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(54) **FILTER, SMOKING ARTICLE, AND FLAVOR INHALATION ARTICLE**

(57) Provided is a filter including: a first filter main body having a first end face on a mouthpiece side and a second end face opposite to the mouthpiece side, the first filter main body being formed of a paper sheet or a non-woven fabric sheet; a second filter main body provided on the second end face side of the first filter main body, the second filter main body having a third end face

facing the second end face, the second filter main body being formed of a paper sheet or a non-woven fabric sheet; and a channel for communicating air between the second end face and the first end face. The airflow resistance of the channel is lower than that of the first filter main body.

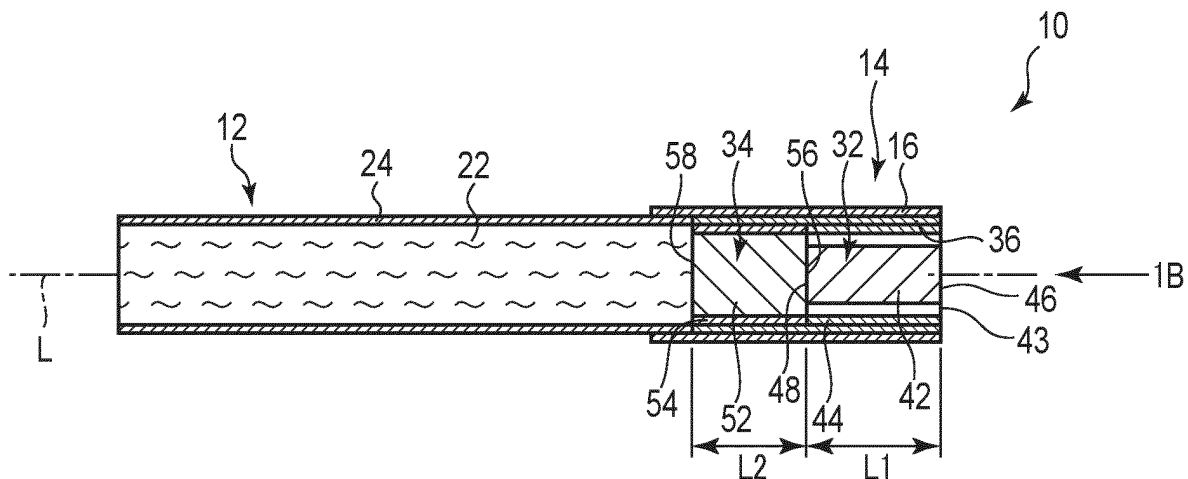


FIG. 1A

Description

BRIEF DESCRIPTION OF THE DRAWINGS

FIELD

[0007]

[0001] The present invention relates to a filter, a smoking article, and a flavor inhalation article.

BACKGROUND

[0002] For example, Jpn. PCT National Publication No. 2014-515933 discloses a paper filter in which a surface of a biodegradable base material (paper) is coated.

[0003] In the case of using a filter (paper filter) obtained by, for example, crimping and then folding a paper sheet, for example, it is usual that a user can visually recognize a large number of holes on a mouthpiece side end surface. For example, after smoking a cigarette with a paper filter, substances such as tar are likely to adhere to the mouthpiece side end surface of the filter. Therefore, a requirement exists to improve the aesthetic appearance of the mouthpiece side end surface of the filter even after use, such as after smoking. For filters, a requirement exists to control a degree of filtration of, for example, tar value, nicotine value, and the like.

CITATION LIST

PATENT LITERATURE

[0004]

[Patent Literature 1] Jpn. Pat. Appln. KOKAI Publication No. H7-166

[Patent Literature 2] Jpn. Pat. Appln. KOKAI Publication No. H7-8254

[Patent Literature 3] Jpn. PCT National Publication No. 2014-515933

SUMMARY

[0005] An object of this invention is to provide a filter that is formed of a paper sheet or non-woven fabric sheet, enhances aesthetic appearance, and has appropriate filtration characteristics, a smoking article including the filter, and a flavor inhalation article including the filter.

[0006] According to one embodiment, a filter includes: a first filter main body including a first end surface on a mouthpiece side and a second end surface on a side opposite to the mouthpiece side, and formed of a paper sheet or a non-woven fabric sheet; a second filter main body provided on a side of the second end surface of the first filter main body, including a third end surface facing the second end surface, and formed of a paper sheet or a non-woven fabric sheet; and a channel portion providing airflow between the second end surface and the first end surface. The channel portion has an airflow resistance lower than an airflow resistance of the first filter main body.

FIG. 1A is a schematic cross-sectional view showing a combustion type flavor inhalation article including a filter according to a first embodiment.

FIG. 1B is a schematic view showing a mouthpiece side end surface when the filter is viewed from a direction indicated by arrow 1B in FIG. 1A.

FIG. 1C is a schematic enlarged view of a position indicated by reference sign 1C in FIG. 1B.

FIG. 1D is a schematic view showing a modification of the mouthpiece side end surface when the filter is viewed from the direction indicated by arrow 1B in FIG. 1A.

FIG. 1E is a schematic enlarged view of a position indicated by reference sign 1E in FIG. 1D.

FIG. 2A is a schematic cross-sectional view showing a combustion type flavor inhalation article including a filter according to a comparative example of the first embodiment.

FIG. 2B is a schematic view showing the end surface when the filter is viewed from a direction indicated by arrow 2B in FIG. 2A.

FIG. 3A is a schematic view showing a state in which a paper sheet serving as a first filter main body and a second filter main body passes through a crimping tool to have a suitable crimp depth.

FIG. 3B is a schematic view showing a state in which the paper sheet serving as the first filter main body and the second filter main body passes through the crimping tool to have a suitable crimp depth greater than the example shown in FIG. 3A.

FIG. 4A is a graph showing a crimp depth after crimping process of the paper sheet serving as the first filter main body and the second filter main body, and airflow resistance (mmH₂O/mm) per 1 mm length of the filter main body after crimp process serving as the first filter main body and the second filter main body.

FIG. 4B is a graph showing air permeability (CU) of the filter main body after crimping process of the paper sheet serving as the first filter main body and the second filter main body, and airflow resistance (mmH₂O/mm) per 1 mm of the filter main body after crimp process serving as the first filter main body and the second filter main body.

FIG. 5 schematically shows a filter structure, filter body length, tar value, nicotine value, carbon monoxide value, and the number of puffs of Lot 1 to Lot 3 of combustion type flavor inhalation articles in which the tar value is set to 6 mg.

FIG. 6 schematically shows a filter structure, filter body length, tar value, nicotine value, carbon monoxide value, and the number of puffs of Lot 4 to Lot 6 of combustion type flavor inhalation articles in which the tar value is set to 1 mg.

FIG. 7A is a photograph showing a mouthpiece side end surface of the first filter main body of the filter shown in FIG. 2B formed of the sheet in which the crimp depth is 0.6 mm

FIG. 7B is a photograph showing a mouthpiece side end surface of the first filter main body of the filter shown in FIG. 2B formed of the sheet in which the crimp depth is 0.3 mm

FIG. 7C is a photograph showing a mouthpiece side end surface of the first filter main body of the filter shown in FIG. 2B formed of the sheet in which the crimp depth is 0.1 mm

FIG. 8A is a photograph showing mouthpiece side end surfaces of eight cigarettes of Lot 1 shown in FIG. 5 after smoking.

FIG. 8B is a photograph showing mouthpiece side end surfaces of eight cigarettes of Lot 2 shown in FIG. 5 after smoking.

FIG. 8C is a photograph showing mouthpiece side end surfaces of eight cigarettes of Lot 3 shown in FIG. 5 after smoking.

FIG. 9 is a table in which the whiteness of the mouthpiece side end surface of each of the eight cigarettes of Lot 1 to Lot 3 is numerically expressed.

FIG. 10 is a graph showing an average value of the whiteness of the mouthpiece side end surface of each of the eight cigarettes of Lot 1 to Lot 3 of the table in FIG. 9.

FIG. 11 is a graph showing an average score of sensory evaluation by fourteen evaluators on the difference in appearance of the mouthpiece side end surface of each of the cigarettes of Lot 1 to Lot 3 after smoking as compared to before smoking.

FIG. 12 is a graph showing an average score of sensory evaluation by fourteen evaluators on stains of the mouthpiece side end surface of each of the cigarettes of Lot 1 to Lot 3 after smoking as compared to before smoking.

FIG. 13A is a photograph showing mouthpiece side end surfaces of eight cigarettes of Lot 4 shown in FIG. 6 after smoking.

FIG. 13B is a photograph showing mouthpiece side end surfaces of eight cigarettes of Lot 5 shown in FIG. 6 after smoking.

FIG. 13C is a photograph showing mouthpiece side end surfaces of eight cigarettes of Lot 6 shown in FIG. 6 after smoking.

FIG. 14 is a table in which the whiteness of the mouthpiece side end surface of each of the eight cigarettes of Lot 4 to Lot 6 is numerically expressed.

FIG. 15 is a graph showing an average value of the whiteness of the mouthpiece side end surface of each of the eight cigarettes of Lot 4 to Lot 6 of the table in FIG. 14.

FIG. 16 is a graph showing an average score of sensory evaluation by fourteen evaluators on the difference in appearance of the mouthpiece side end surface of each of the cigarettes of Lot 4 to Lot 6 after

smoking as compared to before smoking.

FIG. 17 is a graph showing an average score of sensory evaluation by fourteen evaluators on the stains of the mouthpiece side end surface of each of the cigarettes of Lot 4 to Lot 6 after smoking as compared to before smoking.

FIG. 18A is a schematic view showing a state in which a filter main body is folded into a pipe through the guides of a filter main body forming machine, with the ends of non-woven fabric sheets being shifted and overlapped.

FIG. 18B is a schematic view showing a state of a non-woven fabric viewed from a direction indicated by arrow 18B in FIG. 18A in which the ends of sheets are shifted and overlapped.

FIG. 19A is a schematic cross-sectional view of a flavor inhalation article including a filter according to a modification of the first embodiment.

FIG. 19B is a schematic view showing a mouthpiece side end surface when the filter is viewed from a direction indicated by arrow 19B in FIG. 19A.

FIG. 20 is a schematic cross-sectional view showing a non-combustion heating type flavor inhalation article including a filter according to a second embodiment.

FIG. 21 is a schematic cross-sectional view showing a non-combustion heating type flavor inhalation article including a filter according to a third embodiment.

DETAILED DESCRIPTION

[0008] Hereinafter, a filter used for a flavor inhalation article and a flavor inhalation article will be described with reference to the drawings.

[0009] A flavor inhalation article member according to an embodiment includes a base member. The base member is, for example, a flavor inhalation article member to be used in combination with a tobacco material. The base member may be at least one of a member constituting a combustion type flavor inhalation article, a member constituting a non-combustion heating type flavor inhalation article, or a member constituting a non-heating type flavor inhalation article.

[0010] The tobacco material is, for example, cut tobacco. A material for the cut tobacco is not particularly limited, and known materials such as lamina and stem can be used. In addition to the cut tobacco, the tobacco material may also be, for example, granular.

[0011] A combustion type flavor inhalation article is a smoking article that provides tobacco flavor to a consumer by burning a tobacco material.

[0012] The non-combustion heating type flavor inhalation article is an article that provides tobacco flavor to a consumer by heating a tobacco material without burning the tobacco material. A heating temperature of the non-combustion heating type flavor inhalation article can be appropriately set, and is in a wide range, for example,

from a temperature close to normal temperature to a temperature at which the tobacco material does not burn. The heating temperature of the non-combustion heating type flavor inhalation article is, for example, approximately 30 °C to 350 °C.

[0013] The non-heating type flavor inhalation article is an article that provides tobacco flavor to a consumer without burning or heating the tobacco material.

[First Embodiment]

[0014] In the first embodiment, a cigarette as a typical example of a combustion type flavor inhalation article (smoking article) 10 containing a tobacco material will be described. In the first embodiment, an example of the cigarette 10 will be described with reference to FIGS. 1A to 17.

[0015] FIGS. 1A to 1C show the cigarette 10 according to the present embodiment. FIGS. 2A and 2B show a cigarette 110 as a comparative example of the cigarette 10 according to the present embodiment. The same reference signs are provided to the same structural portions of the cigarette 10 and 110. For the cigarette 110, a description of the same structural portions as those of the cigarette 10 will be omitted as appropriate.

[0016] FIG. 1A is a cross-sectional view of the cigarette 10. The cigarette 10 includes a tobacco rod 12, a filter 14, and tipping paper 16. The cigarette 10 has a total length of, for example, approximately 65 mm to 100 mm. The cigarette 10 has an outer diameter of, for example, approximately 5 mm to 10 mm.

[0017] The tobacco rod 12 includes a tobacco material (cut tobacco) 22, and cigarette paper 24 wrapped around the tobacco material 22. The tobacco rod 12 according to the present embodiment has, for example, a diameter of approximately 7 mm, and a length of approximately 83 mm.

[0018] The filter 14 includes a first filter plug 32 on the mouthpiece side, a second filter plug 34 on the tobacco rod 12 side, and forming paper 36 wrapped around outer peripheries of the first filter plug 32 and the second filter plug 34. Lengths of the first filter plug 32 and the second filter plug 34 along longitudinal axis L are referred to as L1 and L2, respectively.

[0019] The first filter plug 32 includes a first filter main body (filter element, filter material) 42, and a first wrapper (tubular portion) 44 wrapped around the outer periphery of the first filter main body 42. The length L1 of the first filter plug 32 is the same as the length of the first filter main body 42. A channel portion (airflow portion) 43 is formed between the outer periphery of the first filter main body 42 and the first wrapper 44. Specifically, the channel portion 43 is located between an outer peripheral surface of the first filter main body 42 and an inner peripheral surface of the first wrapper (tubular portion) 44.

[0020] The first filter main body 42 includes a first end surface 46 on the mouthpiece side (mouthpiece side end surface), and a second end surface 48 on the side op-

posite to the mouthpiece side (end surface on the tobacco rod 12 side). The first end surface 46 and the second end surface 48 have an outer shape that is, for example, substantially circular. In the first filter main body 42, a longitudinal axis (center axis) L that intersects the first end surface 46 and the second end surface 48 is defined. The first end surface 46 is on the mouthpiece side, and the second end surface 48 is on the tobacco rod 12 side. The first end surface 46 is exposed outside.

[0021] As shown in FIGS. 1A to 1C, the outer peripheral surface of the first filter main body 42 is formed into, for example, a spur gear. Therefore, the first filter main body 42 includes a large number of convex parts 42a. The convex parts 42a are each continuously formed along the longitudinal axis L over the entire region between the first end surface 46 and the second end surface 48. The convex parts 42a come into contact with the inner peripheral surface of the first wrapper 44.

[0022] The channel portion 43 includes a plurality of (a large number of) recessed parts (channels) 43a formed, for example, on the outer periphery of the first filter main body 42 in parallel to the longitudinal axis L. Each recessed part 43a is formed between the convex parts 42a of the first filter main body 42. The convex part 42a of the first filter main body 42 and the recessed part 43a of the channel portion 43 are adjacent in a circumferential direction on the outer periphery of the first filter main body 42 around the longitudinal axis L.

[0023] The recessed parts 43a of the channel portion 43 are each continuously formed along the longitudinal axis L over the entire region between the first end surface 46 and the second end surface 48. The recessed parts 43a are separated from the inner peripheral surface of the first wrapper (tubular portion) 44 and provides airflow between the second end surface 48 and the first end surface 46. It is preferable that the channel portion 43 be formed to have an appearance of a so-called AFT filter.

[0024] The second filter plug 34 includes a second filter main body (filter element, filter material) 52, and a second wrapper (tubular portion) 54 wrapped around the outer periphery of the second filter main body 52. The length L2 of the second filter plug 34 is the same as the length of the second filter main body 52. The second filter main body 52 includes a third end surface 56 and a fourth end surface 58. The third end surface 56 and the fourth end surface 58 have an outer shape that is, for example, substantially circular. In the second filter main body 52, a longitudinal axis (center axis) L that intersects the third end surface 56 and the fourth end surface 58 is defined. The third end surface 56 is on the mouthpiece side, and the fourth end surface 58 is on the tobacco rod 12 side. The third end surface 56 faces or is in contact with the second end surface 48.

[0025] To the first filter main body 42 and the second filter main body 52, for example, a plasticizer such as triacetin, an adsorbent such as activated carbon, or a flavoring agent such as menthol may be added as an

additive.

[0026] The forming paper 36 is wrapped around the outer peripheries of the first wrapper 44 and the second wrapper 54 to connect the first wrapper 44 and the second wrapper 54.

[0027] The tipping paper 16 is wrapped around the outer peripheries of the tobacco rod 12 and the filter 14 to connect the tobacco rod 12 and the filter 14.

[0028] The first filter main body 42 and the second filter main body 52 are formed of a paper sheet or a non-woven fabric sheet. In the present embodiment, an example will be described in which a sheet (material) forming the first filter main body 42 and the second filter main body 52 is made of paper. As a paper sheet, one that can be used as a so-called paper filter by a person skilled in the art can be used as is. As the sheet (material) of the first filter main body 42 and the second filter main body 52, for example, glassine paper can be used in addition to the above.

[0029] A paper sheet 72, for example, is crimped by a crimping tool 70 described below. The crimped sheet 72 is subjected to folding process in order to be formed into, for example, a rod of substantially 120 mm. Thereafter, it is cut into appropriate lengths to form the first filter main body 42 and the second filter main body 52. The shape of the first filter main body 42 is maintained by the first wrapper 44. The shape of the second filter main body 52 is maintained by the second wrapper 54. When the first filter main body 42 and the second filter main body 52 are cut to, for example, appropriate lengths, planar end surfaces (mouthpiece side end surfaces 46 and 56, and tobacco-side end surfaces 48 and 58) are respectively formed in the first filter main body 42 and the second filter main body 52.

[0030] The crimp process to the first filter main body 42 and the second filter main body 52 is performed by passing the paper sheet 72 through an appropriate crimping tool 70 shown in FIGS. 3A and 3B from a front side of the drawing sheets in FIGS. 3A and 3B to a direction perpendicular to the drawing sheets. The crimping tool 70 shown in FIGS. 3A and 3B is formed to have an appropriate length in a direction perpendicular to the drawing sheets. The length of the crimping tool 70 in the direction perpendicular to the drawing sheets is an appropriate length in which the sheet 72 can be crimped. It is preferable that the width of crimping tool 70 be greater than the width of sheet 72.

[0031] The crimping tool 70 includes a first base 82, a second base 84, a plurality of first protrusions 86 protruding from the first base 82 toward the second base 84, and a plurality of second protrusions 88 protruding from the second base 84 toward the first base 82. The first base 82 and the second base 84 may be relatively close to or away from each other. The protrusion amounts of the plurality of first protrusions 86 with respect to the first base 82 are substantially the same. The plurality of first protrusions 86 are spaced apart at predetermined intervals in the width direction. The protrusion amounts of the

plurality of second protrusions 88 with respect to the second base 84 are substantially the same. The plurality of second protrusions 88 are spaced apart at predetermined intervals in the width direction. The first protrusions 86 and the second protrusions 88 are located at positions separated from each other when the first base 82 and the second base 84 are brought close to each other. A distance between a top part 86a of the first protrusion 86 and a top part 88a of the second protrusion 88 along a direction in which the first base 82 and the second base 84 are close to or away from each other (reference numeral D 1 in FIG. 3A and reference numeral D2 in FIG. 3B) is defined as an amount of engagement. It is preferable that distances D 1 and D2 be, for example, approximately 1 mm, or less. By adjusting the amount of engagement of the crimping tool 70, it is possible to adjust the crimp depth of the paper sheet 72. The crimp depth can be replaced with a distance between the top parts 86a and 88a of the adjacent protrusions 86 and 88 orthogonal to the moving direction of the sheet 72 of the crimping tool 70. When distance D1 in FIG. 3A is compared with distance D2 in FIG. 3B, distance D2 is larger. At this moment, the crimp depth of the sheet 72 is larger in the example shown in FIG. 3B than in the example shown in FIG. 3A. During the crimp process of the sheet 72, the first base 82, the second base 84, the first protrusions 86, and the second protrusions 88 of the crimping tool 70 are prevented from moving, and their positional relationship is fixed.

[0032] The sheet of the first filter main body 42 is crimped (creped) to a greater crimp depth than the sheet of the second filter main body 52. That is, the crimp depth of the sheet of the first filter main body 42 (the distance between folds of the sheet) is greater than the crimp depth of the sheet of the second filter main body 52 (the distance between folds of the sheet).

[0033] The paper sheet (material) of the first filter main body 42 has an air permeability of, for example, 1000 CU (CORESTA Unit) to 30000 CU after crimp process. The paper sheet (material) of the second filter main body 52 has an air permeability of, for example, 0 CU to 10000 CU after crimp process.

[0034] FIG. 4A shows a graph in which the horizontal axis represents the crimp depth of the crimped paper sheet used for the first filter main body 42 and the second filter main body 52, and the vertical axis represents the airflow resistance (mmH₂O/mm) per 1 mm of the filter main body after crimp process serving as the first filter main body 42 and the second filter main body 52. It is appreciated that the airflow resistance per unit length increases as the crimp depth increases. A broken line in FIG. 4A can be approximated by, for example,

$$y = 17.965x^2 + 6.6054x + 0.1372 \quad (R^2 = 0.9963)$$

[0035] FIG. 4B shows a graph in which the horizontal axis represents the air permeability (CU) of the first filter

main body 42 and the second filter main body 52 after crimping process of the paper sheet used for the first filter main body 42 and the second filter main body 52, and the vertical axis represents the airflow resistance (mmH₂O/mm) per 1 mm of the filter body after crimp process serving as the first filter main body 42 and the second filter main body 52. The lower left plot in FIG. 4B is an example in which the crimp depth is 0 mm. The upper right plot in FIG. 4B is an example in which the crimp depth is 0.6 mm. The remaining plot in FIG. 4B is an example in which the crimp depth is 0.3 mm. It is appreciated that not only the airflow resistance but also the air permeability (CU) increase as the crimp depth increases. A broken line in FIG. 4B can be approximated by, for example,

$$y = -6 \cdot 10^{-9} x^2 + 0.0006x + 0.1687 \quad (R^2 = 1)$$

[0036] In the first filter main body (paper filter) 42, the crimp depth (the distance between the top parts 86a and 88a of the crimping tool 70) is, for example, 0.6 mm. In the second filter main body (paper filter) 52, the crimp depth is, for example, 0.2 mm.

[0037] It is preferable that the airflow resistance of the first filter main body 42 be higher than the airflow resistance of the second filter main body 52. The airflow resistance of the first filter main body 42 is, for example, 0 mmH₂O/mm to 12 mmH₂O/mm, preferably 4 mmH₂O/mm to 12 mmH₂O/mm. The airflow resistance of the second filter main body 52 is, for example, 0 mmH₂O/mm to 12 mmH₂O/mm, preferably 3 mmH₂O/mm to 12 mmH₂O/mm.

[0038] The first wrapper 44, the second wrapper 54, and the forming paper 36 are formed from pulp, for example. The first wrapper 44, the second wrapper 54, and the forming paper 36 are used to maintain the shape of the first filter main body 42 and the second filter main body 52. It is preferable that the first wrapper 44, the second wrapper 54, and the forming paper 36 have a basis weight of, for example, 30 g/m² or more.

[0039] As shown in FIGS. 2A and 2B, the cigarette 110 of the comparative example includes a tobacco rod 12, a filter 114, and tipping paper 16. The cigarette 110 has the same total length and outer diameter as those of the cigarette 10. The tobacco rod 12 of the cigarette 110 shown in FIG. 2A is formed similarly to the tobacco rod 12 of the cigarette 10 shown in FIG. 1A.

[0040] The filter 114 includes a first filter plug 132 on the mouthpiece side, a second filter plug 134 on the tobacco rod 12 side, and forming paper 36 wrapped around outer peripheries of the first filter plug 132 and the second filter plug 134.

[0041] The first filter plug 132 includes a first filter main body (filter element, filter material) 142, and a first wrapper 144 wrapped around the outer periphery of the first filter main body 142.

[0042] The first filter main body 142 includes a first end

surface 146 on the mouthpiece side (mouthpiece side end surface), and a second end surface 148 on the side opposite to the mouthpiece side (end surface on the tobacco rod 12 side). The first end surface 146 and the second end surface 148 have an outer shape of, for example, a substantially circular shape. In the first filter main body 142, a longitudinal axis (center axis) L that intersects the first end surface 146 and the second end surface 148 is defined. The first end surface 146 is on the mouthpiece side, and the second end surface 148 is on the tobacco rod 12 side. The first end surface 146 is exposed to the outside.

[0043] The second filter plug 134 includes a second filter main body (filter element, filter material) 152, and a second wrapper (tubular portion) 154 wrapped around the outer periphery of the second filter main body 152. The length L2 of the second filter plug 134 is the same as the length of the second filter main body 152. The second filter main body 152 includes a third end surface 156 and a fourth end surface 158. The third end surface 156 and the fourth end surface 158 have an outer shape which is, for example, substantially circular. In the second filter main body 152, a longitudinal axis (center axis) L that intersects the third end surface 156 and the fourth end surface 158 is defined. The third end surface 156 is on the mouthpiece side, and the fourth end surface 158 is on the base portion 12 side. The third end surface 156 faces or is in contact with the second end surface 148.

[0044] The forming paper 36 is wrapped around the outer peripheries of the first wrapper 144 and the second wrapper 154 to connect the first wrapper 144 and the second wrapper 154.

[0045] As shown in FIGS. 5 and 6, here, Lots 1 to 6 were prepared. Lot 1 is a comparative example (Comparative Example 1) of Lot 3. Lot 2 is a comparative example (Comparative Example 2) of Lot 3. Lot 4 is a comparative example (Comparative Example 3) of Lot 6. Lot 5 is a comparative example (Comparative Example 4) of Lot 6.

[0046] Lot 1 (Comparative Example 1) is the cigarette 110 having the structure of the filter 114 shown in FIGS. 2A and 2B. Here, an acetate filter is used for the first filter main body 142, and a charcoal filter is used for the second filter main body 152. For Lot 1, a smoking article (here, Winston compact 6 mg manufactured by JAPAN TOBACCO INC. sold in Japan) is used. Thus, the tar value of the cigarette 110 of Lot 1 is controlled to be approximately 6 mg.

[0047] Lot 2 (Comparative Example 2) is the cigarette 110 having the structure of the filter 114 shown in FIGS. 2A and 2B. Here, a material similar to that of the first filter main body 42 is processed and used for the first filter main body 142, and a material similar to that of the second filter main body 52 is processed and used for the second filter main body 152. The crimp depth of the first filter main body 142 is greater than the crimp depth of the second filter main body 152.

[0048] Lot 3 is the cigarette 10 having the structure of

the filter 14 shown in FIGS. 1A to 1C. The channel portion 43 is formed on the outer periphery of the first filter main body 42. For adjustment of the tar value, the first filter main body 142 and the second filter main body 152 of the filter 114 of the cigarette 110 of Lot 2 have lengths L1 and L2, which are different from those of the first filter main body 42 and the second filter main body 52 of the filter 14 of the cigarette 10 of Lot 3. The filter 14 of the cigarette 10 of Lot 3 has the channel portion 43, whereas the filter 114 of the cigarette 110 of Lot 2 does not have the channel portion 43.

[0049] Lot 4 (Comparative Example 3) is the cigarette 110 having the structure of the filter 114 shown in FIGS. 2A and 2B. Here, an acetate filter is used for the first filter main body 142, and a charcoal filter is used for the second filter main body 152. For Lot 4, a smoking article (here, Winston compact 1 mg manufactured by JAPAN TOBACCO INC. sold in Japan) is used. Thus, the tar value of the cigarette 110 of Lot 4 is controlled to be approximately 1 mg.

[0050] Lot 5 (Comparative Example 4) is the cigarette 110 having the structure of the filter 114 shown in FIGS. 2A and 2B. Here, a material similar to that of the first filter main body 42 is processed and used for the first filter main body 142, and a material similar to that of the second filter main body 52 is processed and used for the second filter main body 152. The crimp depth of the first filter main body 142 is greater than the crimp depth of the second filter main body 152.

[0051] Lot 6 is the cigarette 10 having the structure of the filter 14 shown in FIGS. 1A to 1C. The channel portion 43 is formed on the outer periphery of the first filter main body 42. For adjustment of the tar value, the first filter main body 142 and the second filter main body 152 of the filter 114 of the cigarette 110 of Lot 5 have lengths L1 and L2, which are different from those of the first filter main body 42 and the second filter main body 52 of the filter 14 of the cigarette 10 of Lot 6. The filter 14 of the cigarette 10 of Lot 6 has the channel portion 43, whereas the filter 114 of the cigarette 110 of Lot 5 does not have the channel portion 43. The crimp depth of the first filter main body 142 of the filter 114 of Lot 5 is the same as the crimp depth of the first filter main body 42 of the filter 14 of Lot 6. The crimp depth of the second filter main body 152 of the filter 114 of Lot 5 is smaller than the crimp depth of the second filter main body 52 of the filter 14 of Lot 6.

[0052] FIG. 7A shows a photograph of the first end surface 146 of the first filter main body 142 of Lot 2 of the example in which the crimp depth is 0.6 mm. FIG. 7B shows a photograph of the first end surface 146 of the first filter main body 142 of the example in which the crimp depth is 0.3 mm. FIG. 7C shows a photograph of the first end surface 146 of the first filter main body 142 of the example in which the crimp depth is 0.1 mm. As shown in FIGS. 7A to 7C, the greater the crimp depth of the sheet forming the filter main bodies 42 and 52, the greater the possibility of reducing an area of voids and enhancing

an aesthetic appearance of the filter 114. The same applies to the filter 14 of Lot 3. Thus, the greater the crimp depth of the sheet forming the filter main bodies 42 and 52, the more the aesthetic appearance of the filter 14 can be enhanced. When the first end surface 46 of the first filter main body 42 is viewed, it is preferable that the area of voids be 3 mm² or less.

[0053] The tar value and the nicotine value shown in FIGS. 5 and 6 are measured using an automatic smoking machine. The nicotine value is measured by collecting a particulate fraction of mainstream smoke under determined conditions via the automatic smoking machine and melting the collected particles. The tar value is measured by subtracting the weights of nicotine and water from the weight of the particles of mainstream smoke.

[0054] First, Lots 1 to 3 in which the tar value is controlled to 6 mg will be described.

[0055] FIG. 8A shows a photograph of the first end surfaces 146 of the eight cigarettes 110 of Lot 1 after smoking. FIG. 8B shows a photograph of the first end surfaces 146 of the eight cigarettes 110 of Lot 2 after smoking. FIG. 8C shows a photograph of the first end surfaces 46 of the eight cigarettes 10 of Lot 3 after smoking.

[0056] When the cigarette 110 (see FIGS. 2A and 2B) of Lot 1 is smoked and the tobacco material 22 of the tobacco rod 12 is burned, mainstream smoke passes through the second filter main body 152 and the first filter main body 142 to reach the smoker. Similarly, when the cigarette 110 (see FIGS. 2A and 2B) of Lot 2 is smoked and the tobacco material 22 of the tobacco rod 12 is burned, mainstream smoke passes through the second filter main body 152 and the first filter main body 142 to reach the smoker. At this moment, mainstream smoke reaches the smoker not only through the center axis L of the second filter main body 152 and the first filter main body 142, but also through the entirety thereof. Therefore, as shown in FIGS. 8A and 8B, a part of the particulate matter or the like contained in the mainstream smoke is adsorbed to the second filter main body 152 and the first filter main body 142.

[0057] When the cigarette 10 (see FIGS. 1A to 1C) of Lot 3 is smoked and the tobacco material 22 of the tobacco rod 12 is burned, mainstream smoke passes through the second filter main body 52 and the first filter main body 42 to reach the smoker. At this moment, mainstream smoke reaches the first filter main body 42 not only through the center axis L of the second filter main body 52 but also through the entirety thereof. The first filter plug 32 includes the channel portion 43 between the first filter main body 42 and the first wrapper 44. The channel portion 43 has a lower airflow resistance than that of the first filter main body 42 and can take in outside air. A higher percentage of the mainstream smoke passes through the channel portion 43 between the first filter main body 42 and the first wrapper 44. Therefore, as shown in FIG. 8C, a part of the particulate matter or the like contained in the mainstream smoke is easily ad-

sorbed to the second filter main body 52, but barely adsorbed to the first filter main body 42 as compared to the channel portion 43. A part of the particulate matter or the like contained in the mainstream smoke is more likely to be adsorbed to the channel portion 43 or inhaled by the smoker than the first filter main body 42. The tar value, the nicotine value, and the like are controlled throughout the filter 14.

[0058] As shown in FIGS. 9 and 10, for each of the cigarettes 110 and 10 of Lots 1 to 3 (see FIGS. 8A to 8C), the stains due to tar on the first end surfaces 146 and 46 after smoking of the cigarettes 110 and 10 were expressed numerically using a whiteness meter. It is determined that the higher the value, the higher the whiteness and the lesser the stain. Lot 2 has the lowest value and was detected by the whiteness meter to be highly stained. Lot 3 has the value higher than that of Lot 1 and was detected by the whiteness meter to be less stained.

[0059] For Lots 1 to 3, as shown in FIG. 11, sensory evaluation was performed on the difference in appearance of the first end surfaces 146 and 46 before and after smoking. The number of evaluators was fourteen. The graph shown in FIG. 11 indicates average values.

[0060] Here, the difference in appearance shown in FIG. 11 represents a comparison with the first end surfaces 146 and 46 of the cigarettes 110 and 10 of each lot before smoking. The evaluation of the appearance difference was set as follows:

- 1 point: Significant difference
- 2 points: Some difference
- 3 points: Slight difference
- 4 points: Almost no difference
- 5 points: No difference at all

[0061] That is, it can be evaluated that as the average value (AVERAGE) approaches 5 points, the user determines that the appearance difference from the first end surfaces 146 and 46 of the cigarettes 110 and 10 before smoking is small.

[0062] Lot 2 has an appearance difference evaluation score of approximately 1 point, and was evaluated by the evaluators to have a significant difference. Lots 1 and 3 each have an appearance difference evaluation score of approximately 2 points, and were evaluated by the evaluators to have some difference.

[0063] For Lots 1 to 3, as shown in FIG. 12, sensory evaluation was performed on the stains on the first end surfaces 146 and 46 before and after smoking. The number of evaluators was fourteen. The graph shown in FIG. 12 indicates average values.

[0064] Here, the stain indicated in FIG. 12 represents a comparison with the first end surfaces 146 and 46 of the cigarettes 110 and 10 of each lot before smoking. The stain evaluation was set as follows:

- 1 point: Significantly stained
- 2 points: Somewhat stained

- 3 points: Slightly stained
- 4 points: Almost not stained
- 5 points: Not stained at all

[0065] That is, it can be evaluated that as the average value (AVERAGE) approaches 5 points, the user determines that the first end surfaces 146 and 46 of the cigarettes 110 and 10 were not stained as compared to those of before smoking.

[0066] Lot 2 has a stain evaluation score of approximately 1 point, and was evaluated by the evaluators to be significantly stained. Lot 1 has a stain evaluation score of above 2 points, and was evaluated to be somewhat stained. Lot 3 has a stain evaluation score of between 2.5 points and 3 points, and was evaluated to be less stained as compared to Lot 1.

[0067] Next, Lots 4 to 6 in which the tar value is controlled to 1 mg will be described.

[0068] FIG. 13A shows a photograph of the first end surfaces 146 of the eight cigarettes 110 of Lot 4 after smoking. FIG. 13B shows a photograph of the first end surfaces 146 of the eight cigarettes 110 of Lot 5 after smoking. FIG. 13C shows a photograph of the first end surfaces 46 of the eight cigarettes 10 of Lot 6 after smoking.

[0069] When the cigarette 110 (see FIGS. 2A and 2B) of Lot 4 is smoked and the tobacco material 22 of the tobacco rod 12 is burned, as in Lot 1, mainstream smoke passes through the second filter main body 152 and the first filter main body 142 to reach the smoker. Similarly, when the cigarette 110 (see FIGS. 2A and 2B) of Lot 5 is smoked and the tobacco material 22 of the tobacco rod 12 is burned, as in Lot 2, mainstream smoke passes through the second filter main body 152 and the first filter main body 142 to reach the smoker. At this moment, mainstream smoke reaches the smoker not only through the center axis L of the second filter main body 152 and the first filter main body 142 but also through the entirety thereof. Therefore, as shown in FIGS. 13A and 13B, a part of the particulate matter or the like contained in the mainstream smoke is adsorbed to the second filter main body 152 and the first filter main body 142.

[0070] When the cigarette 10 (see FIGS. 1A to 1C) of Lot 6 is smoked and the tobacco material 22 of the tobacco rod 12 is burned, as in Lot 3, mainstream smoke passes through the second filter main body 52 and the first filter main body 42 to reach the smoker. At this moment, mainstream smoke reaches the first filter main body 42 not only through the center axis L of the second filter main body 52 but also through the entirety thereof. The first filter plug 32 includes the channel portion 43 between the first filter main body 42 and the first wrapper 44. Since the channel portion 43 has a lower airflow resistance than that of the first filter main body 42, a higher percentage of the mainstream smoke passes through the channel portion 43 between the first filter main body 42 and the first wrapper 44. Therefore, as shown in FIG. 13C, a part of the particulate matter or the like contained

in the mainstream smoke is easily adsorbed to the second filter main body 52, but barely adsorbed to the first filter main body 42 because of the channel portion 43. A part of the particulate matter or the like contained in the mainstream smoke is likely to be adsorbed to the channel portion 43 than the first filter main body 42.

[0071] As shown in FIGS. 14 and 15, for each of the cigarettes 110 and 10 of Lots 4 to 6 (see FIGS. 13A to 13C), the stains due to tar on the first end surfaces 146 and 46 after smoking of the cigarettes 110 and 10 were numerically expressed using a whiteness meter. Lot 5 had the lowest value and was detected by the whiteness meter to be highly stained. Lot 6 has a value slightly higher than that of Lot 4 and was detected by the whiteness meter to be less stained. Since the tar value of the cigarettes 110 and 10 of Lots 4 to 6 was set to 1 mg, the value detected by the whiteness meter was higher than the value of the cigarettes 110 and 10 of Lots 1 to 3 in which the tar value was set to 6 mg (see FIGS. 9 and 10).

[0072] For Lots 4 to 6, as shown in FIG. 16, sensory evaluation was performed on the difference in appearance of the first end surfaces 146 and 46 before and after smoking. The number of evaluators was fourteen. The graph shown in FIG. 16 indicates average values.

[0073] Here, the difference in appearance shown in FIG. 16 represents a comparison with the first end surfaces 146 and 46 of the cigarettes 110 and 10 of each lot before smoking. The appearance difference evaluation score is the same as the appearance difference evaluation score shown in FIG. 11. That is, it can be evaluated that as the average value (AVERAGE) approaches 5 points, the user determines that the difference in appearance from the first end surfaces 146 and 46 of the cigarettes 110 and 10 before smoking is small.

[0074] Lot 5 has an appearance difference evaluation score of approximately 1 point, and was evaluated by the evaluators to have a significant difference. Lots 4 and 6 each have an appearance difference evaluation score of approximately above 2 points, and were evaluated by the evaluators to have some difference.

[0075] For Lots 4 to 6, as shown in FIG. 17, sensory evaluation was performed on the stains on the first end surfaces 146 and 46 before and after smoking. The number of evaluators was fourteen. The graph shown in FIG. 17 indicates average values.

[0076] Here, the stain shown in FIG. 17 is a comparison with the first end surfaces 146 and 46 of the cigarettes 110 and 10 of each lot before smoking. The stain evaluation score is the same as the stain evaluation score shown in FIG. 12. That is, it can be evaluated that as the average value (AVERAGE) approaches 5 points, the user determines that the first end surfaces 146 and 46 of the cigarettes 110 and 10 are not stained as compared to those prior to smoking.

[0077] Lot 5 has a stain evaluation score of approximately 1 point, and was evaluated by the evaluators to be significantly stained. Lots 4 and 6 each has a stain evaluation score of 2.5 points or so, and were evaluated

to be somewhat stained. Lots 4 and 6 were evaluated to be less stained as compared to Lot 5.

[0078] As described above, according to the present embodiment, the following can be said.

[0079] It is possible to provide the cigarette 10 that includes the filter 14 formed of a paper sheet. At this moment, while the filter 14 formed of the paper sheet is made of paper, by forming the channel portion 43 in the first filter plug 32 on the mouthpiece side of the filter 14, it is possible to suppress stains on the mouthpiece side end surface 46 of the filter 14 after smoking, as compared to the acetate filter and the paper filter 114 having no channel portion. That is, when the first end surface 46 is viewed after smoking, adhesion of stains of a particulate matter or the like to the first filter main body 42 region is suppressed as compared to the channel portion 43. Therefore, while the filter 14 according to the present embodiment is made of paper, the aesthetic appearance after smoking can be enhanced.

[0080] For the filter 14 formed of a paper sheet, the tar value and the like can be controlled by appropriately adjusting the material, basis weight, air permeability, crimp depth, void volume, airflow resistance, and the like of the first filter main body 42 and the second filter main body 52. Thus, the filter 14 is provided in which the filtration characteristics for the mainstream smoke flowing from the tobacco rod 12 toward the mouthpiece side end surface 46 are appropriately controlled during smoking. That is, the cigarette 10 is provided that includes the filter 14 having suitable filtration characteristics.

[0081] The first filter main body 42 may expand outward radially with respect to the center axis L due to elastic deformation. In preparation for a case where the outer shape of the first filter main body 42 cannot be maintained, a paper tube 43b as a tubular body (channel) may be disposed in the recessed part 43a as shown in FIGS. 1D and 1E. In this case, it is easier to maintain the shape of the first filter main body 42 made of paper, for example.

[0082] If the channel portion 43 includes the paper tubes 43b, a part of the particulate matter or the like contained in the mainstream smoke is more likely to be adsorbed into the paper tubes 43b than the recessed parts 43a (the curved surface formed between the convex parts 42a) of the channel portion 43. Therefore, when the first end surface 46 is viewed after smoking, adhesion of stains of particulate matter or the like to the first filter main body 42 region is suppressed as compared to the end surfaces of the paper tubes 43b of the channel portion 43.

[0083] In the present embodiment, as shown in FIGS. 1B and 1D, a description has been given of the example in which a large number of (thirty one) recessed parts of the channel portion 43 are disposed between the first end surface 46 and the second end surface 48 of the first filter main body 42. As shown in FIGS. 1C and 1E, the distances between the convex parts 42a of the first filter main body 42 adjacent in the circumferential direction of the longitudinal axis L and between the recessed parts

43a of the channel portion 43 adjacent in the circumferential direction of the longitudinal axis L are substantially the same. The arrangement and the number of the recessed parts of the channel portion 43 can be appropriately set, for example, twelve recessed parts of the channel portions 43 can be arranged at intervals of 30° with respect to the longitudinal axis L. Therefore, the distances between the convex parts 42a of the first filter main body 42 adjacent in the circumferential direction of the longitudinal axis L and between the recessed parts 43a of the channel portion 43 adjacent in the circumferential direction of the longitudinal axis L may be different.

[0084] In the present embodiment, a description has been given of the example in which paper is used for the first filter main body 42 and the second filter main body 52, but it is also possible to use non-woven fabric by appropriately adjusting a material, basis weight, air permeability, crimp depth, void volume, airflow resistance, and the like.

[0085] If a non-woven fabric is used for the first filter main body 42 and the second filter main body 52, the crimping tool 70 as shown in FIGS. 3A and 3B is not used. If a non-woven fabric is used, instead of the crimping tool 70, a sheet folding machine 170 (see FIG. 18A) that overlaps and folds a plurality of sheets 172a, 172b, 172c, and 172d is used. The sheet folding machine 170 folds, as shown in FIGS. 18A and 18B, the plurality of non-woven fabric sheets 172a, 172b, 172c, 172d overlapped with their ends shifted, while bending the sheets into a substantially S shape or a substantially Z shape using a plurality of guides 182, 184, and 186, for example. The guides 182, 184, and 186 are spaced apart from each other along the moving direction of the sheets 172a, 172b, 172c, and 172d. The guides 182, 184 and 186 each have, for example, a disk shape, and are respectively provided with opening grooves 182a, 184a, 186a for performing folding process on the plurality of sheets 172a, 172b, 172c and 172d. The plurality of sheets 172a, 172b, 172c, 172d overlapped with their ends shifted pass through the guide 182, 184, and 186 and then are guided into a pipe 176 in front of the guide 186 by an endless belt 178. By sequentially passing through the opening grooves 182a, 184a, and 186a of the guides 182, 184, and 186, the plurality of sheets 172a, 172b, 172c, and 172d are gradually close to the substantially S shape or substantially Z shape, and are folded inside the pipe 176. After the first filter main body 42 is folded, the shape of the first filter main body 42 is maintained by the first wrapper 44. If the second filter main body 52 is folded, the shape of the second filter main body 52 is maintained by the second wrapper 54. Thus, the first filter main body 42 and the second filter main body 52 are once formed into, for example, a substantially 120 mm rod shape, and are then cut into appropriate lengths.

[0086] The void volume when the first end surface 46 of the first filter main body 42 made of non-woven fabric is viewed is smaller than the void volume when the third end surface 56 of the second filter main body 52 made

of non-woven fabric or paper is viewed. It is preferable that the area of voids when the first end surface 46 of the first filter main body 42 made of non-woven fabric is viewed be, for example, 3 mm² or less, similarly to the area of voids when the first end surface 46 of the first filter main body 42 made of paper is viewed. It is preferable that the void volume when the first end surface 46 of the first filter main body 42 made of non-woven fabric is viewed be greater than the void volume of the acetate filter on the mouthpiece side. It is preferable that the airflow resistance of the first filter main body 42 made of non-woven fabric be higher than the airflow resistance of the second filter main body 52 made of non-woven fabric or paper. If the first filter main body 42 of the filter 14 is made of non-woven fabric, it is also possible to enhance the aesthetic appearance in the same manner as when it is made of paper. Further, even if the first filter main body 42 and the second filter main body 52 are made of non-woven fabric, it is possible to exhibit substantially the same filter performance (filtration characteristics) as the first filter main body 42 and the second filter main body 52 made of paper.

[0087] That is, according to the present embodiment, there are provided the filter 14 that is formed of a paper sheet or a non-woven fabric sheet, enhances the aesthetic appearance, and has appropriate filtration characteristics, and the cigarette (smoking article) 10 including the filter 14.

[0088] In the cigarette 10 including the filter 14 according to this embodiment, all or most of elements such as a paper material and tobacco material can be formed of naturally derived components. Therefore, it is possible to reduce environmental load on nature as compared to the case of using an acetate filter (Lot 1 and Lot 5), for example.

(Modifications)

[0089] A modification of the filter 14 of the cigarette 10 will be described with reference to FIGS. 19A and 19B.

[0090] As shown in FIGS. 19A and 19B, the first filter plug 32 has a channel portion 43 on the center axis L. The channel portion 43 is formed in a tubular shape. The channel portion 43 penetrates between the first end surface 46 and the second end surface 48 of the first filter main body 42.

[0091] Since the first filter main body 42 is made of paper, there may be a case where the first filter main body 42 expands toward the center axis L due to elastic deformation and diminishes the channel portion 43. In preparation for a case where the channel portion 43 cannot be maintained, as shown in FIG. 19B, a paper tube 43c as a tubular body (channel) may be disposed in the channel portion 43. In this case, it is easy to maintain the shape of the first filter main body 42 made of paper, for example.

[0092] Therefore, the channel portion 43 of the filter 14 is not limited to be between the outer periphery of the

first filter main body 42 and the inner peripheral surface of the first wrapper (tubular portion) 44 as shown in FIGS. 1A to 1C.

[0093] The number of the paper tubes 43c of the channel portion 43 is not limited to one and may be plural so as to penetrate between the first end surface 46 and the second end surface 48 of the first filter main body 42. In this case, one of the paper tubes 43c may or may not be located on the center axis L of the first filter main body 42.

[0094] When the cigarette 10 (see FIG. 19A) is smoked and the tobacco material 22 of the tobacco rod 12 is burned, mainstream smoke passes through the second filter main body 52 and the first filter main body 42 to reach the smoker. At this moment, mainstream smoke reaches the first filter main body 42 not only through the center axis L of the second filter main body 52 but also through the entirety thereof. The first filter plug 32 includes the channel portion 43 on the center axis L of the first filter main body 42. The channel portion 43 has a lower airflow resistance than that of the first filter main body 42. A higher percentage of the mainstream smoke passes through the channel portion 43. Therefore, a part of the particulate matter or the like contained in the mainstream smoke is easily adsorbed to the second filter main body 52, but barely adsorbed to the first filter main body 42 as compared to the channel portion 43. A part of the particulate matter or the like contained in the mainstream smoke is more likely to be adsorbed to the channel portion 43 or inhaled by the smoker than the first filter main body 42. The tar value, the nicotine value, and the like are controlled throughout the filter 14.

[0095] If the channel portion 43 includes the paper tube 43c, a part of the particulate matter or the like contained in the mainstream smoke is more likely to be adsorbed into the paper tube 43c than the inner peripheral surface of the channel portion 43 (the passage formed by the first filter main body 52 itself). If the channel portion 43 does not include the paper tube 43c, a part of the particulate matter or the like contained in the mainstream smoke is adsorbed into the inner peripheral surface of the channel portion 43 (the passage formed by the first filter main body 52 itself).

[0096] Also in this case, when the first end surface 46 is viewed after smoking, adhesion of stains of particulate matter or the like to the region between the channel portion 43 and the first filter main body 42 is suppressed as compared to the channel portion 43 (the end surface of the paper tube 43c).

[0097] According to the modification of the first embodiment, the following can be said.

[0098] It is possible to provide the cigarette 10 that includes the filter 14 formed of a paper sheet. At this moment, while the filter 14 formed of the paper sheet is made of paper, by forming the channel portion 43 in the first filter plug 32 on the mouthpiece side of the filter 14, it is possible to suppress stains on the mouthpiece side end surface 46 of the filter 14 after smoking as compared to the acetate filter and the paper filter 114 having no chan-

nel portion. Therefore, while the filter 14 according to the modification of the first embodiment is made of paper, the aesthetic appearance after smoking can be enhanced.

[0099] For the filter 14 formed of a paper sheet, the tar value and the like can be controlled by appropriately adjusting the material, basis weight, air permeability, crimp depth, void volume, airflow resistance, and the like of the first filter main body 42 and the second filter main body 52. Thus, the filter 14 is provided in which the filtration characteristics for the mainstream smoke flowing from the tobacco rod 12 toward the mouthpiece side end surface 46 are appropriately controlled during smoking. That is, the cigarette 10 is provided that includes the filter 14 having suitable filtration characteristics.

[0100] In the modification of the first embodiment, a description has been given of the example in which paper is used for the first filter main body 42 and the second filter main body 52, but it is also possible to use non-woven fabric by appropriately adjusting a material, basis weight, air permeability, crimp depth, void volume, airflow resistance, and the like.

[0101] That is, according to the modification of the first embodiment, there are provided the filter 14 that is formed of a paper sheet or a non-woven fabric sheet, enhances aesthetic appearance, and has appropriate filtration characteristics, and the cigarette (smoking article) 10 including the filter 14.

[0102] In the cigarette 10 including the filter 14 according to the modification of the first embodiment, all or most of elements such as a paper material and tobacco material can be formed of naturally derived components. Therefore, it is possible to reduce environmental burden on nature as compared with the case of using an acetate filter (Lot 1 and Lot 5), for example.

[Second Embodiment]

[0103] A second embodiment will be described with reference to FIG. 20. This embodiment is a modification of the first embodiment.

[0104] A flavor inhalation article 210 is one of members constituting a non-combustion heating type flavor inhalation article.

[0105] The flavor inhalation article 210 shown in FIG. 20 is a replaceable cartridge for use with a heater. The flavor inhalation article 210 has a columnar shape extending along one direction.

[0106] As shown in FIG. 20, the flavor inhalation article 210 has a base portion 212 forming one end thereof, a filter 214 forming an end opposite to the base portion 212, and a paper tube portion 216 between the base portion 212 and the filter 214. The base portion 212, the paper tube portion 216, and the filter 214 are connected by a cigarette paper 218. The paper tube portion 216 is a paper tube formed by wrapping paper into a cylindrical shape, and the inside thereof is hollow.

[0107] The base portion 212 includes a filler 222 and

a first cigarette paper 224 wrapped around the filler 222.

[0108] The filler 222 includes, for example, a tobacco material and an aerosol source.

[0109] The aerosol source is heated at a predetermined temperature to generate an aerosol with a substance such as a flavor substance derived from a flavor source of the filler 222. The aerosol source may be, for example, glycerin, propylene glycol, triacetin, 1,3-butanediol, or a mixture thereof. The content of the aerosol source in the filler 222 is not particularly limited, and from the viewpoint of generating a sufficient amount of aerosol and providing decent flavor, the content is usually 5% by mass or more, preferably 10% by mass or more, and usually 50% by mass or less, preferably 25% by mass or less.

[0110] The filler 222 includes a tobacco material as a flavor source. The tobacco material is, for example, cut tobacco. When the base portion 212 has a peripheral length of 22 mm and a length of 20 mm, the content of the filler 222 in the flavor inhalation article 210 is, for example, 200 to 400 mg, and preferably 250 to 320 mg. The moisture content of the filler 222 is, for example, 8 to 18% by mass, preferably 10 to 16% by mass. Such a moisture content suppresses occurrence of staining on the wrapping paper and improves roll-up machinability during production of the base portion 212.

[0111] The filter 214 includes a first filter plug 232, a second filter plug 234, and forming paper 236 covering and connecting them. Lengths of the first filter plug 232 and the second filter plug 234 along longitudinal axis L are referred to as L1 and L2, respectively. The second filter plug 234 is disposed between the paper tube portion 216 and the first filter plug 232.

[0112] The first filter plug 232 includes a first filter main body (filter element, filter material) 242, and a first plug wrapper (tubular portion) 244 wrapped around the first filter main body 242. The length L1 of the first filter plug 232 is the same as the length of the first filter main body 242. A channel portion 43 is formed between the outer periphery of the first filter main body 242 and the first wrapper 244. The channel portion 43 is inside the first wrapper (tubular portion) 244 and provides airflow between the second end surface 248 and the first end surface 246. The channel portion 43 is formed in a manner similar to that shown in FIGS. 1A to 1C, for example. The channel portion 43 may include paper tubes 43b (see FIGS. 1D and 1E) as tubular bodies.

[0113] The first filter main body 242 includes a first end surface 246 on the mouthpiece side (mouthpiece side end surface), and a second end surface 248 on the side opposite to the mouthpiece side (end surface on the base portion 212 side). The first end surface 246 and the second end surface 248 have an outer shape of, for example, a substantially circular shape. In the first filter main body 242, a longitudinal axis (center axis) L that intersects the first end surface 246 and the second end surface 248 is defined. The first end surface 246 is on the mouthpiece side, and the second end surface 248 is on the base

portion 212 side. The first end surface 246 is exposed outside.

[0114] The second filter plug 234 includes a second filter main body (filter element, filter material) 252, and a second wrapper (tubular portion) 254 wrapped around the outer periphery of the second filter main body 252. The length L2 of the second filter plug 234 is the same as the length of the second filter main body 252. The second filter main body 252 includes a third end surface 256 and a fourth end surface 258. The third end surface 256 and the fourth end surface 258 have an outer shape of, for example, a substantially circular shape. In the second filter main body 252, a longitudinal axis (center axis) L that intersects the third end surface 256 and the fourth end surface 258 is defined. The third end surface 256 is on the mouthpiece side, and the fourth end surface 258 is on the substrate 212 side. The third end surface 256 faces or is in contact with the second end surface 248.

[0115] The forming paper 236 is wrapped around the outer peripheries of the first wrapper 244 and the second wrapper 254 to connect the first wrapper 244 and the second wrapper 254.

[0116] The cigarette paper 218 is wrapped around the outer peripheries of the base portion 212, the paper tube portion 216, and the filter 214 to connect the base portion 212 and the filter 214 via the paper tube portion 216.

[0117] The first filter main body 242 and the second filter main body 252 are formed of a paper sheet or a non-woven fabric sheet. The relationship between the first filter main body 242 and the second filter main body 252 is the same as the relationship between the first filter main body 42 and the second filter main body 52 described in the first embodiment.

[0118] Thus, it is preferable that the sheet of the first filter main body 242 be crimped to a greater extent than the sheet of the second filter main body 252. It is preferable that the airflow resistance of the first filter main body 242 be higher than the airflow resistance of the second filter main body 252. The airflow resistance of the first filter main body 242 may be lower than the airflow resistance of the second filter main body 252. It is preferable that the airflow resistance of the first filter main body 242 be, for example, 0 mmH₂O/mm to 12 mmH₂O/mm, and that the airflow resistance of the second filter main body 252 be, for example, 0 mmH₂O/mm to 12 mmH₂O/mm.

[0119] It is preferable that the air permeability of the sheet of the first filter main body 242 be 1000 CU (CORESTA Unit) to 30000 CU after crimp process, and that the air permeability of the sheet of the second filter main body 252 be 0 CU to 10000 CU after crimp process.

[0120] The void volume when the mouthpiece side end surface 246 of the first filter main body 242 is viewed is equal to or greater than the void volume of the acetate filter on the mouthpiece side. It is preferable that the area of voids when the mouthpiece side end surface 246 of the first filter main body 242 is viewed be 3 mm² or less.

[0121] Thus, the filter 214 has the aesthetic appearance as in the filter 14 described in the first embodiment,

and is formed in a state of having appropriate filtration characteristics for an aerosol containing a substance such as a flavor substance derived from a flavor source of the filler 222 flowing from the filler 222 of the base portion 212 toward the mouthpiece side end surface 246.

[0122] As described above, according to the present embodiment, the following can be said.

[0123] It is possible to provide the flavor inhalation article 210 that includes the filter 214 formed of a paper sheet. At this moment, while the filter 214 formed of the paper sheet is made of paper, by forming the channel portion 43 in the first filter plug 232 on the mouthpiece side of the filter 214, it is possible to suppress stains on the mouthpiece side end surface 246 of the filter 214 after use, as compared to the acetate filter and the paper filter 114 having no channel portion. Therefore, while the filter 214 according to the present embodiment is made of paper, the aesthetic appearance after use can be enhanced.

[0124] For the filter 214 formed of a paper sheet, it is possible to control smoking taste (sweetness, smoke volume feeling, stimulation, tobacco feeling (smoking satisfaction), and the like) by appropriately adjusting a material, basis weight, air permeability, crimp depth, void volume, airflow resistance, and the like of the first filter main body 242 and the second filter main body 252. Thus, the filter 214 is provided in which the filtration characteristics for the substance such as the flavor substance derived from the flavor source and the aerosol flowing from the tobacco rod 12 toward the mouthpiece side end surface 246 during use (inhalation) are appropriately controlled. That is, the flavor inhalation article 210 is provided that includes the filter 214 having suitable filtration characteristics.

[0125] In the present embodiment, a description has been given of the example in which paper is used for the first filter main body 242 and the second filter main body 252, but it is also possible to use the non-woven fabric sheets 172a, 172b, 172c, and 172d (see FIG. 18A) described in the first embodiment by appropriately adjusting a material, basis weight, air permeability, crimp depth, void volume, airflow resistance, and the like. That is, according to the present embodiment, there are provided the filter 214 that is formed of a paper sheet or a non-woven fabric sheet, enhances aesthetic appearance, and has appropriate filtration characteristics, and the flavor inhalation article 210 including the filter 214.

[0126] Although illustration is omitted, for appropriately adjusting the airflow resistance of the flavor inhalation article 210, the filter 214 may be provided with an opening portion to take in air from the outside. In this case, it is desirable to provide an opening portion in the paper tube portion 216.

[0127] For the flavor inhalation article 210, the dimension in the longitudinal direction, i.e., the length, is preferably 40 to 90 mm, more preferably 50 to 75 mm, and even more preferably 50 to 60 mm. The peripheral length of the flavor inhalation article 210 is preferably 15 to 25

mm, more preferably 17 to 24 mm, and even more preferably 20 to 23 mm. In the flavor inhalation article 210, the lengths of the base portion 212, the paper tube portion 216, the first filter plug 232, and the second filter plug 234 may be 20 mm, 20 mm, 7 mm, and 8 mm, respectively, but the lengths of these individual segments can be appropriately changed according to manufacturing suitability, required qualities, and the like.

[0128] The size of the cut tobacco used in the filler 222 and the method for preparing them are not particularly limited. For example, dried tobacco leaf cut to have a width of 0.8 to 1.2 mm may be used. Alternatively, dried tobacco leaf may be pulverized and homogenized to have an average particle size of about 20 to 200 μm , processed into a sheet, and then cut to have a width of 0.8 to 1.2 mm. Further, the above sheet-processed material that is gathered instead of being cut may be used as the tobacco material.

[0129] For the first wrapper 244 and second wrapper 254, those the same as the wrappers 44 and 54 and the tipping paper 16 used for the cigarette 10 described in the first embodiment can be used.

[0130] In the flavor inhalation article 210 including the filter 214 according to this embodiment, all or most of elements such as a paper material and tobacco material can be formed of naturally derived components. Therefore, it is possible to reduce environmental burden nature as compared with the case of using, for example, an acetate filter for the filter.

[0131] As described in the modification of the first embodiment (see FIGS. 19A and 19B), the channel portion 43 may be formed so as to penetrate through the first filter main body 242.

[Third Embodiment]

[0132] A third embodiment will be described with reference to FIG. 21. This embodiment is a modification of the first embodiment and the second embodiment.

[0133] A flavor inhalation article 310 is one of members constituting a non-combustion heating type flavor inhalation article.

[0134] A flavor inhalation article (capsule) 310 shown in FIG. 21 is a replaceable cartridge for use with a heater. The flavor inhalation article 310 has a columnar shape extending along one direction.

[0135] As shown in FIG. 21, the flavor inhalation article 310 includes a capsule body (tubular portion) 311, a tobacco material 312 enclosed in the capsule body 311, a filter 314 preventing the tobacco material 312 from leaking, and a ring-shaped cap (end piece) 316 supporting the filter 314 with respect to the capsule body 311.

[0136] The capsule body 311 includes an opening 322 at one end (mouthpiece side) and a mesh portion 324 at the other end (tobacco material 312 side). The capsule body 311 includes a step 326 on which the filter 314 is seated. For the mesh portion 324 of the capsule body 311, the mesh size is adjusted, for example, such that it

is permeable to air and appropriate vapor but prevents the tobacco material 312 from leaking out.

[0137] For the capsule body 311 and the cap 316, an appropriate material such as a paper material or non-woven fabric is used. The capsule body 311 and the cap 316 may be formed of a resin material. When the capsule body 311 and the cap 316 are formed of a resin material, it is preferable that all or a part of the material be recyclable.

[0138] In addition to the cut tobacco, the tobacco material 312 may also be, for example, granular.

[0139] The filter 314 allows air and appropriate vapor to pass therethrough and is formed in a substantially cylindrical shape. The filter 314 includes a first filter main body 342, and a second filter main body 352. Lengths of the first filter main body 342 and the second filter main body 352 along longitudinal axis L are referred to as L1 and L2, respectively. A channel portion 43 is formed between the outer periphery of the first filter main body 342 and the capsule body (tubular portion) 311. The first filter main body 342 and the second filter main body 352 are held by the capsule body 311. When the cap (end piece) 316 is placed for the capsule body 311, the cap 316 supports the first filter main body 342 and the second filter main body 352 and prevents the first filter main body 342 and the second filter main body 352 from being pulled out of the capsule body 311.

[0140] Similarly to the first filter main body 42 described in the first embodiment and the first filter main body 242 described in the second embodiment, the first filter main body 342 is formed of an appropriate paper material or non-woven fabric, and a material, basis weight, air permeability, crimp depth, void volume, airflow resistance, and the like are appropriately adjusted. Similarly to the second filter main body 52 described in the first embodiment and the first filter main body 252 described in the second embodiment, the second filter main body 352 is formed of an appropriate paper material or non-woven fabric, and a material, basis weight, air permeability, crimp depth, void volume, airflow resistance, and the like are appropriately adjusted.

[0141] The first filter main body 342 includes a first end surface 346 on the mouthpiece side (mouthpiece side end surface) and a second end surface 348 on the side opposite to the mouthpiece side (end surface on the tobacco material 312 side). The second filter main body 352 includes a first end surface 356 and a second end surface 358. The second end surface 348 and the first end surface 356 face each other or are in contact with each other. The first end surface 346 is exposed outside. The channel portion 43 is inside the capsule body (tubular portion) 311 and provides airflow between the second end surface 348 and the first end surface 346. The channel portion 43 is formed in a manner similar to that shown in FIGS. 1A to 1C, for example. The channel portion 43 may include paper tubes 43b (refer to FIGS. 1D and 1E) as tubular bodies.

[0142] The sheet of the first filter main body 342 is

crimped to a greater extent than the sheet of the second filter main body 352. It is preferable that the airflow resistance of the first filter main body 342 be higher than the airflow resistance of the second filter main body 352.

5 The airflow resistance of the first filter main body 342 may be lower than the airflow resistance of the second filter main body 352. It is preferable that the airflow resistance of the first filter main body 342 be, for example, 0 mmH₂O/mm to 12 mmH₂O/mm. It is preferable that the airflow resistance of the second filter main body 352 be, for example, 0 mmH₂O/mm to 12 mmH₂O/mm

[0143] It is preferable that the sheet of the first filter main body 342 have an air permeability of, for example, 1000 CU (CORESTA Unit) to 30000 CU after crimp process. It is preferable that the sheet of the second filter main body 352 have an air permeability of, for example, 0 CU to 10000 CU after crimp process.

[0144] The void volume when the first end surface 346 of the first filter main body 342 is viewed is equal to or greater than the void volume of the acetate filter on the mouthpiece. It is preferable that the area of voids when the first end surface 346 of the first filter main body 342 is viewed be 3 mm² or less.

[0145] Thus, the filter 314 has an aesthetic appearance as in the filter 14 described in the first embodiment and the filter 214 described in the second embodiment, and is formed in a state of having appropriate filtration characteristics for the substance such as the flavor substance derived from the flavor source and the aerosol flowing from the tobacco material 312 toward the mouthpiece side end surface 46.

[0146] As described above, according to the present embodiment, the following can be said.

[0147] It is possible to provide the flavor inhalation article 310 that includes the filter 314 formed of a paper sheet. At this moment, while the filter 314 formed of the paper sheet is made of paper, by forming the channel portion 43 in the first filter main body 342 on the mouthpiece side of the filter 314, it is possible to suppress stains on the mouthpiece side end surface 346 of the filter 314 after use, as compared to the acetate filter and the paper filter 114 having no channel portion. Therefore, while the filter 314 according to the present embodiment is made of paper, the appearance after use can be enhanced.

[0148] For the filter 314 formed of a paper sheet, it is possible to control smoking taste (sweetness, smoke volume feeling, stimulation, tobacco feeling (smoking satisfaction), and the like) by appropriately adjusting a material, basis weight, air permeability, crimp depth, void volume, airflow resistance, and the like of the first filter main body 342 and the second filter main body 352. Thus, the filter 314 is provided in which the filtration characteristics of the substance such as the flavor substance derived from the flavor source and the aerosol flowing from the tobacco material 312 toward the mouthpiece side end surface 346 during inhalation are appropriately controlled. That is, the flavor inhalation article 310 is provided that includes the filter 314 having suitable filtration char-

acteristics.

[0149] In the present embodiment, a description has been given of the example in which paper is used for the first filter main body 342 and the second filter main body 352, but it is also possible to use the non-woven fabric sheets 172a, 172b, 172c, and 172d (see FIG. 18A) described in the first embodiment by appropriately adjusting a sheet material, basis weight, air permeability, crimp depth, void volume, airflow resistance, and the like. That is, according to the present embodiment, there are provided the filter 314 that is formed of a paper sheet or a non-woven fabric sheet, enhances aesthetic appearance, and has appropriate filtration characteristics, and the flavor inhalation article 310 including the filter 314

[0150] As described in the modification of the first embodiment (see FIGS. 19A and 19B), the channel portion 43 may be formed so as to penetrate through the first filter main body 342.

[0151] The invention of the present application is not limited to the above-described embodiment, and can be variously modified at the implementation stage without departing from the gist thereof. In addition, each embodiment may be carried out in combination as appropriate as possible, and in that case, the combined effect can be obtained. Further, the above-described embodiment includes inventions at various stages, and various inventions can be extracted by an appropriate combination in a plurality of disclosed constitutional requirements.

Claims

1. A filter, comprising:

a first filter main body including a first end surface on a mouthpiece side and a second end surface on a side opposite to the mouthpiece side, and formed of a paper sheet or a non-woven fabric sheet;

a second filter main body provided on a side of the second end surface of the first filter main body, including a third end surface facing the second end surface, and formed of a paper sheet or a non-woven fabric sheet; and

a channel portion providing airflow between the second end surface and the first end surface, the channel portion having an airflow resistance lower than an airflow resistance of the first filter main body.

2. The filter according to claim 1, wherein when the first end surface of the first filter main body is viewed, a void volume of the first filter main body is smaller than a void volume of the channel portion.

3. The filter according to claim 1 or 2, comprising:

a first wrapper wrapped around an outer periph-

ery of the first filter main body, wherein the channel portion is between an outer peripheral surface of the first filter main body and an inner peripheral surface of the first wrapper.

4. The filter according to claim 3, wherein the channel portion includes a paper tubular body or a non-woven fabric tubular body.

5. The filter according to claim 1 or 2, wherein the channel portion has a cylindrical shape penetrating between the second end surface and the first end surface of the first filter main body.

6. The filter according to claim 5, wherein the channel portion includes a paper tubular body or a non-woven fabric tubular body.

7. The filter according to any one of claims 1 to 6, wherein the first end surface is exposed outside.

8. The filter according to any one of claims 1 to 7, wherein the paper sheet of the first filter main body is crimped to a crimp depth greater than a crimp depth of the paper sheet of the second filter main body.

9. The filter according to any one of claims 1 to 7, wherein each of the first filter main body and the second filter main body is formed by a plurality of non-woven fabric sheets that are overlapped and folded.

10. The filter according to any one of claims 1 to 9, wherein the sheet of the first filter main body and the second filter main body has an air permeability of 1000 CU (CORESTA Unit) to 30000 CU.

11. The filter according to any one of claims 1 to 10, wherein the first filter main body and the second filter main body have an airflow resistance of 0 mmH₂O/mm to 12 mmH₂O/mm

12. A smoking article comprising the filter according to any one of claims 1 to 11.

13. A flavor inhalation article comprising the filter according to any one of claims 1 to 11.

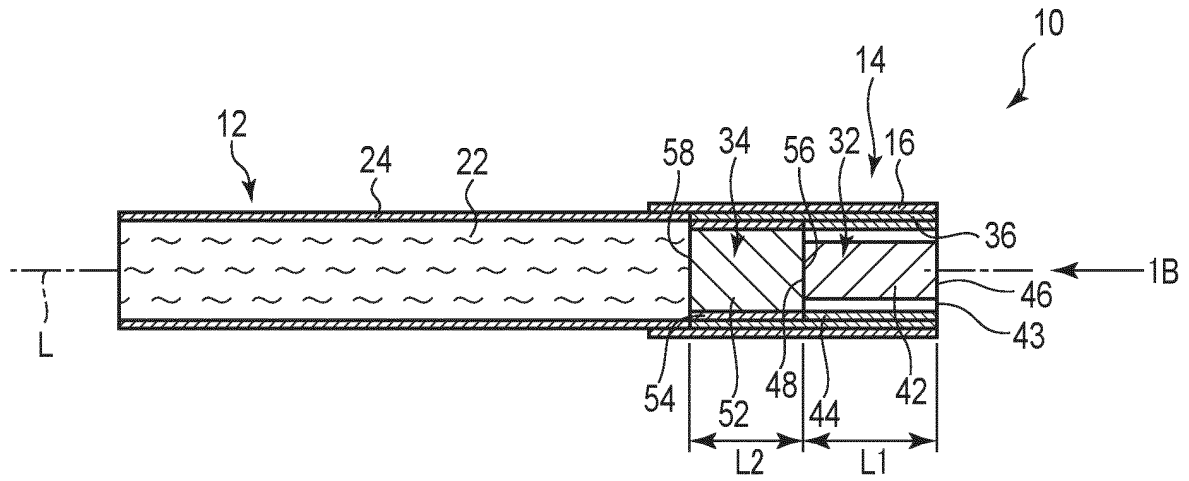


FIG. 1A

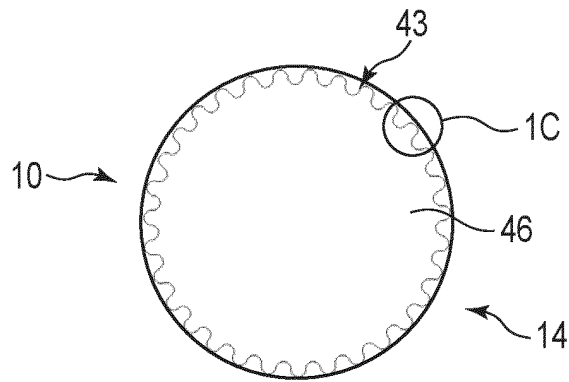


FIG. 1B

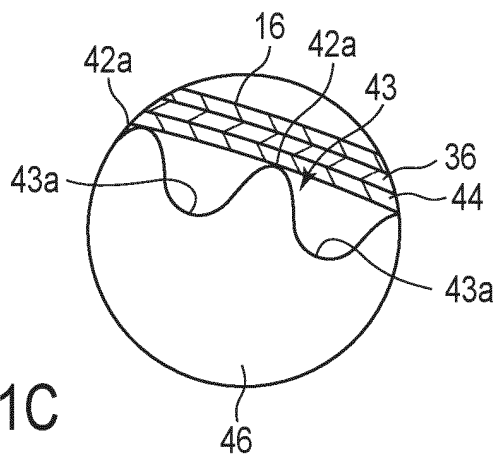


FIG. 1C

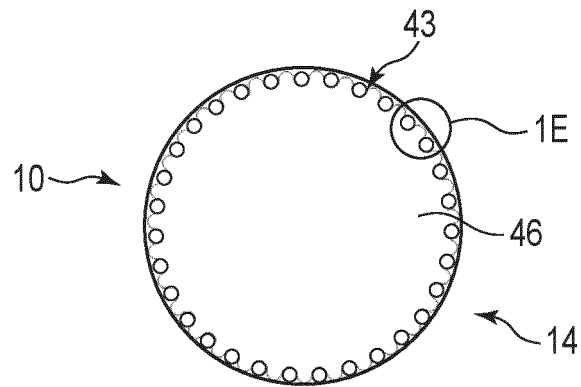


FIG. 1D

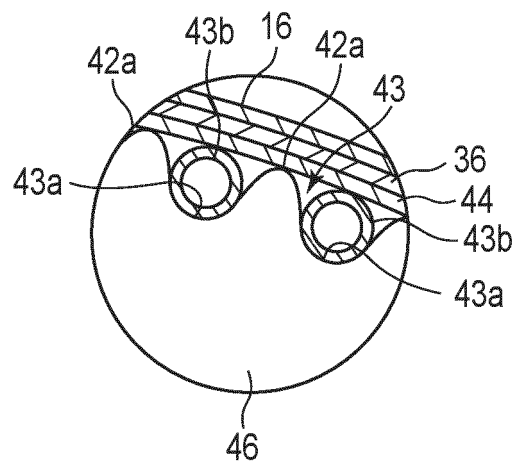


FIG. 1E

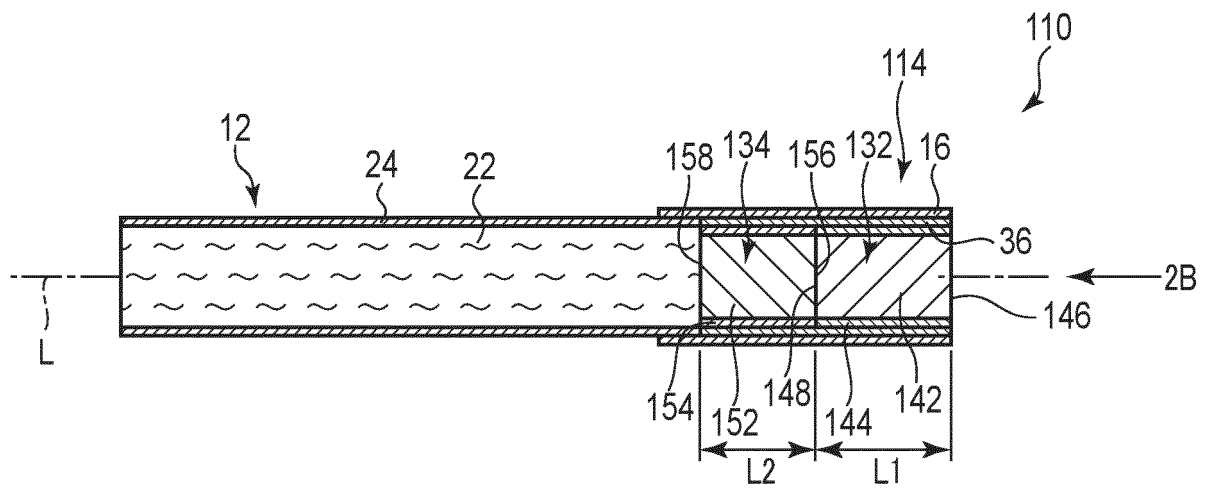


FIG. 2A

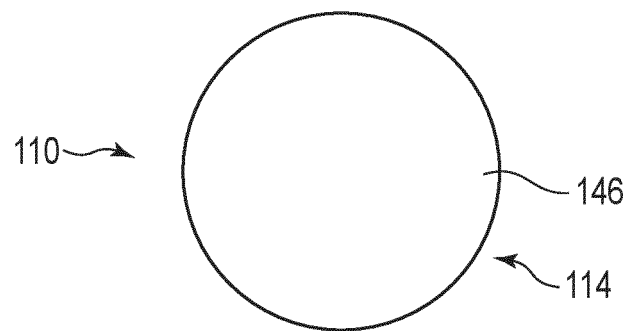


FIG. 2B

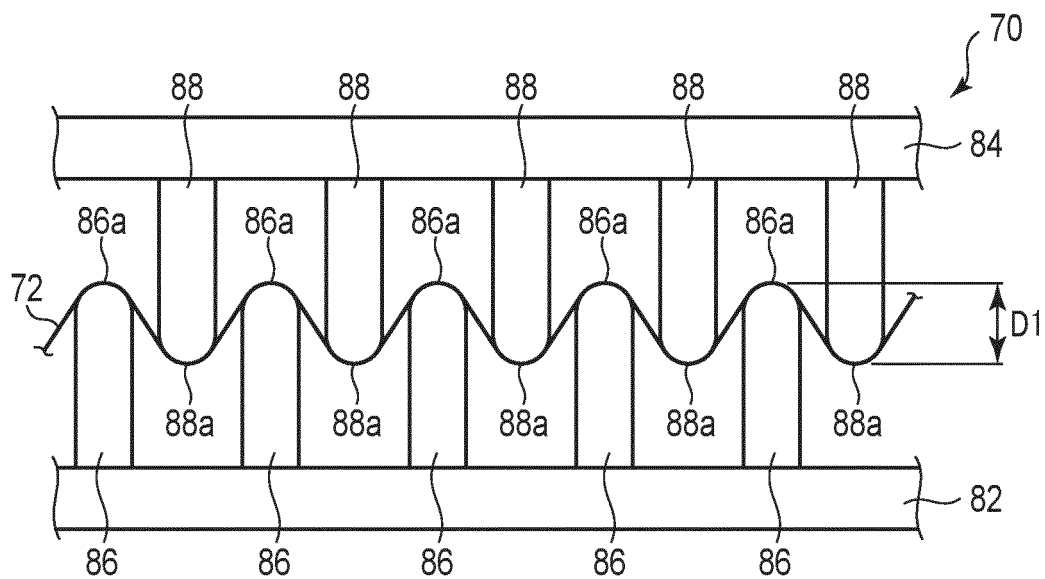


FIG. 3A

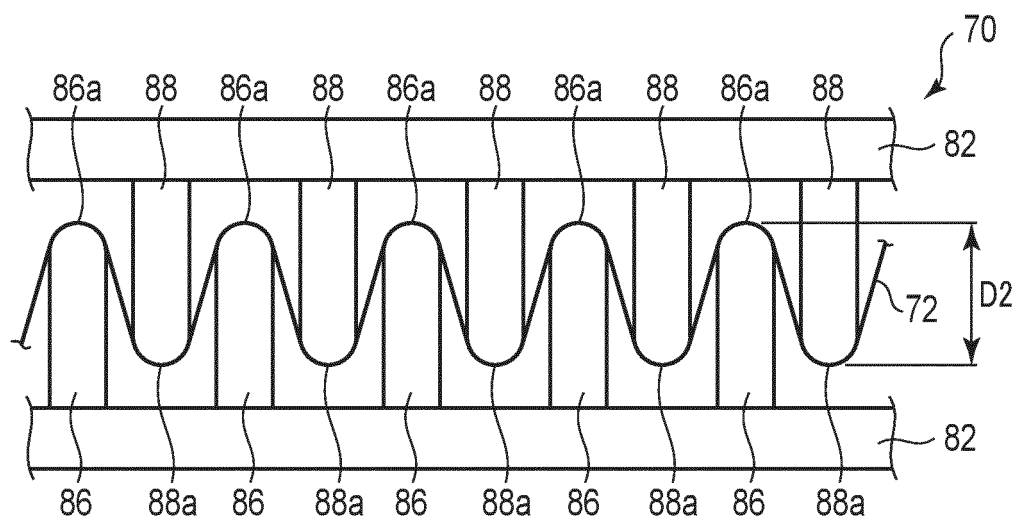


FIG. 3B

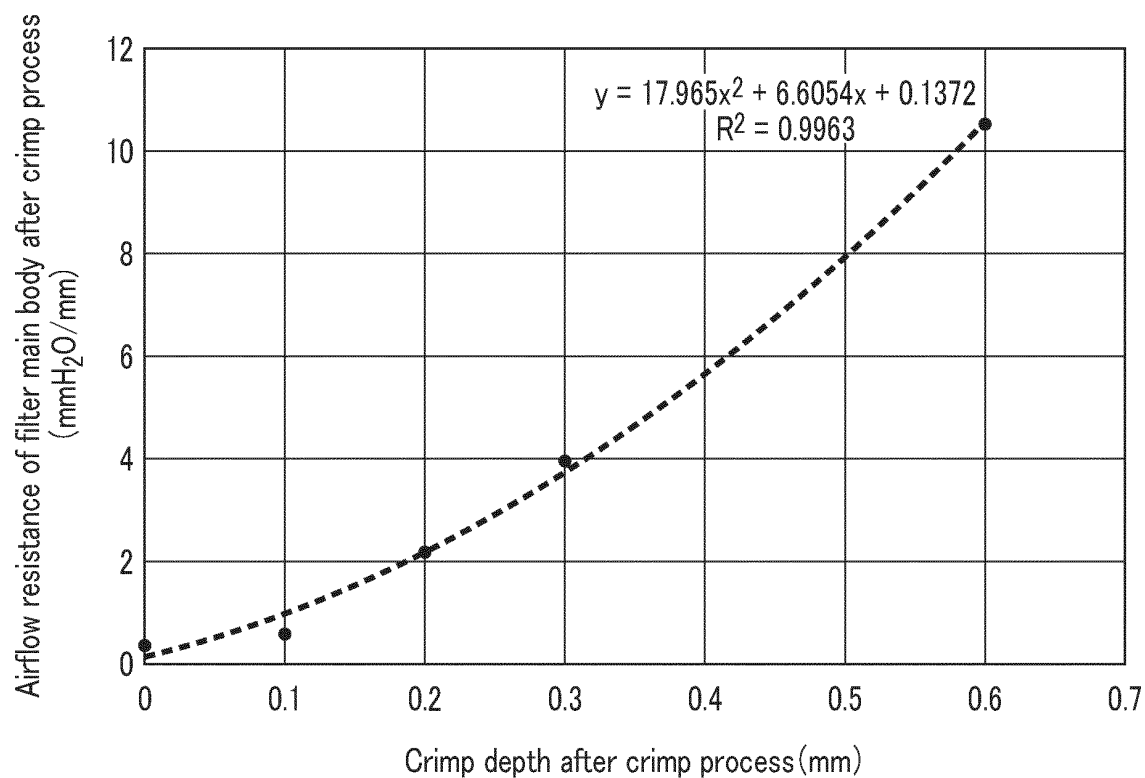


FIG. 4A

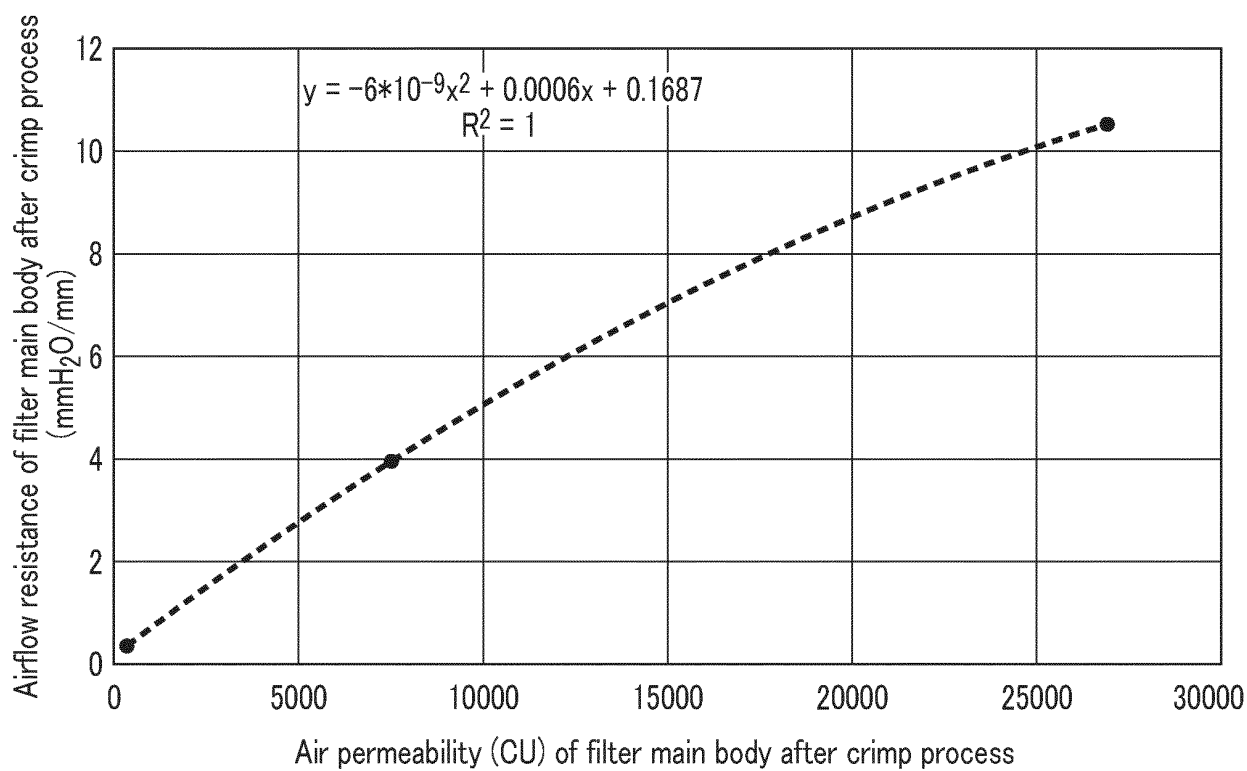


FIG. 4B

		Mouthpiece side filter length L1[mm]	Tobacco side filter length L2[mm]	Tar [mg]	Nicotine [mg]	Carbon monoxide [ppm]	Number of puffs [times]
Lot 1 (Comparative Example 1)	Winston compact 6mg Mouthpiece side: Acetate filter Tobacco side: Charcoal filter	15	12	6.3	0.54	7.5	7.1
Lot 2 (Comparative Example 2)	Mouthpiece side filter Amount of crimping: Large (0.6mm) Tobacco side filter Amount of crimping: Small (0.2mm) Airflow portion: Absence	9	18	6.0	0.44	8.6	7.0
Lot 3	Mouthpiece side filter Amount of crimping: Large (0.6mm) Tobacco side filter Amount of crimping: Small (0.2mm) Airflow portion: Presence	15	20	4.4	0.29	8.5	7.0

FIG. 5

		Mouthpiece side filter length L1[mm]	Tobacco side filter length L2[mm]	Tar [mg]	Nicotine [mg]	Carbon monoxide [ppm]	Number of puffs [times]
Lot 4 (Comparative Example 3)	Winston compact 1mg	15	12	1.2	0.11	2.0	7.9
	Mouthpiece side: Acetate filter Tobacco side: Charcoal filter						
Lot 5 (Comparative Example 4)	Mouthpiece side filter	15	12	2.2	0.15	8.4	7.0
	Amount of crimping: Large (0.6mm) Tobacco side filter Amount of crimping: Small (0.2mm) Airflow portion: Absence						
Lot 6	Mouthpiece side filter	12	15	1.6	0.11	4.7	7.2
	Amount of crimping: Large (0.6mm) Tobacco side filter Amount of crimping: Intermediate (0.3mm) Airflow portion: Presence						

FIG. 6

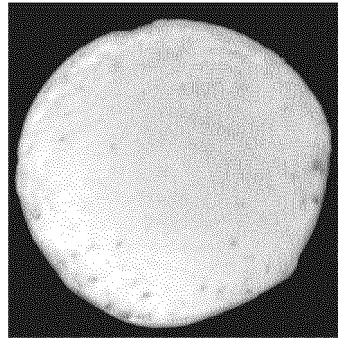


FIG. 7A

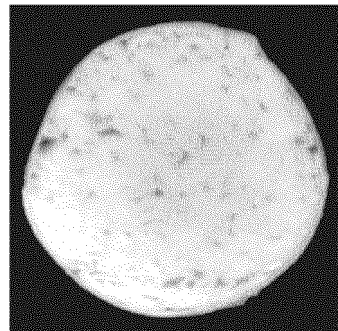


FIG. 7B

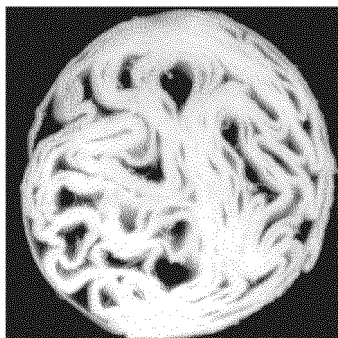


FIG. 7C

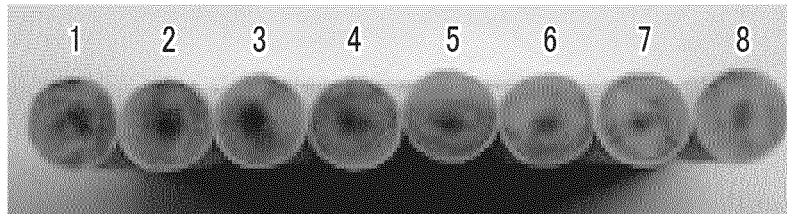


FIG. 8A

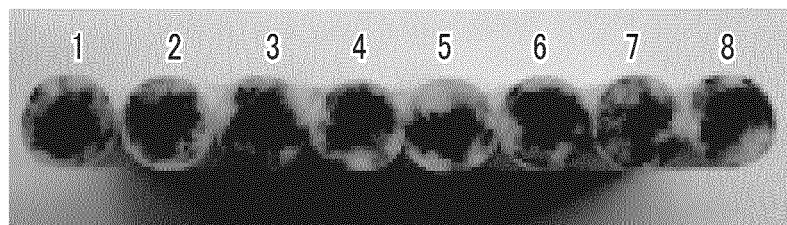


FIG. 8B

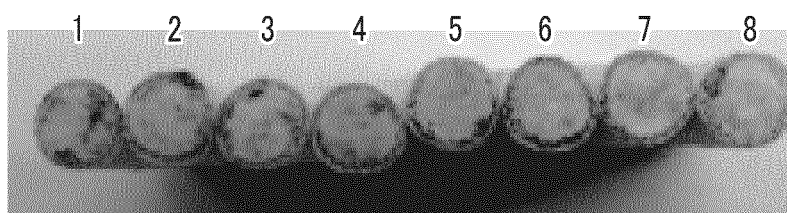


FIG. 8C

No.	Lot 1	Lot 2	Lot 3
1	10.7	7.8	13.9
2	11.7	8.9	15.6
3	10.3	7.5	15.3
4	10.7	7.1	16.0
5	11.0	8.2	13.9
6	10.3	7.8	15.6
7	9.2	6.4	16.4
8	12.1	7.8	15.3
AVE	10.75	7.69	15.25

FIG. 9

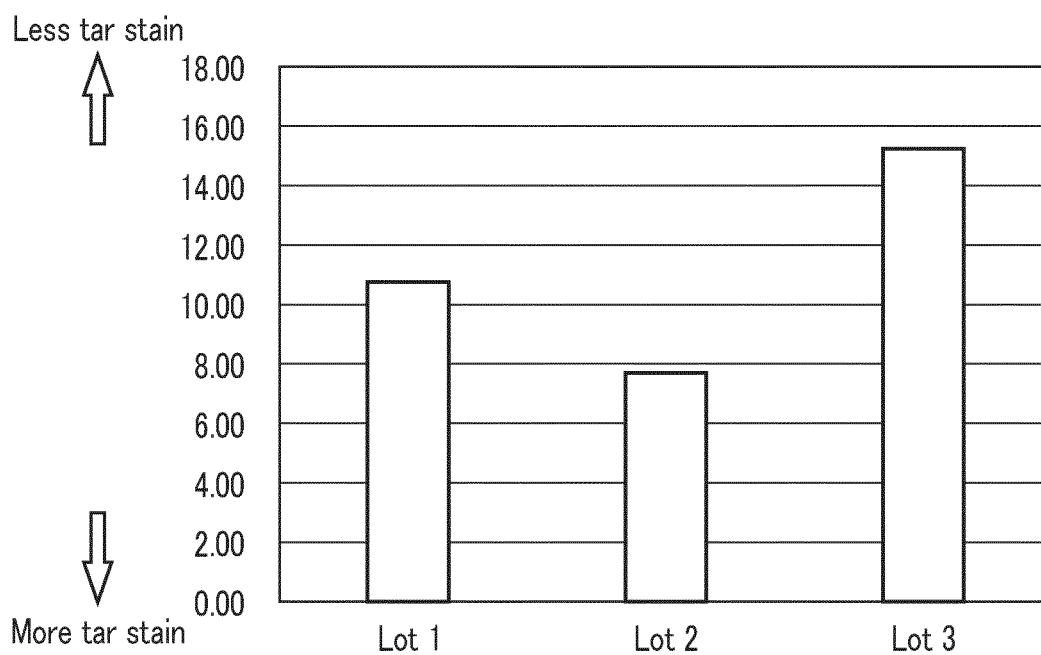


FIG. 10

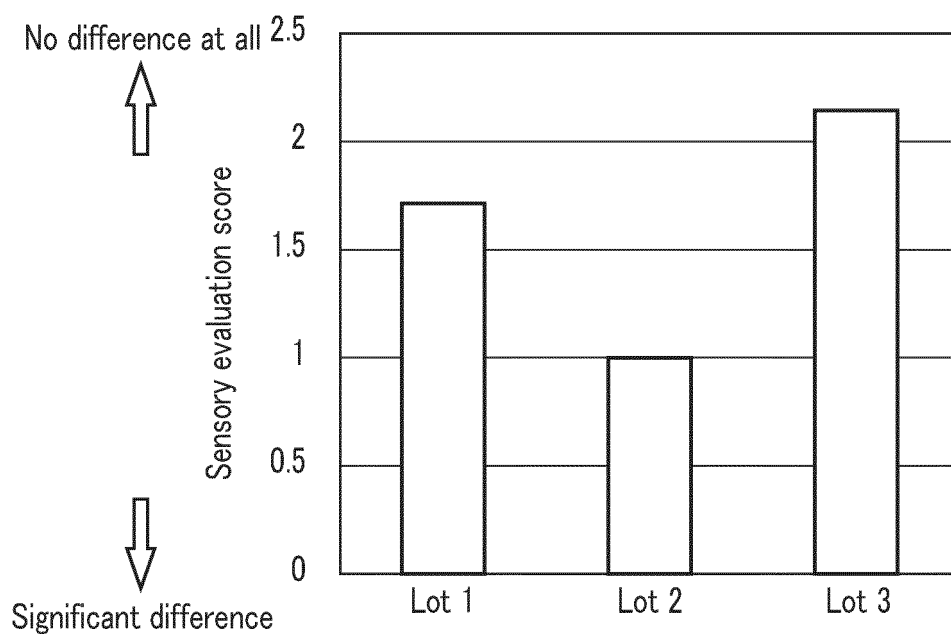


FIG. 11

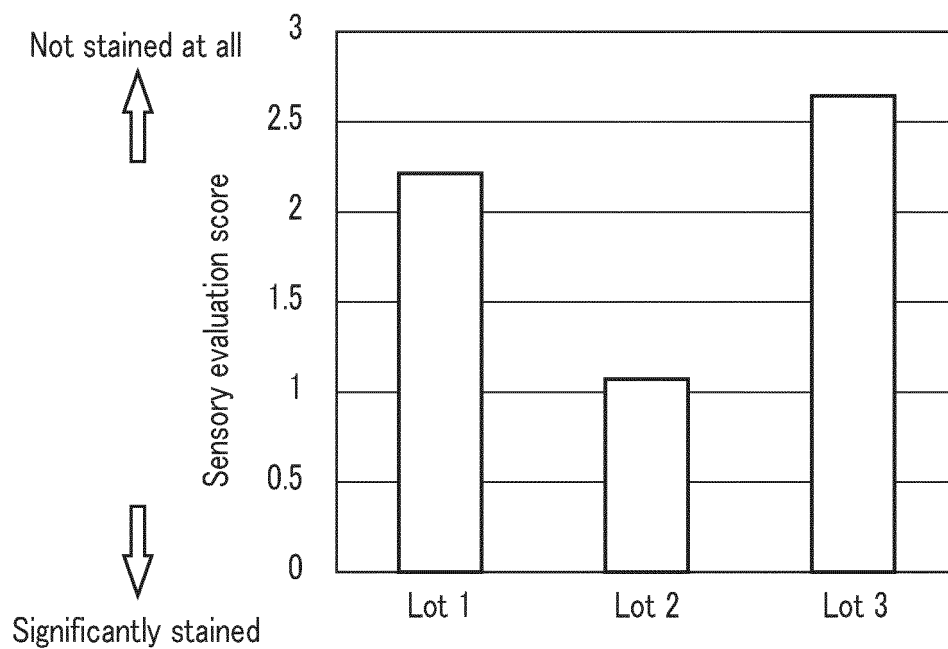


FIG. 12

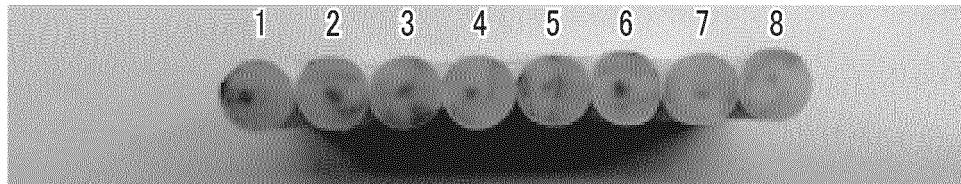


FIG. 13A

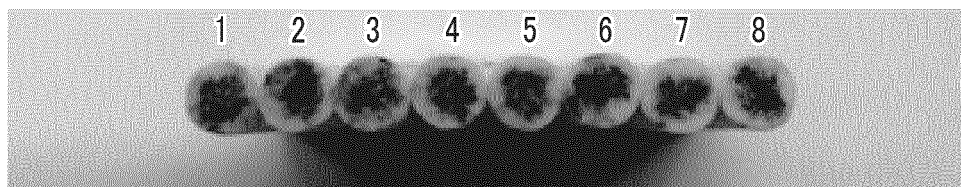


FIG. 13B

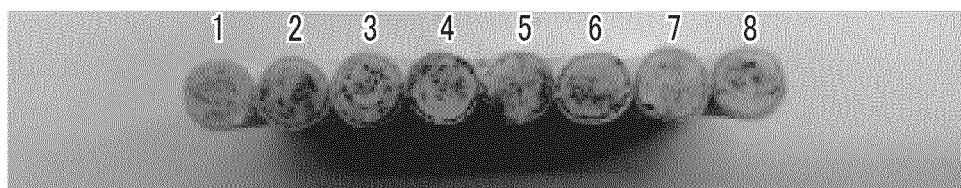


FIG. 13C

No.	Lot 4	Lot 5	Lot 6
1	16.0	11.0	13.5
2	14.9	11.4	16.7
3	15.3	12.8	15.6
4	13.9	10.7	14.9
5	16.0	11.7	17.4
6	14.9	9.2	16.0
7	16.7	11.4	14.6
8	14.6	9.6	16.7
AVE	15.29	10.98	15.68

FIG. 14

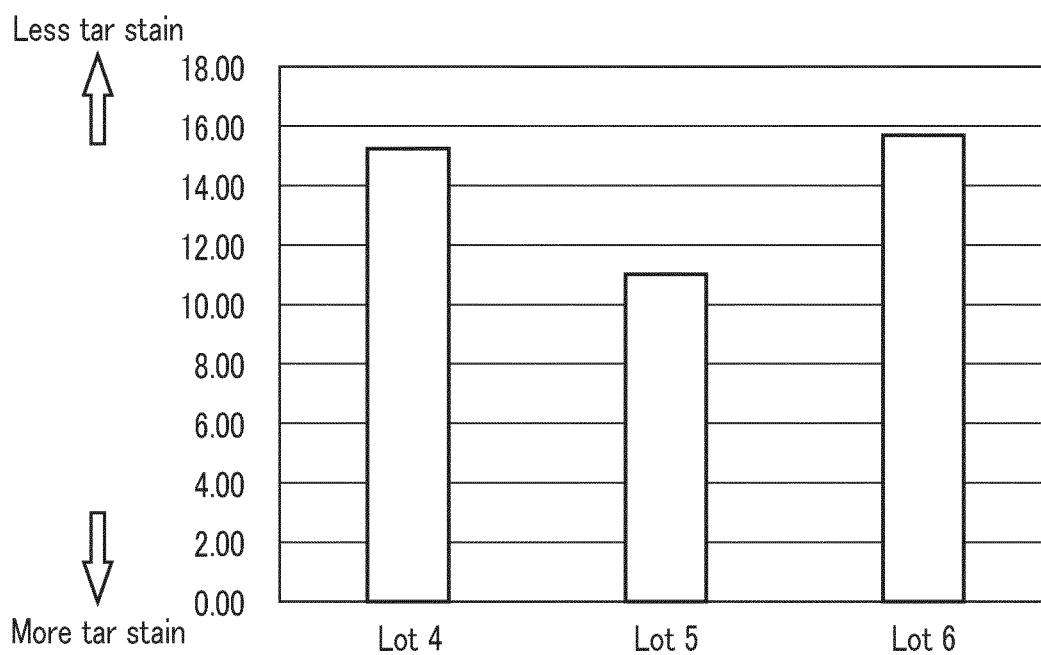


FIG. 15

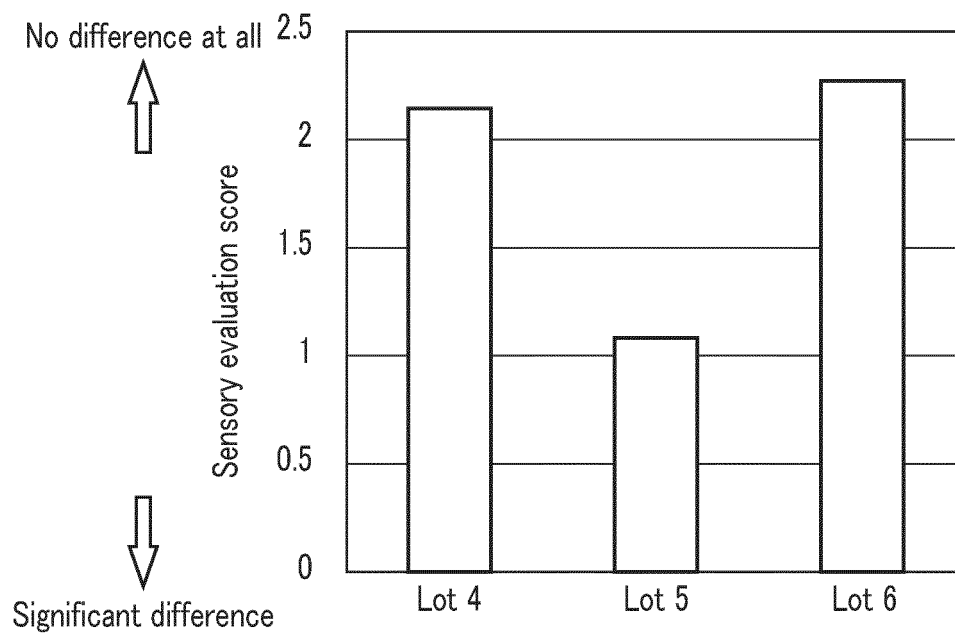


FIG. 16

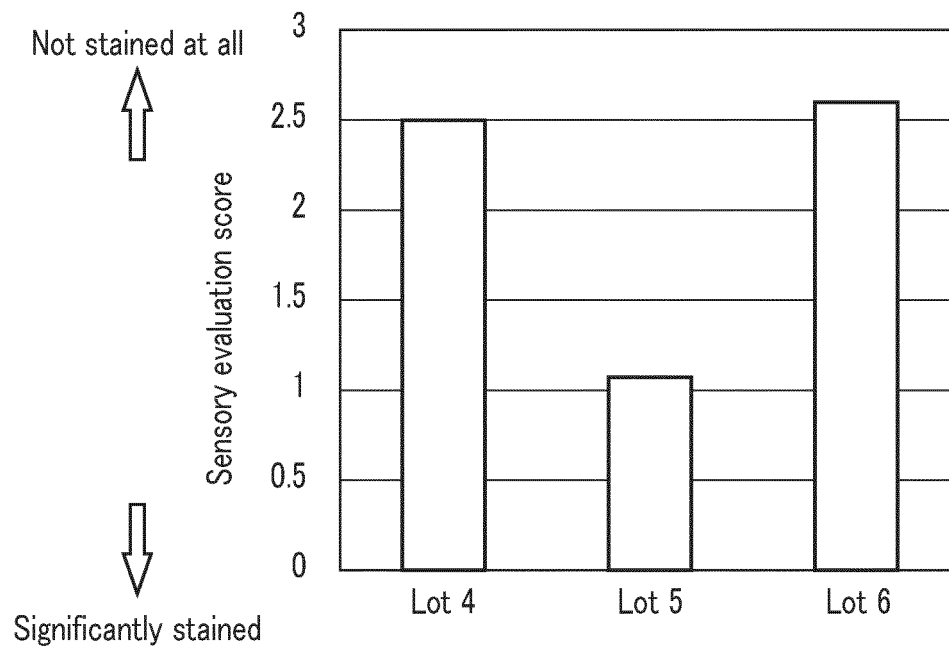


FIG. 17

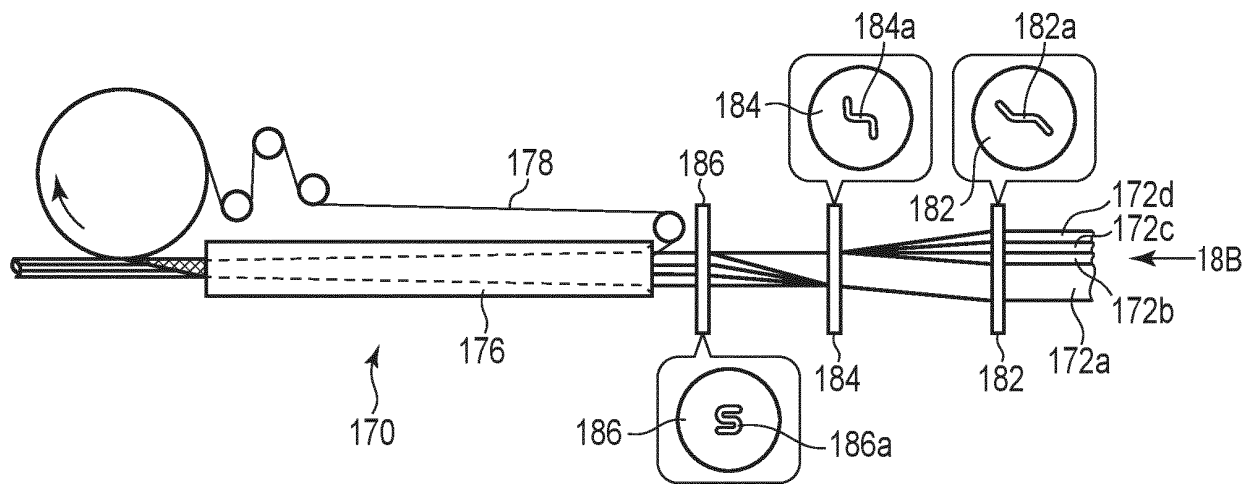


FIG. 18A

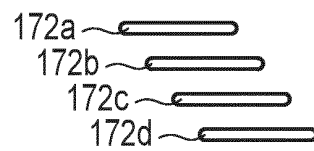


FIG. 18B

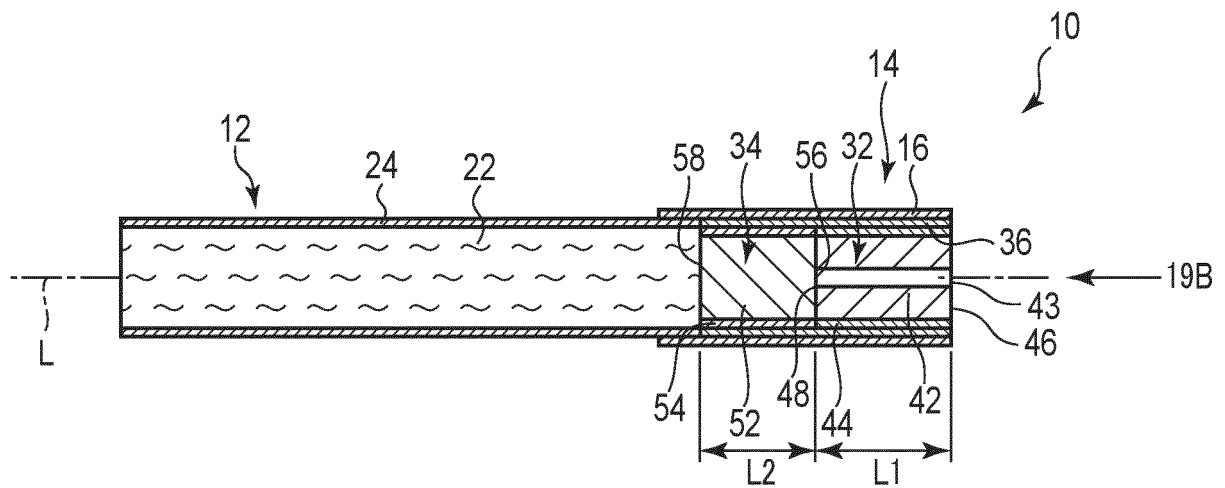


FIG. 19A

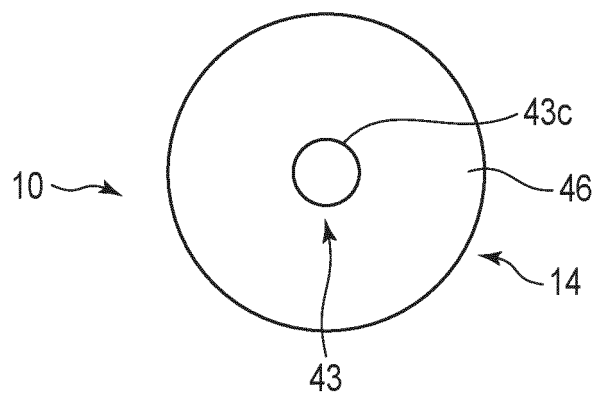


FIG. 19B

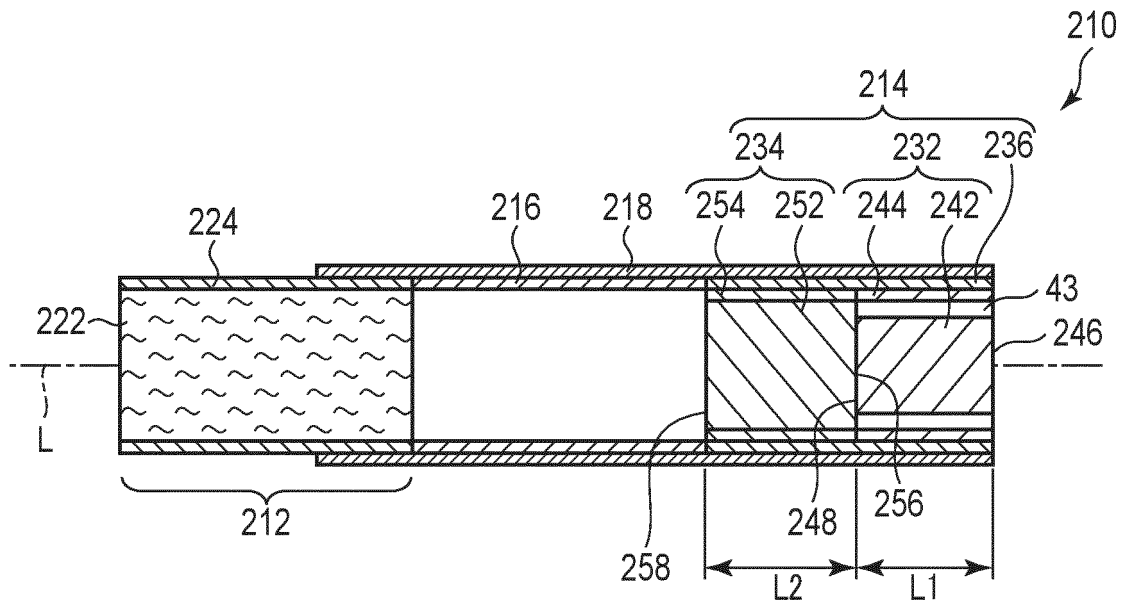


FIG. 20

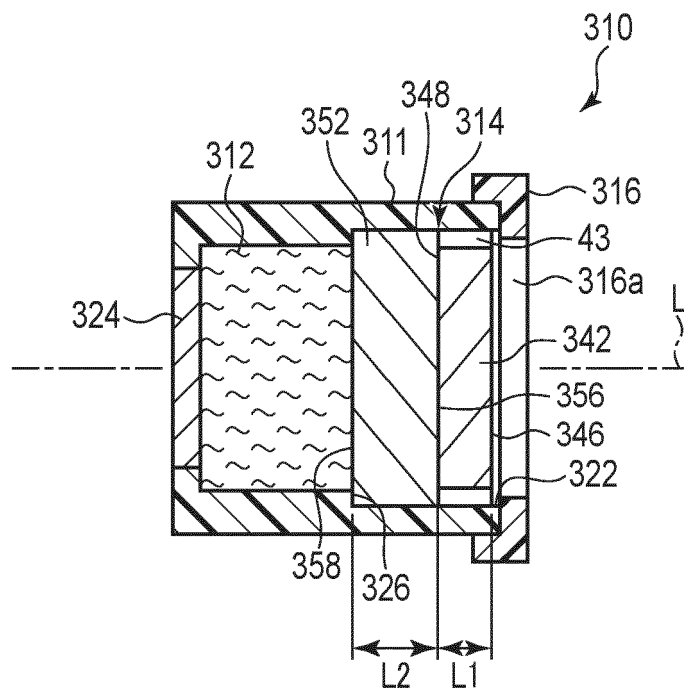


FIG. 21

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/008714

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. A24D3/04 (2006.01) i

FI: A24D3/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl. A24D3/04

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2020

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.
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Y	WO 2011/118042 A1 (JAPAN TOBACCO INC.) 29.09.2011 (2011-09-29), abstract, paragraph [0029], fig. 1, 2	1-7, 10-13
Y	JP 01-243979 A (R J REYNOLDS TOBACCO CO.) 28.09.1989 (1989-09-28), specification, page 3, right lower paragraph, line 12 to page 4, left upper paragraph, line 20, page 8, right upper paragraph, lines 3-13, fig. 8-10	1-7, 9-13
Y	JP 2016-002064 A (DAICEL CORPORATION) 12.01.2016 (2016-01-12), paragraphs [0017]-[0019], fig. 1, 2	3-4, 7, 9-13
Y	JP 44-3727 B1 (HONSHU PAPER CO., LTD.) 17.02.1969 (1969-02-17), fig. 1-8	9-13

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

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"O" document referring to an oral disclosure, use, exhibition or other means

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search
15.04.2020Date of mailing of the international search report
12.05.2020Name 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

International application No.

PCT/JP2020/008714

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 35-2052 B1 (MULLER, P. A.) 11.03.1960 (1960-03-11), entire text, all drawings	1-13
A	JP 55-148080 A (MITSUBISHI RAYON CO., LTD.) 18.11.1980 (1980-11-18), entire text, all drawings	1-13

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
 Information on patent family members

International application No.

PCT/JP2020/008714

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WO 2011/118042 A1 29.09.2011 EP 2550878 A1
 paragraph [0029], fig. 1, 2
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JP 01-243979 A 28.09.1989 US 4807809 A
 column 2, line 43 to column 3, line 6,
 column 8, lines 5-15, fig. 8-10

JP 2016-002064 A 12.01.2016 EP 3023014 A1
 paragraphs [0017]-[0019], fig. 1, 2

JP 44-3727 B1 17.02.1969 (Family: none)

JP 35-2052 B1 11.03.1960 (Family: none)

JP 55-148080 A 18.11.1980 (Family: none)

REFERENCES CITED IN THE DESCRIPTION

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- JP H78254 A [0004]