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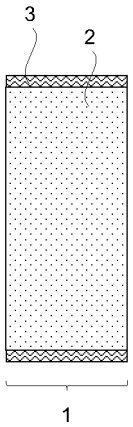
(54) FILTER SEGMENT, NON-COMBUSTION HEATING TYPE SMOKING ARTICLE AND NON-COMBUSTION HEATING TYPE SMOKING SYSTEM

(57) Provided is a filter segment that allows sufficient cooling of a vaporized aerosol component without destroying a smoking flavor. The filter segment for a heat-not-burn smoking article, has a resistance to draw per segment of 15 to 60 mmH_2O/seg.

Fig.1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a filter segment, 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 from a filter segment that is provided in the mouth side end within the mouthpiece segment, 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, the vaporized aerosol component needs to be cooled sufficiently to allow a user to inhale it from a filter segment that is provided in the mouth side end. As a cooling segment for a heat-not-burn smoking article, for example, 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.

[0007] However, when a vaporized aerosol component is cooled solely by external air introduced from the perforations that are provided in a cooling segment, a large amount of external air needs to be introduced for sufficient cooling.

Consequently, a smoking flavor is destroyed. For this reason, there is a need for developing a method that allows sufficient cooling of a vaporized aerosol component without destroying a smoking flavor.

[0008] An object of the present invention is to provide a filter segment that allows sufficient cooling of a vaporized aerosol component without destroying a smoking flavor and to provide a heat-not-burn smoking article and a heat-not-burn smoking system including the filter segment.

SOLUTION TO PROBLEM

[0009] A filter segment according to the present invention is a filter segment for a heat-not-burn smoking article, having a resistance to draw per segment of 15 to 60 mmH_2O/seg.

[0010] A heat-not-burn smoking article according to the present invention includes a tobacco-containing segment; a tubular cooling segment having one or more perforations on the perimeter; and the above-mentioned filter segment.

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

ADVANTAGEOUS EFFECTS OF INVENTION

[0012] According to the present invention, it is possible to provide a filter segment that allows sufficient cooling of a vaporized aerosol component without destroying a smoking flavor and to provide a heat-not-burn smoking article and a heat-not-burn smoking system including the filter segment.

BRIEF DESCRIPTION OF DRAWINGS

[0013]

Fig. 1 is a cross-sectional view illustrating an exemplary configuration of a filter segment according to the present invention.

Fig. 2 is a cross-sectional view of an exemplary heat-not-burn smoking article according to the present invention.

Fig. 3 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.

DESCRIPTION OF EMBODIMENTS

[Filter Segment]

[0014] A filter segment according to the present invention is a filter segment for a heat-not-burn smoking article. The filter segment has a resistance to draw per segment of 15 to 60 mmH_2O/seg.

[0015] By controlling the resistance to draw per segment within the range of 15 to 60 mmH_2O/seg, it is possible in the present invention to sufficiently cool a vaporized aerosol component without destroying a smoking flavor. Specifically, when the resistance to draw per segment is 15 mmH_2O/seg or more, heat is also trapped together in the filter segment since an aerosol and water vapor are thoroughly trapped therein. In addition, trapped aerosol and water vapor exhibit cooling effects. For these reasons, cooling effects are obtained in the filter segment. Meanwhile, when the resistance to draw per segment is 60 mmH_2O/seg or less, unnecessary trapping of an aerosol is suppressed to deliver sufficiently a tobacco component and a flavor component contained in an aerosol to a user. Consequently, a smoking flavor is not destroyed. Further, even when cooling is performed by external air introduced from perforations that are provided in a cooling segment, it is possible to reduce the amount of external air introduced from the perforations and to obtain a satisfactory smoking flavor since cooling effects are also obtained in the filter segment. Hereinafter, the details of the present invention will be described.

[0016] Fig. 1 illustrates an exemplary configuration of a filter segment according to the present invention. The filter segment 1 illustrated in Fig. 1 comprises a first filling layer 2 and a first inner plug wrapper 3 that covers the first filling layer 2. Since the first filling layer 2 is present all the way up to the end in the filter segment 1, the end has an appearance similar to a common combustion smoking article. A filler for the first filling layer 2 may be, for example, cellulose acetate fiber bundles added with a plasticizer (triacetin), paper primarily made of pulp, and so forth. These fillers may be used alone or in combination.

[0017] In the present invention, the filter segment has a resistance to draw per segment of 15 to 60 mmH_2O/seg, preferably 20 to 40 mmH_2O/seg, and more preferably 25 to 30 mmH_2O/seg. For example, when the length of the filter segment in the axial direction (horizontal direction in Fig. 1) is 7 mm, the resistance to draw per segment is 15 to 60

mmH_2O/7 mm. The resistance to draw can be changed appropriately by the amount, material, or the like of a filler to be packed in the filter segment. For example, when a filler is cellulose acetate fibers, it is possible to increase a resistance to draw by increasing the amount of cellulose acetate fibers to be packed in the filter segment. When a filler is cellulose acetate fibers, the filling density of the cellulose acetate fibers may be 0.13 to 0.18 g/cm^3. Herein, the resistance to draw is a value measured by a resistance to draw measuring device (product name: SODIMAX from Sodim SAS).

[0018] The perimeter length of the filter segment is not particularly limited but is preferably 16 to 25 mm, more preferably 20 to 24 mm, and further preferably 21 to 23 mm The length of the filter segment in the axial direction (horizontal direction in Fig. 1) can be selected from 4 to 10 mm to satisfy the resistance to draw of 15 to 60 mmH_2O/seg. The length of the filter segment in the axial direction is preferably 5 to 9 mm and more preferably 6 to 8 mm. The cross-sectional shape of the filter segment is not particularly limited and may be circular, elliptic, or polygonal, for example. Further, a breakable capsule containing a flavor, a flavor bead, or a flavor may be added directly to the filter segment.

[Heat-not-burn Smoking Article]

[0019] A heat-not-burn smoking article according to the present invention includes a tobacco-containing segment; a tubular cooling segment having one or more perforations on the perimeter; and the filter segment according to the present invention. Since the filter segment according to the present invention is included, the heat-not-burn smoking article allows sufficient cooling of a vaporized aerosol component without destroying a smoking flavor. The heat-not-burn smoking article according to the present invention may include other segments, in addition to the tobacco-containing segment, the cooling segment, and the filter segment.

[0020] Fig. 2 illustrates an exemplary heat-not-burn smoking article according to the present invention. The heat-not-burn smoking article 30 illustrated in Fig. 2 includes a tobacco-containing segment 10 and a mouthpiece segment 11. The mouthpiece segment 11 includes a cooling segment 12, a center hole segment 13, and a filter segment 1 according to the present invention that is disposed in the mouth side end. During smoking, the tobacco-containing segment 10 is heated and inhalation takes place at the end of the filter segment 1. Here, the positions of the cooling segment 12 and the center hole segment 13 may be switched, and the positions of the center hole segment 13 and the filter segment 1 may also be switched. Further, the mouthpiece segment 11 need not include the center hole segment 13.

[0021] 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 and/or water. 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. Furthermore, a plurality of cylindrically formed sheets may be arranged concentrically. 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."

[0022] There are a plurality of conventional methods for pulverizing tobacco and forming into uniform sheets. Such sheets include a sheet made by a papermaking 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."

[0023] 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 450 mg and preferably 280 to 400 mg per tobacco-containing segment 10.

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

[0026] The content of an aerosol former in the tobacco filler 14 is not particularly limited but is typically 5 to 50 mass% and preferably 10 to 20 mass% from a viewpoint of generating an aerosol sufficiently and imparting a satisfactory smoking flavor. When the tobacco filler 14 contains a volatile flavor component, the content of the volatile flavor component in the tobacco filler is not particularly limited but is, from a viewpoint of imparting a satisfactory smoking flavor, typically 10,000 ppm or more, preferably 20,000 ppm or more, more preferably 25,000 ppm or more and typically 50,000 ppm or less, preferably 40,000 ppm or less, and more preferably 33,000 ppm or less based on the mass of the tobacco filler.

[0027] 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, an aerosol former, and water contained in the tobacco filler 14 are vaporized by heating the tobacco-containing segment 10 and moved to the mouthpiece segment 11 through inhalation.

[0028] The cooling segment 12 comprises a tubular member 16. The tubular member 16 may be a paper tube of cylindrically processed cardboard, for example. The tubular member 16 and a mouthpiece lining paper 21 are provided with a perforation 17 passing therethrough. Due to the presence of the perforation 17, external air is introduced inside the cooling segment 12 during inhalation. Consequently, a vaporized aerosol component generated through heating of the tobacco-containing segment 10 comes into contact with external air and liquefies due to the lowering temperature, thereby forming an aerosol. The size (diameter) of the perforation 17 is not particularly limited and may be 0.5 to 1.5 mm, for example. The number of the perforation 17 is also not particularly limited and may be one or two or more. For example, a plurality of perforations 17 may be provided on the perimeter of the cooling segment 12. The amount of external air introduced from the perforation 17 is preferably 85 volume% or less and more preferably 80 volume% or less based on the total volume of gas inhaled by a user. When the amount of external air is 85 volume% or less, it is possible to satisfactorily suppress reduction in smoking flavor due to dilution with external air. The lower limit in the range of the amount of external air is preferably 55 volume% or more and more preferably 60 volume% or more in view of cooling performance.

[0029] 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 13 comprises a second filling layer 18 having a hollow portion and a second inner plug wrapper 19 that covers the second filling layer 18. The center hole segment 13 acts to increase the strength of the mouthpiece segment 11. The second filling layer 18 may be, for example, a rod

of ø5.0 to ø1.0 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 second filling layer 18 has a high filling density of fibers, air and an aerosol flow only through the hollow portion and hardly flow within the second filling layer 18 during inhalation. Since the second filling layer 18 inside the center hole segment 13 is a fiber-filled layer, a user rarely feels odd by touch from the outside during use. Here, the center hole segment 13 may retain its shape through thermoforming without having the second inner plug wrapper 19.

[0030] The center hole segment 13 and the filter segment 1 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 12, and the connected center hole segment 13 and filter segment 1 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. These segments may also be joined separately using a plurality of lining papers.

[0031] The length of the heat-not-burn smoking article according to the present invention in the axial direction, in other words, the horizontal direction in Fig. 2 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 12 is 20 mm, the length of the center hole segment 13 is 8 mm, and the length of the filter segment 1 is 7 mm. Here, the length of the filter segment 1 can be selected within the range of 4 to 10 mm. The length is selected such that the filter segment 1 has the resistance to draw per segment of 15 to 60 mmH_2O/seg. 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 a filter segment is disposed on the downstream side of a cooling segment without using a center hole segment can also act as a heat-not-burn smoking article.

[Heat-not-burn Smoking System]

[0032] 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 allows sufficient cooling of a vaporized aerosol component without destroying a smoking flavor. 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.

[0033] Fig. 3 illustrates an exemplary heat-not-burn smoking system according to the present invention. The heat-not-burn smoking system illustrated in Fig. 3 includes the heat-not-burn smoking article 30 according to 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. 3 (a) illustrates the state before inserting the heat-not-burn smoking article 30 into the heating device 31, and Fig. 3 (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. 3 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. 3 (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.

[0034] 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

[0035] 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.

(Cooling Performance Evaluation)

[0036] A filter segment of a heat-not-burn smoking article in which perforations provided in a cooling segment are blocked was connected to a smoking machine through a tube. Further, a thermocouple was placed immediately following the filter segment. The heat-not-burn smoking article was heated, in its tobacco-containing segment, by a heater and inhaled by the smoking machine. Heating by the heater was performed by holding at 230°C for 50 seconds, holding at 200°C for 130 seconds, and then holding at 170°C. Inhalation was started 40 seconds after starting heating and performed as 5 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 HCI method (Health Canada Intense smoking regime). The maximum temperature detected by the thermocouple in the first puff was measured to evaluate cooling performance. The results are shown in Table 1. Since the aerosol temperature in the first puff is the highest, there is no problem in a practical sense if the first puff is at a temperature sensorily suitable for smoking. The HCI method is prescribed in Health Canada - Tobacco Reporting Regulations SOR/2000-273. Here, the evaluation test was performed while blocking perforations to evaluate the cooling capability of the filter segment alone in the absence of cooling due to air introduced from the perforations. In addition, inhalation while blocking perforations is specified as a condition in the HCI method.

(Sensory Evaluation)

[0037] A heat-not-burn smoking article that has a filter segment and in which perforations provided in a cooling segment are open was smoked, at the same interval as in the above-described cooling performance evaluation, by fully trained four panelists to perform a sensory evaluation (evaluation of smoking flavor and sensed temperature). The sensory evaluation was made by the following criteria.

A: suitable for smoking in terms of both smoking flavor and sensed temperature
B: sensed temperature suitable for smoking but slightly weak smoking flavor
C: smoking flavor suitable for smoking but slightly unsuitable sensed temperature

(Example 1)

[0038] The following tobacco-containing segment, cooling segment, center hole segment, and filter segment were prepared.

< Tobacco-containing Segment >

[0039] A tobacco filler was obtained by cutting tobacco sheets that had been prepared by a papermaking process into a width of 0.8 mm and adding 16 mass% of glycerol as an aerosol former thereto. The tobacco sheets cut into a width of 0.8 mm had a longitudinal length of about 5 mm to 20 mm. The tobacco filler had a moisture content of about 12 mass%. The tobacco filler was wrapped in a 50 μm-thick wrapper that has a basis weight of 35 g/m^2 and that is primarily made of wood pulp to produce a tobacco-containing segment. As a wrapping device, a common cigarette manufacturing machine was used. The resulting tobacco-containing segment had a cylindrical shape of 22 mm in circumference and 20 mm in length in the axial direction. The tobacco filler wrapped in the wrapper was packed in random orientation within the rod. The mass of the tobacco filler in the tobacco-containing segment was 280 mg/seg.

< Cooling Segment >

[0040] A cooling segment as a paper tube was manufactured by a straw maker from Hauni Maschinenbau GmbH using cardboard having a thickness of 125 μm and a basis weight of 100 g/m^2. The cooling segment had a cylindrical shape of about 21.75 mm in circumference and 20 mm in length in the axial direction. Since the straw maker employs the mechanism of forming a paper tube by sticking two layers of cardboard together, the obtained cooling segment had a thickness of about 250 μm.

< Center Hole Segment >

[0041] A hollow center hole segment was manufactured by a center hole segment maker from Hauni Maschinenbau GmbH using cellulose acetate fiber bundles as a filler and triacetin, as a plasticizer, for ensuring the segment hardness through bonding among cellulose acetate fibers. The cellulose acetate fiber bundles had a monofilament fineness of 8.0 denier, a total fineness of 40,000 denier, and a Y cross-section as a fiber cross-sectional shape. Based on the mass of the cellulose acetate fiber bundles, 15 mass% of triacetin was sprayed on the cellulose acetate fiber bundles. The center

hole segment had a cylindrical shape of about 21.5 mm in circumference and 8 mm in length in the axial direction. A hollow portion of about ø5 mm in inner diameter was formed in the central part of the cylinder. The center hole segment was prepared as a so-called "unwrapped rod" without using a wrapper for wrapping the cellulose acetate fiber bundles. The cellulose acetate fiber bundles packed in a hollow shape had a filling density of 0.280 g/cm^3.

< Filter Segment >

[0042] A solid filter segment was manufactured by a filter maker from Hauni Maschinenbau GmbH using cellulose acetate fiber bundles as a filler and triacetin, as a plasticizer, for ensuring the segment hardness through bonding among cellulose acetate fibers. The cellulose acetate fiber bundles sprayed with triacetin were wrapped, by the filter maker, in an inner plug wrapper having a basis weight of 27 g/m^2. The cellulose acetate fiber bundles had a monofilament fineness of 5 denier, a total fineness of 35,000 denier, and a Y cross-section as a fiber cross-sectional shape. Based on the mass of the cellulose acetate fiber bundles, 6 mass% of triacetin was sprayed on the cellulose acetate fiber bundles. The filter segment had a cylindrical shape of about 21.5 mm in circumference and 7 mm in length in the axial direction. The cellulose acetate fiber bundles had a filling density of 0.135 g/cm^3.

[0043] The center hole segment and the filter segment were joined with an outer plug wrapper. Subsequently, the tobacco-containing segment, the cooling segment, and the connected center hole segment and filter segment were joined by a combiner using a mouthpiece lining paper. After joining, perforations penetrating the mouthpiece lining paper and the cooling segment (paper tube) were opened by a laser perforating machine installed in the combiner. Each perforation had a shape of about 250 μm in length and about 200 μm in width, and 17 perforations were formed in a row on the circumference at almost regular intervals. The ratio of the amount of external air introduced from the perforations was about 75% based on the total volume of gas inhaled by a user. A heat-not-burn smoking article was thus obtained. The filter segment had a resistance to draw per segment of 21.8 mmH_2O/seg. The above-described cooling performance evaluation and sensory evaluation were performed for the obtained heat-not-burn smoking article. The results are shown in Table 1.

(Example 2)

[0044] A heat-not-burn smoking article was prepared in the same manner as Example 1 except for using a filter segment in which the amount of cellulose acetate fibers to be packed was increased. The filter segment had a resistance to draw per segment of 25.0 mmH_2O/seg. The above-described cooling performance evaluation and sensory evaluation were performed for the obtained heat-not-burn smoking article. The results are shown in Table 1.

(Example 3)

[0045] A heat-not-burn smoking article was prepared in the same manner as Example 1 except for using a filter segment in which the amount of cellulose acetate fibers to be packed was increased. The filter segment had a resistance to draw per segment of 30.8 mmH_2O/seg. The above-described cooling performance evaluation and sensory evaluation were performed for the obtained heat-not-burn smoking article. The results are shown in Table 1.

(Comparative Example 1)

[0046] A heat-not-burn smoking article was prepared in the same manner as Example 1 except for using, as a filter segment, a tubular segment without being filled with cellulose acetate fibers. The filter segment had a resistance to draw per segment of 0.0 mmH_2O/seg. The above-described cooling performance evaluation was performed for the obtained heat-not-burn smoking article. The result is shown in Table 1.

(Comparative Example 2)

[0047] A heat-not-burn smoking article was prepared in the same manner as Example 1 except for halving the length of the filter segment. The filter segment had a resistance to draw per segment of 10.9 mmH_2O/seg. The above-described cooling performance evaluation was performed for the obtained heat-not-burn smoking article. The result is shown in Table 1.

(Comparative Example 3)

[0048] A heat-not-burn smoking article was prepared in the same manner as Example 3 except for doubling the length of the filter segment. The filter segment had a resistance to draw per segment of 61.6 mmH_2O/seg. The above-described

cooling performance evaluation was performed for the obtained heat-not-burn smoking article. The result is shown in Table 1.

[Table 1]

	Resistance to draw (mmH_2O/seg)	Cooling performance evaluation	Sensory evaluation
		Maximum temperature in first puff (°C)	
Ex. 1	21.8	73.3	C
Ex. 2	25.0	71.0	A
Ex. 3	30.8	70.3	B
Comp. Ex. 1	0.0	76.7	-
Comp. Ex. 2	10.9	75.7	-
Comp. Ex. 3	61.6	68.0	-

As shown in Table 1, it was confirmed in Examples 1 to 3 that the maximum temperature in the first puff is satisfactorily low and hence a vaporized aerosol component is sufficiently cooled. Moreover, from the results of the sensory evaluation for Examples 1 to 3, it was confirmed that Example 2, which is suitable for smoking in terms of both smoking flavor and sensed temperature, is the best. Meanwhile, it was observed that Example 3 has a smoking flavor slightly weaker than Example 2 and Example 1 has a sensed temperature slightly higher than Example 2. However, these results pose no problem in a practical sense. It is noted that Comparative Example 3 has a satisfactorily low maximum temperature in the first puff in the cooling performance evaluation. However, since the resistance to draw per segment is twice that of Example 3, the smoking flavor is predicted to be further weaker than that of Example 3 if the sensory evaluation is performed.

REFERENCE SIGNS LIST

[0049]

1 Filter segment
2 First filling layer
3 First inner plug wrapper
10 Tobacco-containing segment
11 Mouthpiece segment
12 Cooling segment
13 Center hole segment
14 Tobacco filler
15 Wrapper
16 Tubular member
17 Perforation
18 Second filling layer
19 Second inner plug wrapper
20 Outer plug wrapper
21 Mouthpiece lining paper
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 filter segment for a heat-not-burn smoking article, having a resistance to draw per segment of 15 to 60 mmH_2O/seg.

2. The filter segment according to Claim 1, wherein the resistance to draw per segment is 20 to 40 mmH_2O/seg.

3. The filter segment according to Claim 1 or 2, wherein the resistance to draw per segment is 25 to 30 mmH_2O/seg.

4. The filter segment according to any one of Claims 1 to 3, having a length in the axial direction of 4 to 10 mm.

5. The filter segment according to Claim 1, wherein the resistance to draw per segment is 15 to 60 mmH_2O/7 mm.

6. A heat-not-burn smoking article comprising

   a tobacco-containing segment;
   a tubular cooling segment having one or more perforations on the perimeter; and
   the filter segment according to any one of Claims 1 to 5.

7. The heat-not-burn smoking article according to Claim 6, wherein a plurality of the perforations are provided.

8. The heat-not-burn smoking article according to Claim 6 or 7, wherein the tobacco-containing segment contains tobacco and an aerosol former.

9. A heat-not-burn smoking system comprising

   the heat-not-burn smoking article according to any one of Claims 6 to 8; and
   a heating device for heating the tobacco-containing segment.

10. The heat-not-burn smoking system according to Claim 9, wherein a heating temperature by the heating device is 150°C to 400°C.

Fig.1

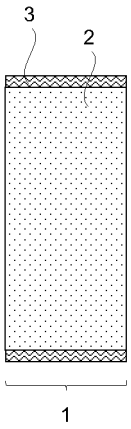


Fig.2

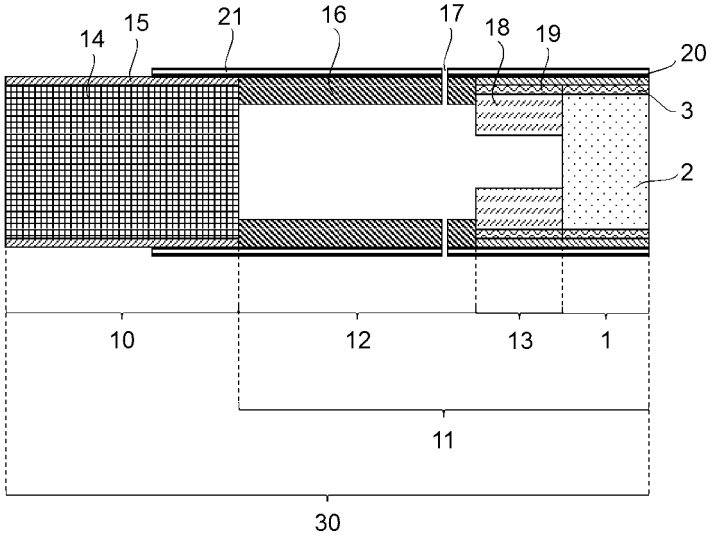
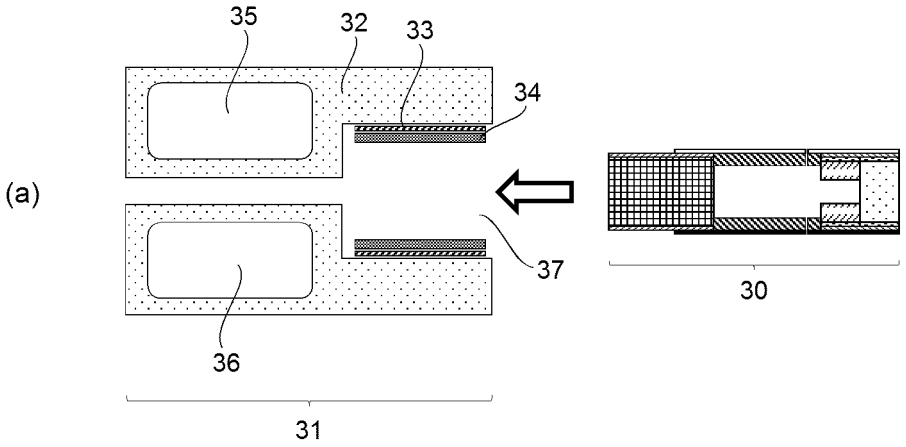


Fig.3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/044286

A. CLASSIFICATION OF SUBJECT MATTER
A24D 3/04(2006.01)i; A24F 47/00(2020.01)i
FI: A2447/00; 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)
A24D3/00-3/18; A24F47/00

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.
X	WO 2017/198876 A1 (BRITISH AMERICAN TOBACCO (INVESTMENTS) LIMITED) 23.11.2017 (2017-11-23) in particular, specification, page 3, line 30 to page 4, line 8, page 13, lines 8-12	1-3, 9
X	in particular, specification, page 4, lines 16-17	4
X Y	in particular, specification, page 12, lines 3-22, page 13, lines 18-21, fig. 1	6-7 5, 8, 10
X	CN 107981411 A (CHINA TOBACCO ZHEJIANG IND CO.) 04.05.2018 (2018-05-04) in particular, paragraphs [0026], [0039], [0050], [0061], [0072], [0083], [0094]	1-4, 9
X Y	in particular, paragraphs [0023]-[0027], fig. 1	6-7 5, 8, 10

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/044286

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 5877618 B2 (PHILIP MORRIS PRODUCTS S.A.) 08.03.2016 (2016-03-08) in particular, paragraph [0050]	5
Y	in particular, paragraphs [0042]-[0043]	8
Y	in particular, paragraph [0074]	10

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2019/044286

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
WO 2017/198876 A1	23 Nov. 2017	JP 2019-523631 A in particular, paragraphs [0016]- [0019], [0066]- [0068], [0073]- [0075], fig. 1 US 2019/0174819 A1 EP 3457876 A1 CN 109219359 A RU 2701414 C1	
CN 107981411 A	04 May 2018	(Family: none)	
JP 5877618 B2	08 Mar. 2016	US 2015/0027474 A1 in particular, paragraphs [0042]- [0043], [0050], [0084] WO 2013/120565 A2 EP 2625975 A1 TW 201345447 A AR 89503 A1 AU 2012370060 A1 CA 2864238 A1 CN 104203015 A KR 10-2014-0135173 A MX 2014009773 A HK 1200288 A1 DK 2814342 T3 RU 2014137106 A ES 2573814 T3 NZ 628456 A RS 54626 B1 PL 2814342 T3 HU E028558 T2 UA 115049 C2 ZA 201405902 B IN 6886DEN2014 A SG 11201404855P A	

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REFERENCES CITED IN THE DESCRIPTION

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