispersed through mixing in 116 g of water heated to 80°C. Into the resulting mixture, solution A was added while stirring thoroughly with a stirrer to prepare a dispersion. The dispersion was applied to either surface of a paper (trade name: 50NFB from Nippon Paper Papyrus Co., Ltd., basis weight: 50 g/m², air permeability: 0 CU,

oil-resistant paper) and dried at 60°C to 90°C to yield a polymer-coated paper in which a 20 to 30 μm-thick polymer layer is formed on the paper. Through the SEM observation of its cross-section, the polymer layer was confirmed to have a porous structure. To squeeze into as a bar shape, the polymer-coated paper was creased and formed.

(Preparation of Heat-not-burn Smoking Article for Evaluation)

[0061] A commercial heat-not-burn smoking article (trade name: IQOS regular from Philip Morris International Inc.) was prepared. The heat-not-burn smoking article has a segment configuration the same as the heat-not-burn smoking article 30 illustrated in Fig. 7 except that the order of the cooling segment 5 and the center hole segment 12 is switched. A portion corresponding to a tobacco-containing segment of the heat-not-burn smoking article contains tobacco and glycerol as an aerosol former. Moreover, a gathered polylactic acid film is disposed in a portion corresponding to the cooling segment of the heat-not-burn smoking article.

[0062] A heat-not-burn smoking article for evaluation was obtained by taking out the polylactic acid film disposed inside the portion corresponding to the cooling segment of the heat-not-burn smoking article and disposing the prepared and formed polymer-coated paper instead. The polymer layer-formed surface of the polymer-coated paper had a surface area of 106 mm² per 1 mm of the portion corresponding to the cooling segment in the axial direction.

(Evaluation of Cooling Performance)

[0063] Thermocouples (trade name: Type K 0.5 mmφ from Chino Corporation) were inserted into positions immediately preceding and immediately following the portion corresponding to the cooling segment of the heat-not-burn smoking article for evaluation. The temperature detected by a thermocouple inserted into the position immediately preceding the portion corresponding to the cooling segment is referred to as "cooling segment inlet temperature," and the temperature detected by a thermocouple inserted into the position immediately following the portion corresponding to the cooling segment is referred to as "cooling segment outlet temperature." The portion corresponding to the tobacco-containing segment of the heat-not-burn smoking article for evaluation was heated at about 350°C by using a heating device designed for the commercial heat-not-burn smoking article (trade name: IQOS2.4 from Philip Morris International Inc.) and inhalation was performed. The inhalation was performed as 10 puffs in total at 55 mL/puff for 2 seconds (30 second interval for each puff, i.e. 2 seconds for inhaling and 28 seconds for waiting). The cooling segment inlet temperature and the cooling segment outlet temperature were measured for each puff, and the aver-

age values for 10 puffs were calculated (referred to as "average inlet temperature" and "average outlet temperature," respectively). The average outlet temperature was 63.6°C. The cooling efficiency per unit area, which is calculated as a temperature lowered through cooling (ΔT (°C)) divided by the surface area (cm²) of the polymer layer-formed surface of the polymer-coated paper, was 0.43°C/cm². Here, ΔT (°C) is a value obtained by subtracting the average outlet temperature from the average inlet temperature.

(Evaluation of Filtration Properties of Aerosol)

[0064] A glass fiber filter (trade name: Cambridge filter 44 mm from Borgwaldt KC GmbH) was placed at a position immediately following the mouth end of the heat-not-burn smoking article for evaluation. The portion corresponding to the tobacco-containing segment of the heat-not-burn smoking article for evaluation was heated at 350°C by using a heating device designed for the commercial heat-not-burn smoking article (trade name: IQOS2.4 from Philip Morris International Inc.) and inhalation was performed. The inhalation was performed as 10 puffs in total at 55 mL/puff for 2 seconds (30 second interval for each puff, i.e. 2 seconds for inhaling and 28 seconds for waiting) in accordance with the CIR (Canadian intense smoking regimen). The amounts of glycerol and menthol trapped by the Cambridge filter pad were quantified for each puff. Specifically, trapped components were subjected to shaking extraction using 10 mL of isopropanol (IPA) as an extraction solvent under conditions of 200 rpm for 20 minutes. The obtained extract was analyzed by GC under the following conditions to quantify the amounts of glycerol and menthol per puff.

Inlet temperature: 240°C

Oven temperature: retention at 150°C for 1.3 min, subsequent temperature rising at 70°C/min to 240°C, retention for 5 min

Column: (trade name) DB-WAX 10 m × 0.18 mm × 0.18 μm from Agilent Technologies, Inc.

Detector: FID

[0065] The amounts of glycerol and menthol per puff are shown in Figs. 9 and 10, respectively.

[Comparative Example 1]

[0066] A commercial heat-not-burn smoking article (trade name: IQOS Menthol from Philip Morris International Inc.) was prepared. The heat-not-burn smoking article has a segment configuration the same as the heat-not-burn smoking article 30 illustrated in Fig. 7 except that the order of the cooling segment 5 and the center hole segment 12 is switched. A portion corresponding to a tobacco-containing segment of the heat-not-burn smoking article contains tobacco, glycerol as an aerosol former, and menthol as a volatile flavor component.

Moreover, a gathered polylactic acid film is disposed in a portion corresponding to the cooling segment of the heat-not-burn smoking article. The polymer layer-formed surface of the polylactic acid film has a surface area of 220 mm² per 1 mm of the portion corresponding to the cooling segment in the axial direction. It is noted that the amount of menthol (6 mg/article) contained in this heat-not-burn smoking article is less than the amount of menthol (12 mg/article) contained in the heat-not-burn smoking article for evaluation prepared in Example 1.

[0067] Heating and inhalation were performed in the same manner as Example 1 except for using the prepared heat-not-burn smoking article, and the cooling performance and filtration properties of an aerosol were evaluated. The average outlet temperature was 59.2°C. The cooling efficiency per unit area was 0.26°C/mm². The amounts of glycerol and menthol per puff are shown in Figs. 9 and 10, respectively. Here, in the calculation of the cooling efficiency per unit area, the surface area was calculated by assuming that a polymer layer is formed on one surface in the polylactic acid film.

[0068] In the evaluation of cooling performance, the average outlet temperature in Example 1, which used a polymer-coated paper, was almost comparable to that in Comparative Example 1, which used a polylactic acid film. However, since the polymer-coated paper has a smaller surface area than the polylactic acid film, the cooling efficiency per unit area was higher in Example 1.

[0069] Moreover, the porosity is high inside the cooling segment in Example 1 due to the small surface area.

[0070] Consequently, the amount of glycerol delivered was larger as shown in Fig. 9, in other words, filtration properties of an aerosol were lower. Further, without volatilization before use, menthol was delivered in a stable manner throughout inhalation in Example 1 as shown in Fig. 10.

[Example 2]

(Preparation of Heat-not-burn Smoking Article for Evaluation)

[0071] A commercial heat-not-burn smoking article (trade name: Ploom S from Japan Tobacco Inc.) was prepared. The heat-not-burn smoking article is the heat-not-burn smoking article 30 illustrated in Fig. 11 in which the second cooling segment 5 is replaced with a center hole segment and the center hole segment 12 is replaced with a filter segment filled with cellulose acetate fibers. In this heat-not-burn smoking article, the center hole segment was replaced with a cooling segment filled with the polymer-coated paper prepared in Example 1 and the filter segment was replaced with a center hole segment having a hollow portion of 1.5 mm in diameter. Consequently, the heat-not-burn smoking article 30 illustrated in Fig. 11 in which the polymer-coated paper prepared in Example 1 is packed inside the second cooling segment 5 was prepared. The length of the tobacco-contain-

ing segment 10 was 20 mm, the length of the first cooling segment 22 was 20 mm, the length of the second cooling segment 5 was 8 mm, and the length of the center hole segment 12 was 7 mm.

(Evaluation of Cooling Performance)

[0072] A thermocouple was provided at a position 7 mm downstream side (user side) of the mouth end face of the heat-not-burn smoking article for evaluation to measure the vapor temperature. A portion corresponding to a tobacco-containing segment of the heat-not-burn smoking article for evaluation was heated at 230°C by using a heating device designed for the commercial heat-not-burn smoking article (trade name: Ploom S from Japan Tobacco Inc.) and inhalation was performed. The inhalation was performed as 8 puffs in total at 55 mL/puff for 2 seconds (30 second interval for each puff, i.e. 2 seconds for inhaling and 28 seconds for waiting). The highest vapor temperature measured by the thermocouple is shown in Fig. 12.

(Evaluation of Filtration Properties of Aerosol)

[0073] A glass fiber filter (trade name: Cambridge filter 44 mm from Borgwaldt KC GmbH) was placed at a position immediately following the mouth end of the heat-not-burn smoking article for evaluation. The portion corresponding to the tobacco-containing segment of the heat-not-burn smoking article for evaluation was heated at 230°C by using a heating device designed for the commercial heat-not-burn smoking article (trade name: Ploom S from Japan Tobacco Inc.) and inhalation was performed. The inhalation was performed as 8 puffs in total at 55 mL/puff for 2 seconds (30 second interval for each puff, i.e. 2 seconds for inhaling and 28 seconds for waiting) in accordance with the CIR (Canadian intense smoking regimen). Glycerol and nicotine trapped by the Cambridge filter pad were quantified for each puff. Glycerol and nicotine were quantified in a similar manner to Example 1. The amounts of glycerol and nicotine per puff are shown in Figs. 13 and 14, respectively.

[Example 3]

[0074] A polymer-coated paper was prepared in the same manner as Example 1 except for omitting the addition of menthol. A heat-not-burn smoking article for evaluation was prepared in the same manner as Example 2 except for using the prepared polymer-coated paper, and the cooling performance and filtration properties of an aerosol were evaluated. The evaluation results are shown in Figs. 12 to 14.

[Comparative Example 2]

[0075] A heat-not-burn smoking article for evaluation was prepared in the same manner as Example 2 except

for using, in place of the polymer-coated paper, an unprocessed paper used for preparing the polymer-coated paper in Example 1, and the cooling performance was evaluated. The evaluation result is shown in Fig. 12.

5

[Comparative Example 3]

[0076] A commercial heat-not-burn smoking article (trade name: Ploom S from Japan Tobacco Inc.) was prepared. The heat-not-burn smoking article is the heat-not-burn smoking article 30 illustrated in Fig. 11 in which the second cooling segment 5 is replaced with a center hole segment and the center hole segment 12 is replaced with a filter segment filled with cellulose acetate fibers. In this heat-not-burn smoking article, the center hole segment was replaced with a center hole segment having a hollow portion of 1.5 mm in diameter and the filter segment was replaced with a center hole segment having a hollow portion of 4.5 mm in diameter. The cooling performance and filtration properties of an aerosol were evaluated for the obtained heat-not-burn smoking article for evaluation in the same manner as Example 2. The evaluation results are shown in Figs. 12 to 14.

25 [Comparative Example 4]

[0077] A commercial heat-not-burn smoking article (trade name: Ploom S from Japan Tobacco Inc.) as it was used as a heat-not-burn smoking article for evaluation, and cooling performance and filtration properties of an aerosol were evaluated in the same manner as Example 2. The evaluation results are shown in Figs. 12 to 14.

[0078] As shown in Fig. 12, the vapor temperature was lower and thus the cooling performance was higher in Examples 2 and 3, in which a cooling segment including a polymer-coated paper was used, than in Comparative Examples 2 to 4, in which a cooling segment including a polymer-coated paper was not used.

[0079] Further, as shown in Figs. 13 and 14, it was found that sufficient amounts of glycerol and nicotine were delivered to exhibit low filtration properties of an aerosol in Examples 2 and 3, in which a cooling segment including a polymer-coated paper and, on the downstream side thereof, a center hole segment having a hollow portion were provided. Meanwhile, the amounts of glycerol and nicotine were small in Comparative Example 4, revealing that the filtration properties of an aerosol or the like are enhanced in the presence of a filter segment without a hollow portion. Moreover, although sufficient amounts of glycerol and nicotine were delivered in Comparative Example 3, satisfactory cooling performance was not attained in this case as shown in Fig. 12.

55 REFERENCE SIGNS LIST

[0080]

- 1 Paper
- 2 Polymer layer
- 3 Polymer-coated paper
- 4 Wrapper
- 5 Cooling segment (second cooling segment)
- 10 Tobacco-containing segment
- 11 Mouthpiece segment
- 12 Center hole segment
- 13 Filter segment
- 14 Tobacco filler
- 15 Wrapper
- 16 First filling layer
- 17 First inner plug wrapper
- 18 Second filling layer
- 19 Second inner plug wrapper
- 20 Outer plug wrapper
- 21 Mouthpiece lining paper
- 22 First cooling segment
- 23 Tubular member
- 24 Perforation
- 30 Heat-not-burn smoking article
- 31 Heating device
- 32 Body
- 33 Heater
- 34 Metal tube
- 35 Battery unit
- 36 Control unit
- 37 Recess

Claims

- 1. A cooling segment for a heat-not-burn smoking article, comprising a polymer-coated paper including a paper and a polymer layer that contains a polymer and that is provided on the paper.
- 2. The cooling segment according to Claim 1, wherein the polymer layer further contains at least one of a volatile flavor component and an aerosol former.
- 3. The cooling segment according to Claim 1 or 2, wherein the polymer has a glass transition temperature of 400°C or lower.
- 4. The cooling segment according to any one of Claims 1 to 3, wherein the polymer layer has a porous structure.
- 5. The cooling segment according to any one of Claims 1 to 4, wherein the polymer-coated paper is gathered and disposed inside the cooling segment; and grooves formed through gathering extend in the axial direction of the cooling segment.
- 6. The cooling segment according to Claim 5, wherein a polymer layer-formed surface of the polymer-coated paper has a surface area of 100 to 280 mm² per

1 mm of the cooling segment in the axial direction.

- 7. The cooling segment according to any one of Claims 1 to 6, wherein the polymer layer is provided on either surface or both surfaces of the polymer-coated paper.

- 8. The cooling segment according to any one of Claims 1 to 7, wherein

the polymer-coated paper is rectangular and the cooling segment comprises a plurality of rectangular polymer-coated papers;
the rectangular polymer-coated papers have a length in the longitudinal direction longer than the diameter of the cooling segment; and
the rectangular polymer-coated papers are disposed with the longitudinal direction aligned almost parallel to the axial direction of the cooling segment.

- 9. The cooling segment according to any one of Claims 1 to 7, wherein

the polymer-coated paper is strand-shaped and the cooling segment comprises a plurality of strand-shaped polymer-coated papers;
the strand-shaped polymer-coated papers have a length in the longitudinal direction shorter than the diameter of the cooling segment; and
a plurality of the strand-shaped polymer-coated papers are packed inside the cooling segment.

- 10. A heat-not-burn smoking article comprising a tobacco-containing segment and the cooling segment according to any one of Claims 1 to 9.

- 11. A heat-not-burn smoking system comprising the heat-not-burn smoking article according to Claim 10 and a heating device for heating the tobacco-containing segment.

- 12. The heat-not-burn smoking system according to Claim 11, wherein a heating temperature by the heating device is 400°C or lower.

- 13. A method of manufacturing the cooling segment according to any one of Claims 1 to 9, comprising producing the polymer-coated paper by applying a coating liquid containing the polymer to the paper.

Fig.1

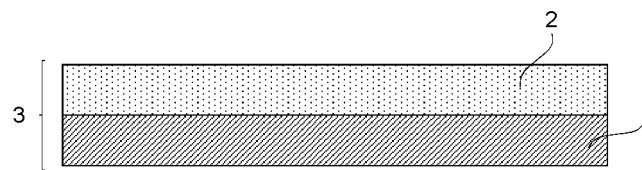


Fig.2

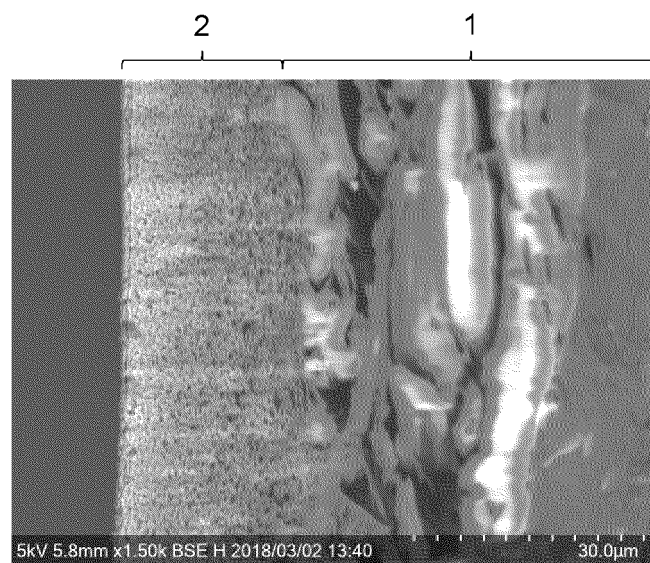


Fig.3

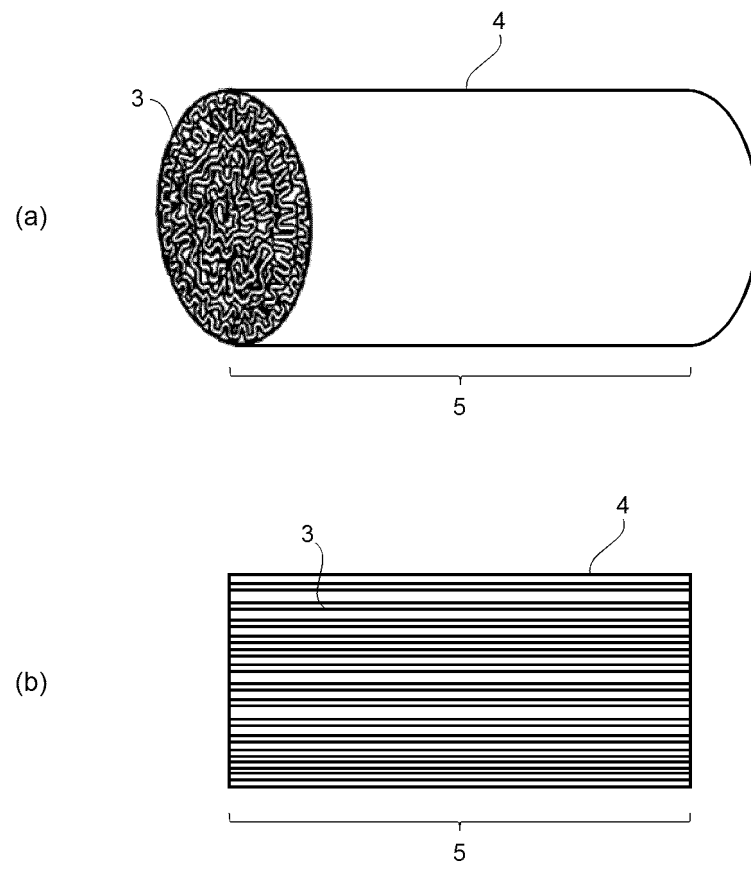


Fig.4

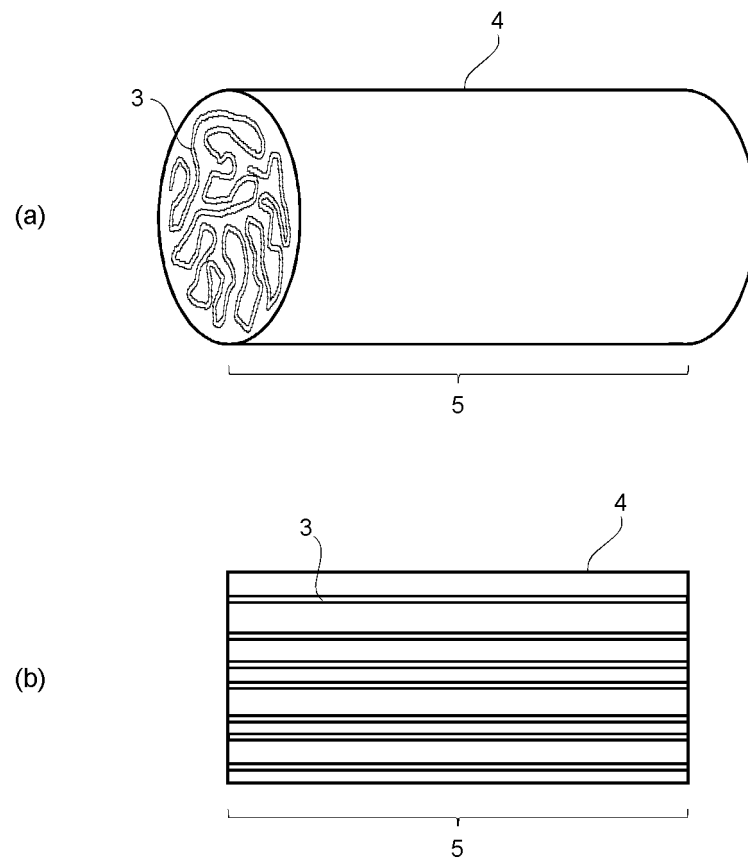


Fig.5

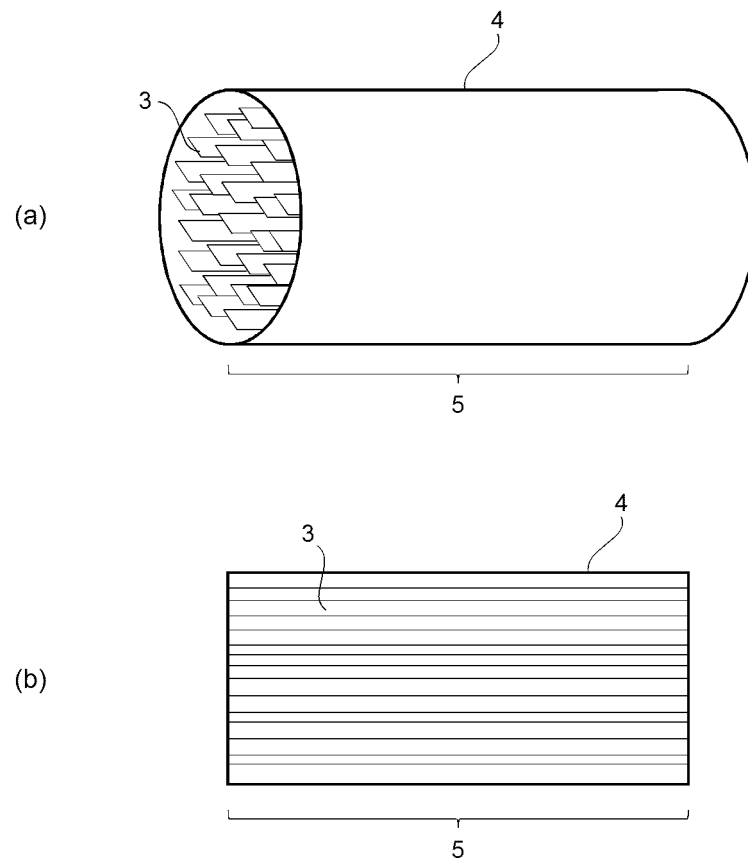


Fig.6

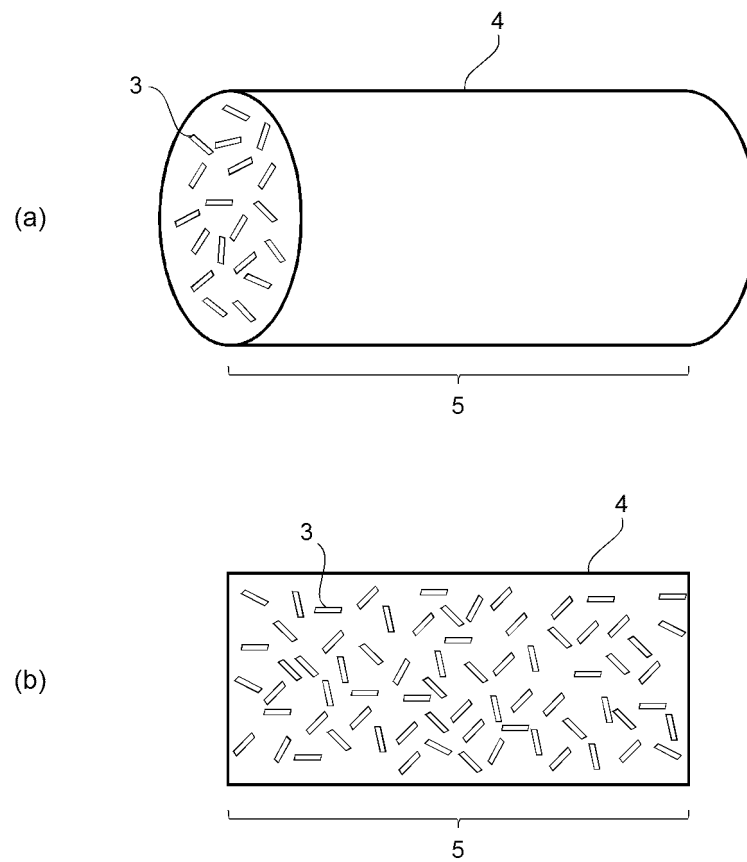


Fig.7

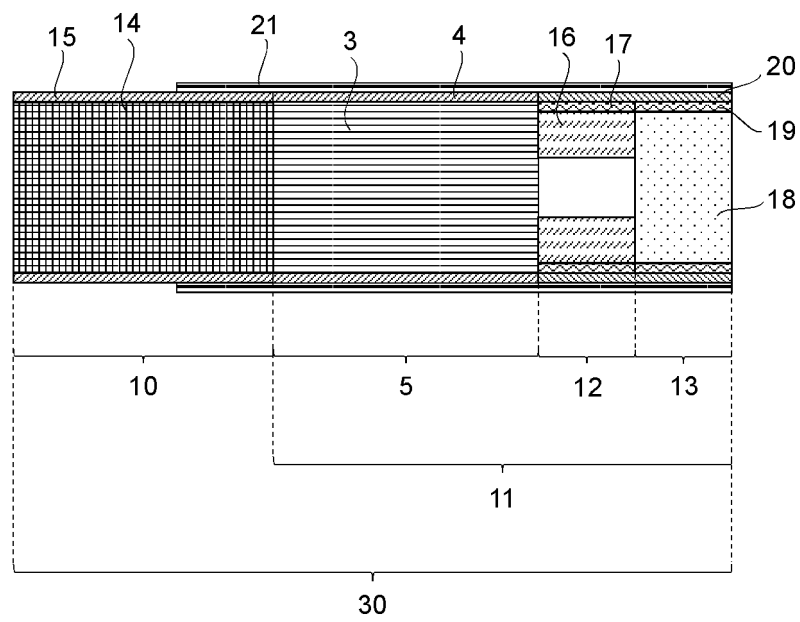


Fig.8

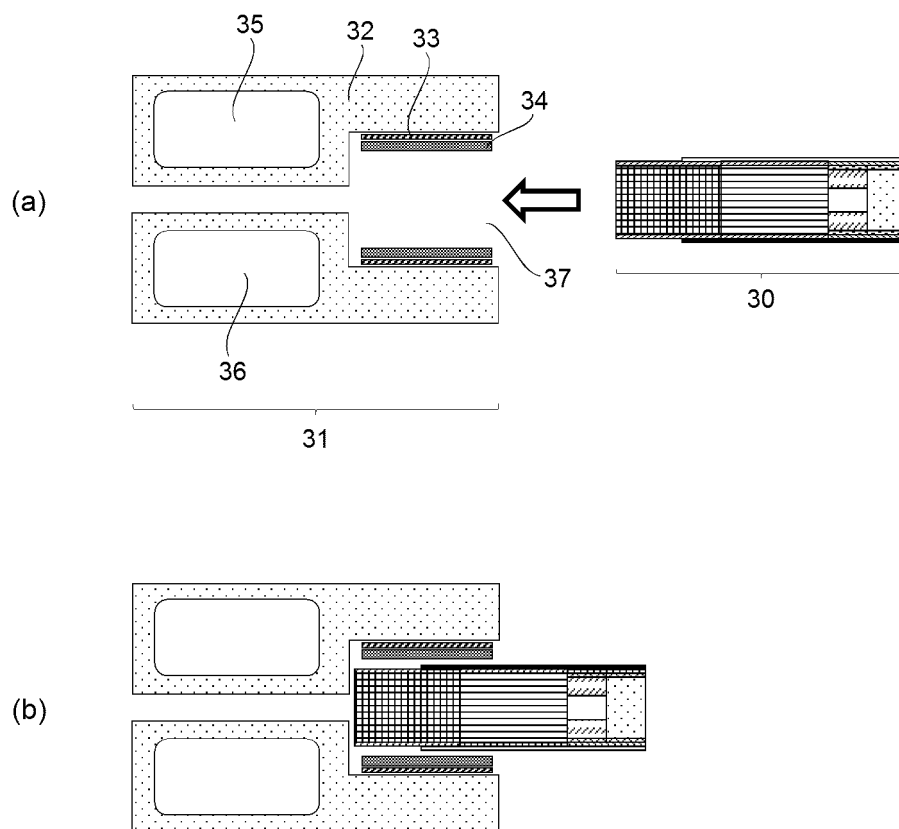


Fig.9

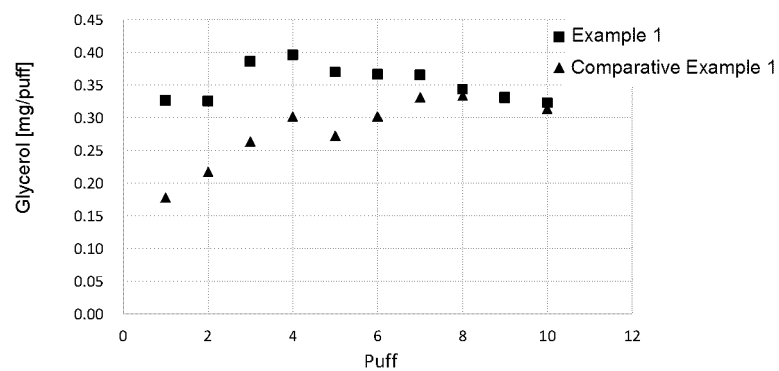


Fig.10

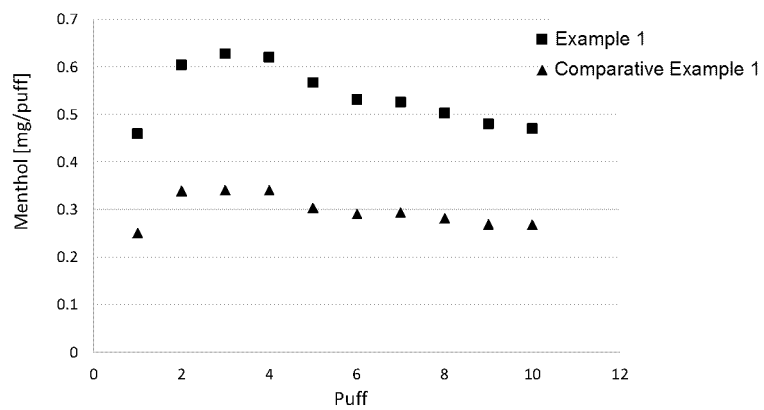


Fig.11

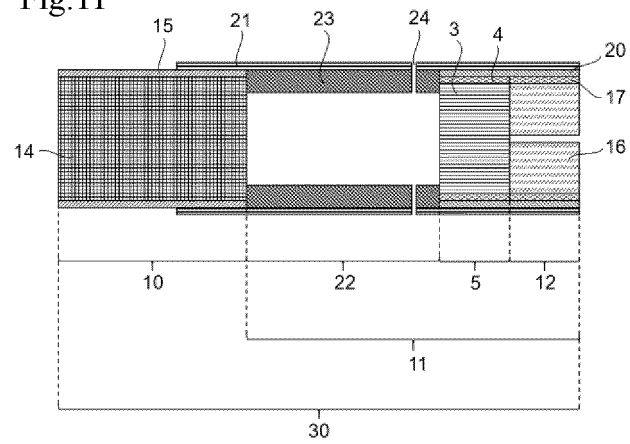


Fig.12

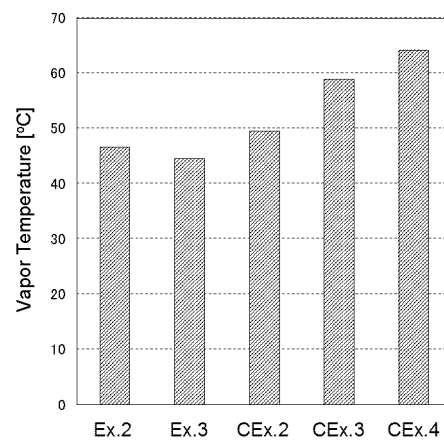


Fig.13

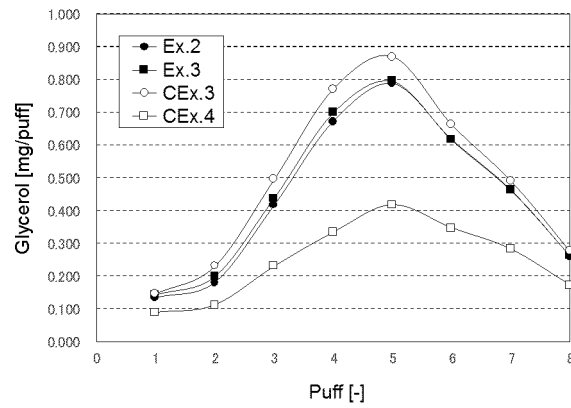
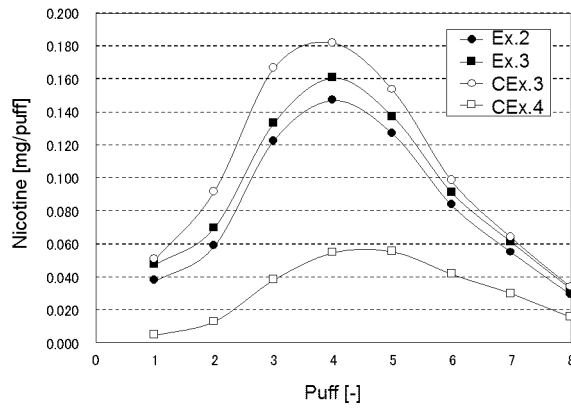


Fig.14



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2019/044305

A. CLASSIFICATION OF SUBJECT MATTER

A24D 3/04 (2006.01) i; A24F 40/20 (2020.01) i; A24D 3/17 (2020.01) i
 FI: A24F47/00; 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; A24F40/20; A24D3/17

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	1971-2020
Registered utility model specifications of Japan	1996-2020
Published registered utility model applications of Japan	1994-2020

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 5771338 B2 (PHILIP MORRIS PRODUCTS S.A.) 26.08.2015 (2015-08-26) paragraphs [0044]-[0047], [0061]-[0066], fig. 1-3	1-13
Y	WO 2016/162934 A1 (JAPAN TOBACCO INC.) 13.10.2016 (2016-10-13) paragraph [0044]	1-13
Y	JP 2012-65633 A (IGARASHI, Satoshi) 05.04.2012 (2012-04-05) paragraphs [0035]-[0037]	1-13
Y	JP 2013-532953 A (JAPAN TOBACCO INC.) 22.08.2013 (2013-08-22) paragraphs [0044]-[0046]	1-13



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
17 January 2020 (17.01.2020)

Date of mailing of the international search report
28 January 2020 (28.01.2020)

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2019/044305

Patent referred in the Report	Documents	Publication Date	Patent Family	Publication Date
JP 5771338 B2		26 Aug. 2015	US 2015/0027475 A1 paragraphs [0042]- [0045], [0061]- [0066], fig. 1-3 WO 2013/120566 A2 EP 2625974 A1 CN 104270970 A KR 10-2014-0130137 A	
WO 2016/162934 A1		13 Oct. 2016	US 2018/0014571 A1 paragraph [0048] EP 3284354 A1 CN 107404946 A KR 10-2017-0127531 A	
JP 2012-65633 A		05 Apr. 2012	(Family: none)	
JP 2013-532953 A		22 Aug. 2013	US 2013/0133675 A1 paragraphs [0088]- [0091] WO 2012/014490 A1 EP 2597976 A1 CN 103037718 A	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 5292410 B [0005]
- JP 5771338 B [0005]
- JP 2013507906 W [0005]
- WO 2017198838 A [0005]
- JP 5877618 B [0005]
- JP 2016506729 W [0005]

Non-patent literature cited in the description

- Tobacco no Jiten (Dictionary of Tobacco). Tobacco Academic Studies Center, 31 March 2009 [0047]