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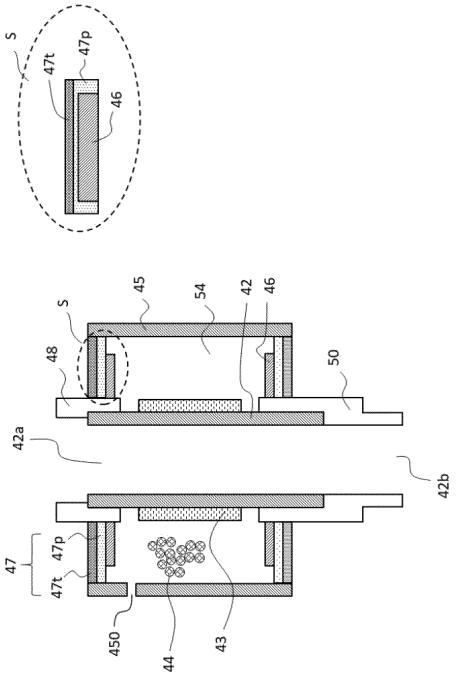
(54) HEATING ASSEMBLY AND FLAVOR INHALER PROVIDED WITH SAME

(57) Provided is a heating assembly comprising: an inner cylinder into which a flavor-generating article can be inserted; an outer cylinder disposed outside the inner cylinder; a pair of sealing members disposed between each of the ends of the inner cylinder and each of the ends of the outer cylinder so as to form a closed space having heat insulation function between the inner cylinder and the outer cylinder; and a heating member, wherein the heat conductivity of the sealing members is lower than that of the inner cylinder.

Fig.4



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Description

TECHNICAL FIELD

[0001] The present invention relates to a heating assembly and a flavor inhaler provided with the same.

BACKGROUND ART

[0002] There have conventionally been known flavor inhalers for inhaling flavor without burning a material (e.g., PTLs 1, 2). Such flavor inhalers may cause a problem with safety since users may suffer from burn injuries when excessive heat for heating a flavor source transfers to users via inhalers. Therefore, there has been a demand for measures to prevent heat from easily transferring to users.

CITATION LIST

PATENT LITERATURES

[0003]

PTL 1: Japanese Unexamined Patent Application Publication No. JP 2017-148065
PTL 2: Japanese Translation of PCT International Publication No. JP 2018-522551

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] An object of the present invention is to provide a heating assembly that enables provision of a flavor inhaler having excellent heat insulation performance for preventing heat from transferring to the outside.

SOLUTION TO PROBLEM

[0005] The present inventors found that the aforementioned object can be achieved by using a member having particular heat insulation properties, and thus completed the present invention. More specifically, the aforementioned object can be achieved by the following invention.

(1) A heating assembly comprising:

an inner cylinder into which a flavor-generating article can be inserted;
an outer cylinder disposed outside the inner cylinder;
a pair of sealing members disposed between each of the ends of the inner cylinder and each of the ends of the outer cylinder so as to form a closed space having heat insulation function between the inner cylinder and the outer cylinder; and
a heating member,
wherein the heat conductivity of the sealing members is lower than that of the inner cylinder.

(2) The heating assembly as set forth in (1), wherein the inner cylinder and the sealing member differ in heat conductivity by not less than 13 W/m/K.
(3) The heating assembly as set forth in (1) or (2), wherein the heating member is disposed in the closed space and is in proximity to the inner cylinder.
(4) The heating assembly as set forth in (3), wherein the heating member is disposed on a surface of the inner cylinder which faces toward the outer cylinder.
(5) The heating assembly as set forth in any of (1) to (4), further comprising a heat insulation material in the closed space.
(6) The heating assembly as set forth in any of (1) to (5), wherein the heat insulation material is an aerogel.
(7) The heating assembly as set forth in any of (1) to (6), wherein the inner cylinder is made of a metal.
(8) The heating assembly as set forth in any of (1) to (7), further comprising, in the closed space, isolation members that isolate at least part of the sealing members from the closed space.
(9) The heating assembly as set forth in any of (1) to (8), further comprising cylindrical caps that communicate with the end faces of the inner cylinder.
(10) The heating assembly as set forth in any of (5) to (9), wherein the heat insulation material is in a granular form.
(11) The heating assembly as set forth in any of (1) to (10), wherein at least one of the sealing members comprises a thermally curable resin or a photocurable resin.
(12) The heating assembly as set forth in any of (1) to (11), wherein at least one of the sealing members has a multi-layer structure comprising a plurality of layers stacked in the longitudinal direction of the heating assembly.
(13) The heating assembly as set forth in any of (1) to (12), wherein among said plurality of layers, the innermost layer comprises a photocurable resin.
(14) A flavor inhaler comprising the heating assembly as set forth in any of (1) to (13).

ADVANTAGEOUS EFFECTS OF INVENTION

[0006] The present invention can provide a heating assembly that enables formation of a flavor inhaler having excellent heat insulation performance for preventing heat from transferring to the outside.

BRIEF DESCRIPTION OF DRAWINGS

[0007]

[FIG. 1] FIG. 1 depicts a perspective view of one

embodiment of a flavor inhaler.

[FIG. 2] FIG. 2 depicts a cross-sectional view of the flavor inhaler shown in FIG. 1.

[FIG. 3] FIG. 3 depicts a lateral view of one embodiment of a heating assembly.

[FIG. 4] FIG. 4 depicts an enlarged cross-sectional view of a heating assembly.

[FIG. 5] FIG. 5 illustrates the positional relationship between a heating assembly and a smoking article.

[FIG. 6] FIG. 6 depicts a schematic view of one embodiment of a smoking article.

DESCRIPTION OF EMBODIMENTS

1. Flavor inhaler

[0008] The "flavor inhaler" refers to an apparatus for generating a flavor by heating a flavor-generating article. The "flavor-generating article" refers to an article that enables generation of a flavor or inhalation of a favor and which comprises a flavor-generating substrate. The "flavor-generating substrate" refers to a substrate that is configured to generate a flavor and which comprises an aerosol source.

[0009] FIG. 1 illustrates one embodiment of a flavor inhaler. As shown in FIG. 1B, a flavor inhaler 10 has an opening 12a for inserting a smoking article 110 which is one embodiment of a flavor-generating article. FIG. 2 illustrates a cross-sectional view taken along arrow 2-2 in FIG. 1A. As shown in this figure, the opening 12a communicates with the heating assembly 41, and the smoking article 110 is heated in the heating assembly 41. Hereunder, the heating assembly will be first described, and then the details of the flavor inhaler will be described.

(1) Heating assembly

[0010] As shown in FIG. 2, the heating assembly 41 is disposed in a heating section 40 of the flavor inhaler 10, and has a cylindrical shape as a whole. The heating assembly 41 is configured to house part of the smoking article 110 within its interior, and has a function of defining an air flow passage for supplying air to the smoking article 110 and a function of heating the smoking article 110 from its outer periphery.

[0011] FIG. 3 depicts a lateral view of one embodiment of the heating assembly 41. The heating assembly 41 comprises an outer cylinder 45, a top cap 48, and a bottom cap 50. Though not shown in this figure, an inner cylinder is disposed in the interior of the outer cylinder 45. The inner cylinder may be covered by a heat-shrinkable tube 52. In this case, the heat-shrinkable tube may extend so as to cover part of the top cap 48 or the bottom cap 50.

[0012] Next, the structure of the heating assembly 41 will be described by reference to FIG. 4. FIG. 4 depicts an enlarged cross-sectional view of the heating assembly 41. In this figure, 42 represents an inner cylinder, 45 represents an outer cylinder, 47 represents a sealing member, 47t represents a sealing member made of a thermally curable resin, 47p represents a sealing member made of a photocurable resin, 43 represents a heating member, 54 represents a closed space, 44 represents a heat insulation material, 46 represents a washer, 42a represents a first opening, and 42b represents a second opening.

[0013] The position at which the heating member 43 is disposed is not limited. When, like in this embodiment, the inner cylinder 42 and the heating member 43 are in proximity to, or in contact with, each other, it is preferred that the inner cylinder 42 should have excellent heat conductivity since it acts to transfer heat generated from the heating member 43 to a smoking article 110. The inner cylinder 42 preferably has a heat conductivity of from 10 to 20 W/m/K, more preferably from 14 to 16 W/m/K. From this viewpoint, the material used to make the inner cylinder 42 is preferably a metal, more preferably stainless steel. The material used to make the outer cylinder 45 is not limited, but is preferably a metal, more preferably stainless steel, from the viewpoints of ease of handling, durability, and the like. The inner diameter of the inner cylinder 42 depends on the dimension of the smoking article 110. In one embodiment, the inner diameter of the inner cylinder 42 is the same as that of part of a bottom cap 50 as described later. The distance between the inner cylinder 42 and the outer cylinder 45 is preferably in the range of from 2 to 5 mm, more preferably from 2.5 to 3.5 mm The length of the inner cylinder 42 will be described later.

[0014] As mentioned above, the position at which the heating member 43 is disposed is not limited. As shown in this embodiment, the heating member 43 may be disposed on a surface of the inner cylinder 42 which faces toward the outer cylinder 45 and heat the smoking article 110 inserted into the inner cylinder 42. Also, the heating member 43 may be installed independently from the inner cylinder 42, the outer cylinder 45, and the closed space 54. For example, it is also possible that a cylindrical member into which the smoking article 110 can be inserted may be disposed in the inside of the inner cylinder and the heating member 43 may be installed on a surface of said cylindrical member. The heating member 43 is able to generate heat at a temperature of preferably not more than 400°C, more preferably not more than 300°C, particularly preferably not more than 250°C. The heating member 43 is preferably a film heater comprising a heat-generating resistance element and a polymeric layer made of a polyimide or the like. Though not shown in the figure, the heating member 43 can be fixed on the inner cylinder 42 using a heat-shrinkable tube. From the viewpoint of enhancement of a heat insulation effect, it is preferred that the heating member 43 should not be in contact with the sealing members 47.

[0015] Since the closed space 54 can have vacuum inside or contain a gas such as air inside, it has heat insulation capability and prevents heat generated from

the heating member 43 from easily transferring to the outer cylinder 45. However, the present inventors found that heat generated from the heating member 43 easily transfers via the sealing members 47 acting as heat bridges to the outer cylinder 45. Thus, the present invention solves the problem with this heat transfer by ensuring that the heat conductivity of the heat bridges is lower than that of the inner cylinder 42. As a result, an increase in the temperature of a housing 11 can be prevented so that users can use the flavor inhaler 10 in a comfortable and safe manner. It is preferred that the heat conductivity of the sealing members 47 should be lower by not less than 13 W/m/K than that of the inner cylinder 42. To be specific, the heat conductivity of the sealing members 47 is preferably in the range of from 0.1 to 1.0 W/m/K, more preferably from 0.2 to 0.6 W/m/K.

[0016] The sealing members 47 preferably comprise a thermally curable resin or a photocurable resin. The "thermally curable resin" refers to a cured product formed of a thermally curable monomer that reacts at room temperature or by heating to form a crosslinked structure, and examples thereof include acrylate resins, epoxy resins, urethane resins, phenol resins, silicone resins, and the like. Among them, acrylate resins are preferred from the viewpoints of curability and ease of handling. Also, from the viewpoints of strength and the like, the thermally curable monomer preferably has a molecular weight of approximately from 100 to 1000, more preferably approximately from 280 to 400.

[0017] The "photocurable resin" refers to a cured product formed of a photocurable monomer that forms a crosslinked structure by exposure to light, and is preferably a UV-curable resin that cures by exposure to UV light. Examples of the photocurable resin include, but are not limited to, radically polymerizable acrylate resins and cationically polymerizable epoxy resins. From the viewpoints of curability and ease of handling, the photocurable resin is preferably a radically polymerizable acrylate resin, more preferably an epoxy acrylate resin. Also, from the viewpoints of strength and the like, the photocurable monomer preferably has a molecular weight of approximately from 160 to 270. In addition, curable resins that combine both thermal curability and photocurability may also be used.

[0018] The thermally curable resin and the photocurable resin preferably have a Tg (glass-transition temperature) of not more than 200°C, more preferably not more than 100°C, particularly preferably not more than 50°C. Since the thermally curable resin and the photocurable resin have such a preferred Tg as mentioned above, when the heating member 43 generates heat, the temperature rises at that portion of the sealing members 47 which is close to the heating member 43. When the Tg of the curable resins is low, the resins become flexible but do not melt due to heating of the heating member 43 so that stress caused by thermal expansion of the inner cylinder 42, or by thermal expansion of the inner cylinder and the outer cylinder can be relaxed. The curable resins may also contain a known filler such as silica or glass particles.

[0019] From the viewpoints of strength and the like, the sealing members 47 preferably have a thickness of from 0.3 to 2.0 mm, more preferably from 0.5 mm to 1.0 mm The sealing members 47 preferably have a multilayer structure comprising a plurality of layers stacked in the longitudinal direction of the heating assembly, wherein the innermost layer more preferably comprises a photocurable resin. Although the closed space 54 has heat insulation capability as mentioned above, the closed space 54 is preferably provided with a heat insulation material 44 in order to enhance a heat insulation effect. In such a case, when a sealing member is made using a photocurable resin, which is formed by a rapid curing reaction, the heat insulation material 44 can be easily filled in the closed space 54. Further, by stacking a sealing member made of a thermally curable resin on the photocurable resin, the strength of the sealing member can be enhanced and, at the same time, the heat insulation property of the sealing member can be increased. In some cases, photocurable resins have a lower heat conductivity than thermally curable resins, and thermally curable resins are more likely to contain voids than photocurable resins. Therefore, by stacking a sealing member made of a thermally curable resin on a sealing member made of a photocurable resin, both higher heat conductivity and higher reliability can be achieved.

[0020] FIG. 4 illustrates an embodiment in which spaces at both ends of the inner cylinder 42 and the outer cylinder 45 are sealed by the aforementioned curable resins. It is preferred that at least one of spaces at the ends of the inner cylinder 42 and the outer cylinder 45 should be sealed by the aforementioned curable resins. The outer cylinder 45 may be provided with a hole 450. The purpose of this is to prevent voids from forming in the sealing members 47 due to expansion of air in the closed space upon curing of the sealing members 47 by heating. The hole 450 may be sealed with a known sealing after curing.

[0021] The heat insulation material 44 is preferably in a granular form. The average particle size, D50, of the heat insulation material 44 is preferably in the range of from 0.05 to 2 mm, more preferably from 0.1 to 1 mm Average particle size can be determined by image analysis. Though only part of the heat insulation material 44 is shown in the figure for the sake of clarity, it is preferred that an adequate amount of the heat insulation material 44 should be filled in the closed space 54. When a granular heat insulation material is densely filled in the closed space 54 in this manner, the heat insulation material is more likely to spill over the closed space. However, in the present invention, the heat insulation material can be filled smoothly since the sealing members 47 can be cured rapidly. Therefore, this invention has more advantageous effects when a granular heat insulation material is used. Examples of the granular heat insulation material include an aerogel. The "aerogel" is a porous material

and can be exemplified by silicon aerogel and carbon aerogel. The amount of an aerogel filled varies with the density of the aerogel and the volume of the closed space 54, but in one embodiment is in the range of approximately from 100 to 300 mg.

[0022] It is preferred that the sealing members should not contain free components. Due to the absence of free components in the sealing members, penetration of free components into the closed space 54 or the heat insulation material 44 can be prevented so that advantageous heat insulation performance can be sustained. It is preferred that isolation members that isolate at least part of the sealing members 47 from the closed space 54 should be disposed in the closed space, since even if any free components are are released from the sealing member, penetration of said components can be prevented by the isolation members. Further, when the sealing members 47 come into direct contact with the heat insulation material 44, such as aerogel, the sealing member 47 or free components released therefrom may penetrate into the heat insulation material 44, resulting in inadequate heat insulation performance. However, by arranging the aforementioned isolation members in the closed space 54, such penetration can be prevented. The material used to make the isolation members is not limited, but is preferably a metal, a resin, or ceramic, more preferably stainless steel. The isolation members preferably extend in a circumferential direction. To be specific, the isolation members are preferably ring-shaped members such as washers 46. In order to avoid the isolation members from acting as heat bridges, it is preferred that the isolation members should be disposed so as to isolate at least part of the sealing members 47 from the closed space 54. In other words, it is preferred that the isolation members should be disposed at a distance from at least one of the inner cylinder 42 or the outer cylinder 45.

[0023] When the sealing members 47 are composed of a plurality of layers as mentioned above, it is preferred that a photocurable resin layer having a rapid curing property should be used as the innermost layer, and a thermally curable resin layer should be provided on the photocurable resin layer to thereby achieve secure sealing. Therefore, from the viewpoint of achieving a higher curing rate, it is preferred that the photocurable resin layer should be relatively thin and the thermally curable resin layer should be relatively thick. Thus, the ratio of the volume of the thermally curable resin layer to that of the photocurable resin layer is preferably in the range of from 1.0 to 2.0, more preferably from 1.2 to 1.5. The ratio of the average thickness of the thermally curable resin layer to that of the photocurable resin layer is preferably in the range of from 1.0 to 2.0, more preferably from 1.2 to 1.5. In the embodiment where the isolation members are disposed, it is preferred that the photocurable resin layer and the thermally curable resin layer should be stacked in this order on each of the isolation members, and besides that the different layers should satisfy the aforementioned relationships. Further, in this embodiment, it is preferred that both of the side surfaces and one of the principal surfaces of each of the isolation members should be covered by the photocurable resin layer so as not to ensure that the isolation members do not come into contact with the inner cylinder 42 or the outer cylinder 45 (refer to the panel in a dotted circle in FIG. 4). In other words, in the direction from the inner cylinder 42 toward the outer cylinder 45 in the heating assembly 41, the isolation member and a first photocurable resin are preferably disposed in this order, and a first photocurable resin, the isolation member, and a second photocurable resin are more preferably disposed in this order. Additionally, in this embodiment, the first photocurable resin and the second photocurable resin may be of the same type or of different types, but these resins are preferably of the same type from the viewpoint of ease of production. Also in this embodiment, it is preferred that the different layers should satisfy the aforementioned relationships. To be specific, the ratio of the volume of the thermally curable resin layer to that of the layer composed of the first and second photocurable resins is preferably in the range of from 1.0 to 2.0, more preferably from 1.2 to 1.5. The ratio of the average thickness of the thermally curable resin layer to that of the layer composed of the first and second photocurable resins is preferably in the range of from 1.0 to 2.0, more preferably from 1.2 to 1.5. When no second photocurable resin is used, the volume ratio and the thickness ratio of the aforementioned layers can be determined on the basis of the volume and thickness of a layer formed of the first photocurable resin alone. The average thickness of the photocurable resin layer is an average value of the thicknesses of the layer composed of the first and second photocurable resins, excluding the isolation member, in the longitudinal direction of the heating assembly 41.

[0024] The heating assembly 41 has a top cap 48 and a bottom cap 50. The top cap 48 and the bottom cap 50 can be formed from, for example, a known resin. The top cap 48 is a cylindrical member having an internal space communicating with a first opening 42a of the inner cylinder 42, and is configured so that a smoking article 110 can be inserted thereinto.

[0025] As shown in FIGs. 3 and 4, the top cap 48 is connected to the first opening 42a of the inner cylinder 42. The bottom cap 50 is an elongated cylindrical member connected to a second opening 42b of the inner cylinder 42. In FIGs. 3 and 4, air flows from the bottom to the top of the panel, and therefore, the bottom and top of the panel are called "upstream" and "downstream", respectively. An internal flow passage is formed which introduces air from the downstream end 50a of the bottom cap 50 toward the second opening 42b of the inner cylinder 42. In this embodiment, the heating assembly 41 includes the top cap 48 and the bottom cap 50 between the inner cylinder 42 and the sealing members 47. Therefore, the sealability of the internal flow passage is increased, thereby preventing air from leaking from the internal flow passage.

[0026] The inner diameter of the bottom cap 50 can be constant from the downstream end 50a to the upstream end 50b. It is also acceptable that the inner surface of the bottom cap 50 is formed in a tapered shape so that the inner diameter of the bottom cap 50 becomes gradually larger from the downstream end 50a toward the upstream end 50b. When the maximum inner diameter of the bottom cap 50 is defined as Smax, and the maximum outer diameter of the smoking article 110 is defined as Sc, the ratio of Sc to Smax (Sc/Smax) is, for example, in the range of from 1.4 to 2.34, preferably from 1.56 to 2.01. When the ratio of the maximum outer diameter of the smoking article 110 to the maximum inner diameter of the bottom cap 50 falls within the aforementioned range, adequate air flow passage 70 can be ensured while an end of the smoking article 110 is securely held by an engaging part 50d of the bottom cap 50.

(2) Production of heating assembly

[0027] The heating assembly is preferably produced through the following steps.

Step 1: Providing a double cylinder having an inner cylinder disposed inside an outer cylinder.
Step 2: Sealing a space between one end of the inner cylinder and one end of the outer cylinder, which is located on the same side as said one end of the inner cylinder, with a first sealing member having lower heat conductivity than the inner cylinder.
Step 3: Sealing a space between opening ends of the inner cylinder and the outer cylinder with a second sealing member having lower heat conductivity than the inner cylinder.

[0028] Step 1 can be carried out by, for example, attaching a film heater serving as a heating member 43 on the outer peripheral surface of the inner cylinder 42 and arranging the outer cylinder 45 outside the inner cylinder 42.

[0029] The first sealing member used at step 2 may be of a different type from, or of the same type as, the second sealing member. In the former case, the first sealing member can be made of any type of material, such as thermoplastic resin or ceramic. When the top cap 48 or the bottom cap 50 is attached in advance to the inner cylinder 42, it is easy to identify the position of sealing with the first sealing member. This effect also applies at step 3. After the sealing with the first sealing member, an isolation member such as washer may be disposed on the first sealing member.

[0030] The second sealing member used at step 3 is preferably made of a photocurable resin. This is because photocurable monomers are able to cure rapidly and thus are satisfactory in workability. At an interval between steps 2 and 3, an aerogel or the like, serving as a heat insulation material 44, may be filled in a space formed by the inner cylinder, the outer cylinder, and the first sealing member. In this embodiment, when a photocurable resin is used as the second sealing member, the heat insulation material 44 can be densely filled as mentioned above. Further, in this embodiment, before step 3, an isolation member such as washer may be disposed on a layer filled with the heat insulation material 44. Furthermore, by arranging a thermally curable resin layer on the photocurable resin layer, more secure sealing can be achieved, resulting in enhanced product reliability.

(3) Flavor inhaler

[0031] Next, the overall structure of the flavor inhaler will be described. As shown in FIG. 1, the flavor inhaler 10 has a top housing 11A, a bottom housing 11B, a cover 12, a switch 13, and a lid 14. The top housing 11A and the bottom housing 11B are connected to each other to constitute the outermost housing 11 of the flavor inhaler 10. The housing 11 is of a size that fits in a user's hand. When a user uses the flavor inhaler 10, s/he can inhale flavor while holding the flavor inhaler 10 by hand.

[0032] As shown in FIG. 1B, the cover 12 has an opening 12a into which the smoking article 110 can be inserted. The lid 14 is configured so that it can move between a first position at which the opening 12a is closed and a second position at which the opening 12a is opened, along a surface of the cover 12. The switch 13 is used to turn on and off the flavor inhaler 10. For example, when a user operates the switch 13 while the smoking article 110 is inserted into the opening 12a as shown in FIG. 1B, power is supplied to a heating member (not shown) from a battery (not shown) so that the smoking article 110 can be heated without burning. When the smoking article 110 is heated, an aerosol evaporates from an aerosol source contained in the smoking article 110 to incorporate the flavor of a flavor source in the aerosol. The user can inhale the flavor-containing aerosol by sucking on a portion of the smoking article 110 which protrudes from the flavor inhaler 10 (see FIG. 1B). In the present invention, the longitudinal direction of the flavor inhaler 10 refers to a direction in which the smoking article 110 is inserted into the opening 12a.

[0033] Next, the internal structure of the flavor inhaler 10 will be described. FIG. 2 depicts a cross-sectional view taken along arrow 2-2 in FIG. 1A. As shown in FIG. 2, the flavor inhaler 10 has a power section 20, a circuit section 30, and a heating section 40 in an interior space of the housing 11. The circuit section 30 has a first circuit board 31, and a second circuit board 32 electrically connected to the first circuit board 31. The first circuit board 31 is disposed, for example, to extend in the longitudinal direction as shown in the figure. Therefore, the power section 20 and the heating section 40 are partitioned by the first circuit board 31. As a consequence, heat generated in the heating section 40 is prevented from transferring to the power section 20.

[0034] The power section 20 has a powder source 21 electrically connected to the first circuit board 31 and the

second circuit board 32. The power source 21 can be, for example, a rechargeable or non-rechargeable battery.

[0035] The heating section 40 includes the heating assembly 41 as described above. The bottom housing 11B has a ventilation hole 15 formed thereon to alloy air to flow into the interior of the heating assembly 41. To be specific, the ventilation hole 15 is in fluid communication with the upstream end of the heating assembly 41. The downstream end of the heating assembly 41 is in fluid communication with the opening 12a as shown in FIG. 1B.

[0036] When a user sucks on a portion of the smoking article 110 which protrudes from the flavor inhaler 10 while the smoking article 110 is inserted from the opening 12a into the flavor inhaler 10 as shown in FIG. 1B, air flows from the ventilation hole 15 into the interior of the heating assembly 41. The introduced air passes through the interior of the heating assembly 41 and reaches the interior of the user's mouth together with an aerosol generated from the smoking article 110.

[0037] In the present invention, since particular types of sealing members are used in the heating assembly 41, heat is difficult to transfer to the housing 11, so that users can use the flavor inhaler in a comfortable and safe manner.

2. Flavor-generating article

[0038] The following will describe the smoking article 110 which is a preferred embodiment of a flavor-generating article. FIG. 6 depicts a cross-sectional view of the smoking article 110. In an embodiment shown in FIG. 6, the smoking article 110 has a substrate section 110A that includes a filling 111 (which is one example of a flavor-generating substrate) and a first wrapping paper 112 which is wrapped around the filling 111, and a mouthpiece section 110B which forms an end opposite to the substrate section 110A. The substrate section 110A and the mouthpiece section 110B are connected by a second wrapping paper 113 which is different from the first wrapping paper 112. However, the substrate section 110A and the mouthpiece section 110B can also be connected using the first wrapping paper 112 alone without using the second wrapping paper 113.

[0039] In FIG. 6, the mouthpiece section 110B has a paper pipe 114, a filter 115, and a hollow segment 116 disposed between the paper tube 114 and the filter 115. The hollow segment 116 is composed of, for example, a filling layer having one or more hollow channels, and a plug wrapper which covers the filling layer.

[0040] The mouthpiece section 110B shown in FIG. 6 is composed of three segments, but, in this embodiment, the mouthpiece section 110B may be composed of one or two segments or may be composed of four or more segments.

[0041] In the embodiment shown in FIG. 6, the longitudinal length of the smoking article 110 is preferably in the range of from 40 mm to 90 mm, more preferably from 50 mm to 75 mm, still more preferably from 50 mm to 60 mm. The circumference of the smoking article 110 is preferably in the range of from 15 mm to 25 mm, more preferably from 17 mm to 24 mm, still more preferably from 20 mm to 22 mm In the smoking article 110, the substrate section 110A can have a length of 20 mm, the first wrapping paper 112 can have a length of 20 mm, the hollow segment 116 can have a length of 8 mm, and the filter 115 can have a length of 7 mm However, the lengths of these individual segments can be changed, as appropriate, depending on the suitability for production, the required quality, and the like.

[0042] In this embodiment, the filling 111 in the smoking article 110 can contain an aerosol source which generates an aerosol upon heating at a specified temperature. The type of the aerosol source is not particularly limited, and can be selected from extracts from various natural products or constituents thereof depending on the intended use. Examples of the aerosol source include, but are not limited to, glycerol, propylene glycol, triacetin, 1,3-butanediol, and mixtures thereof. The content of the aerosol source in the filling 111 is not particularly limited, and is generally not less than 5 wt.%, preferably not less than 10 wt.%, and is generally not more than 50 wt.%, preferably not more than 20 wt.%, from the viewpoints of generation of an adequate amount of aerosol and impartation of good smoking flavor.

[0043] In this embodiment, the filling 111 of the smoking article 110 can contain a tobacco shred as a flavor source. The material used to make a tobacco shred is not particularly limited, and any known materials such as lamina and midrib can be used. The content of the filling 111 in a smoking article 110 with a circumference of 22 mm and a length of 20 mm is in the range of, for example, from 200 mg to 400 mg, preferably from 250 mg to 320 mg. The water content in the filling 111 is in the range of, for example, from 10 wt.% to 15 wt.%, preferably from 11 wt.% to 13 wt.%. Such a water content prevents the occurrence of staining in a wrapping paper and improves rolling-up processability during production of the substrate section 110A. The filling 111 may also contain one or two or more types of flavorings. The types of such flavorings are not particularly limited, but menthol is preferred from the viewpoint of impartation of good smoking flavor.

[0044] Next, the following will describe the positional relationship between the smoking article 110 and the heating assembly 41 when the smoking article 110 is inserted into the flavor inhaler 10. FIG. 5 schematically illustrates the positional relationship in the axial direction of the substrate section 110A of the smoking article 110 with respect to the heating member 43 and the inner cylinder 42 in the flavor inhaler 10 of this embodiment. As referred to herein, the "axial (line)" refers to the central axis of the first opening 42a in the flavor inhaler 10. When the smoking article 110 is inserted through the first opening 42a, the axial line of the first opening partially overlaps

with the central axis of the smoking article 110.

[0045] When the axial length of the heating member 43 is denoted as D0 and the axial length of the substrate section 110A of the smoking article 110 is denoted as L0, the relationship of D0 < L0 holds. Further, the ratio of D0/L0 is in the range of from 0.70 to 0.90, preferably from 0.75 to 0.85, and can be typically 0.80. Therefore, when the length L0 of the substrate section 110A is 20 mm, the length D0 of the heating member 43 is in the range of from 14 to 18 mm, preferably from 15 to 17 mm, and can be typically 16 mm.

[0046] By reference to FIG. 5, the upstream end of the substrate section 110A can protrude upstream for a length of D1 from the upstream end of the heating member 43. Since the heating member 43 does not extend to the radial outside of the portion of the substrate section 110A which protrudes from the heating member 43, said protruding portion can have a somewhat lower internal temperature than the other portion of the substrate section 110A. Therefore, an aerosol can be prevented from being generated at and near the upstream end of the substrate section 110A, so that an aerosol generated there can be prevented from condensing in the air flow passage or from flowing back through the air flow passage and leaking outside the flavor inhaler. The ratio of the protruding length D1 to the overall length L0 of the substrate section 110A (D1/L0) is in the range of from 0.25 to 0.40, preferably from 0.30 to 0.35, and can be typically 0.325. Such being the case, when the overall length L0 of the substrate section 110A is 20 mm, the protruding length D1 is in the range of from 5 to 8 mm, preferably from 6 to 7 mm, and can be typically 6.5 mm. The protruding length D1 as referred to herein can also be defined as the axial distance between the upstream end of the heating member 43 and the upstream end of the inner cylinder 42.

[0047] By reference to FIG. 5, the downstream end of the heating member 43 can protrude downstream for a length of D2 from the downstream end of the substrate section 110A. Therefore, the heating member 43 can adequately heat the downstream end of the substrate section 110A and its vicinity, thereby preventing deficiency in the amount of an aerosol generated in that region or condensation of the generated aerosol. The ratio of the protruding length D2 of the heating member 43 to the overall length L0 of the substrate section 110A (D2/L0) is in the range of from 0.075 to 0.175, preferably from 0.1 to 0.15, and can be typically 0.125. Such being the case, when the overall length L0 of the substrate section 110A is 20 mm, the protruding length D2 of the heating member 43 is in the range of from 1.5 to 3.5 mm, preferably from 2 to 3 mm, and can be typically 2.5 mm.

[0048] The axial position of the upstream end of the inner cylinder 42 can be almost the same as that of the upstream end of the substrate section 110A. On the other hand, like the downstream end of the heating member 43, the downstream end of the inner cylinder 42 can protrude downstream for a length of D3 from the downstream end of the substrate section 110A. Therefore, the heating member 43 can heat not only the downstream end of the substrate section 110A and its vicinity, but also the upstream end of the paper pipe 114 and its vicinity, thereby preventing an aerosol generated from the substrate section 110A from condensing due to excessive cooling at and near the upstream end of the paper pipe 114. The ratio of the protruding length D3 of the inner cylinder 42 to the protruding length D2 of the heating member 43 (D3/D2) is in the range of from 1.86 to 5.67, preferably from 2.33 to 4.00, and can be more preferably 3.00.

REFERENCE SIGNS LIST

[0049]

10:	Flavor inhaler
11:	Housing
12:	Cover
12a:	Opening
13:	Switch
14:	Lid
15:	Ventilation hole
16:	Cap
20:	Power section
21:	Power source
30:	Circuit section
31:	First circuit board
32:	Second circuit board
40:	Heating section
41:	Heating assembly
42:	Inner cylinder
42a:	First opening
42b:	Second opening
43:	Heating member
44:	Heat insulation material
45:	Outer cylinder
450:	Hole
46:	Washer
47:	Sealing member
47t:	Sealing member made of a thermally curable resin
47p:	Sealing member made of a photocurable resin
48:	Top cap
50:	Bottom cap
52:	Heat-shrinkable tube
54:	Closed space
70:	Air flow passage
110:	Smoking article
110A:	Substrate section
110B:	Mouthpiece section
111:	Filling
112:	First wrapping paper
113:	Second wrapping paper
114:	Paper tube
115:	Filter
116:	Hollow segment

Claims

1. A heating assembly comprising:

   an inner cylinder into which a flavor-generating article can be inserted;
   an outer cylinder disposed outside the inner cylinder;
   a pair of sealing members disposed between each of the ends of the inner cylinder and each of the ends of the outer cylinder so as to form a closed space having heat insulation function between the inner cylinder and the outer cylinder; and
   a heating member,
   wherein the heat conductivity of the sealing members is lower than that of the inner cylinder.

2. The heating assembly according to claim 1, wherein the inner cylinder and the sealing member differ in heat conductivity by not less than 13 W/m/K.

3. The heating assembly according to claim 1 or 2, wherein the heating member is disposed in the closed space and is in proximity to the inner cylinder.

4. The heating assembly according to claim 3, wherein the heating member is disposed on a surface of the inner cylinder which faces toward the outer cylinder.

5. The heating assembly according to any of claims 1 to 4, further comprising a heat insulation material in the closed space.

6. The heating assembly according to any of claims 1 to 5, wherein the heat insulation material is an aerogel.

7. The heating assembly according to any of claims 1 to 6, wherein the inner cylinder is made of a metal.

8. The heating assembly according to any of claims 1 to 7, further comprising, in the closed space, isolation members that isolate at least part of the sealing members from the closed space.

9. The heating assembly according to any of claims 1 to 8, further comprising cylindrical caps that communicate with the end faces of the inner cylinder.

10. The heating assembly according to any of claims 5 to 9, wherein the heat insulation material is in a granular form.

11. The heating assembly according to any of claims 1 to 10, wherein at least one of the sealing members comprises a thermally curable resin or a photocurable resin.

12. The heating assembly according to any of claims 1 to 11, wherein at least one of the sealing members has a multi-layer structure comprising a plurality of layers stacked in the longitudinal direction of the heating assembly.

13. The heating assembly according to any of claims 1 to 12, wherein among said plurality of layers, the innermost layer comprises a photocurable resin.

14. A flavor inhaler comprising the heating assembly according to any of claims 1 to 13.

Fig.1

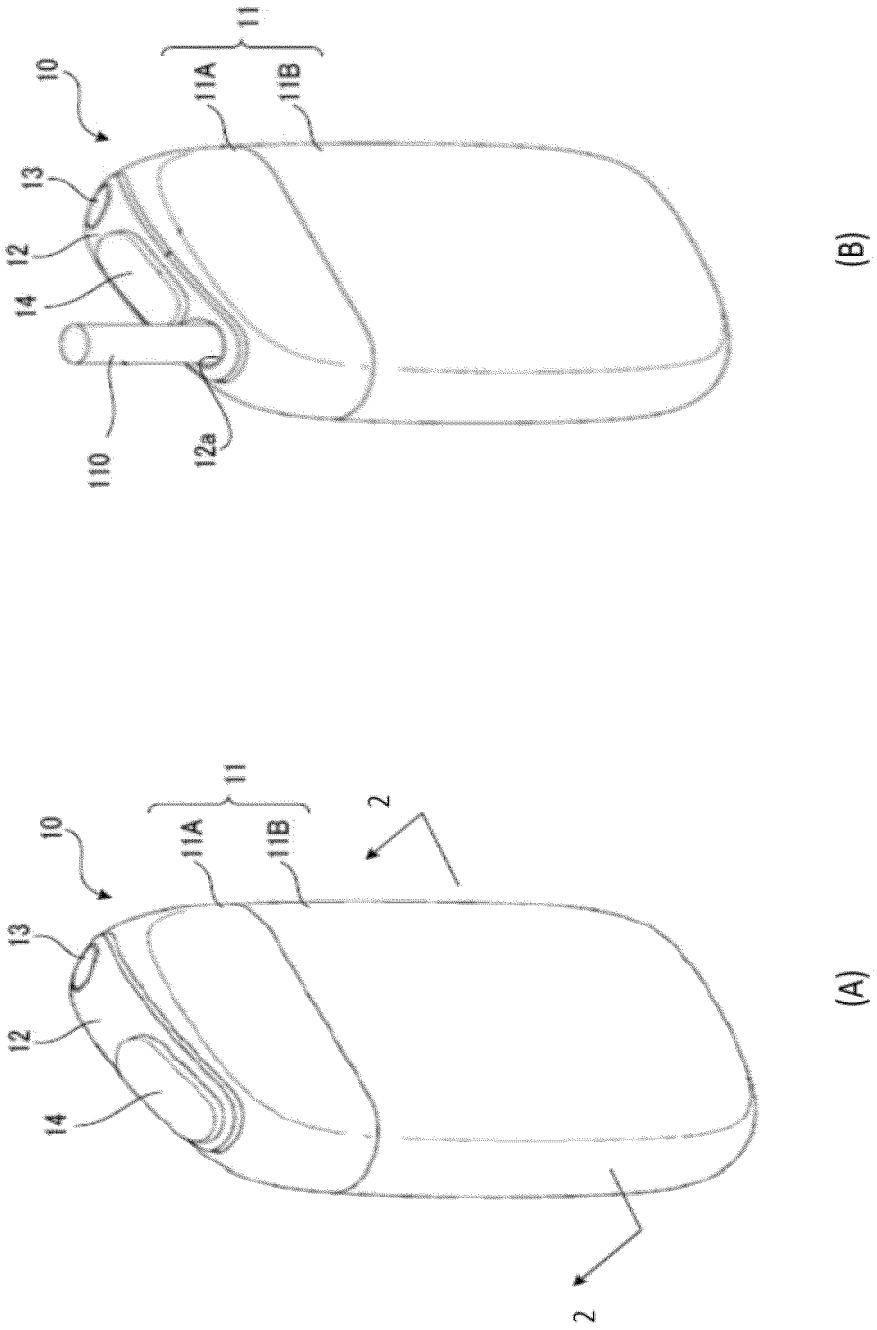


Fig.2

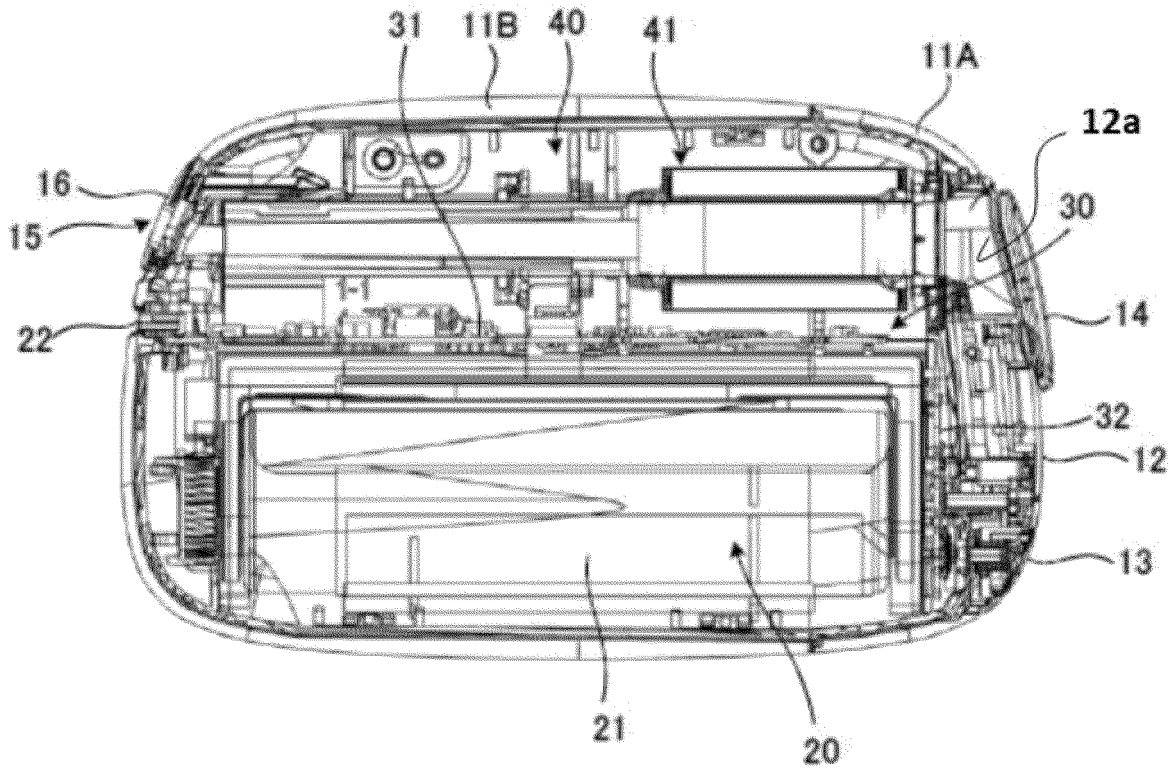


Fig.3

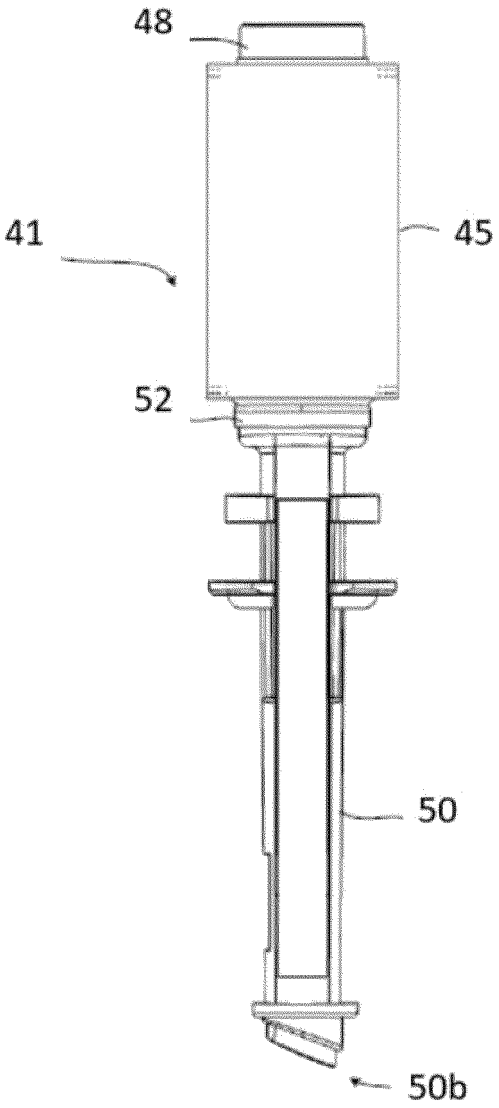


Fig.4

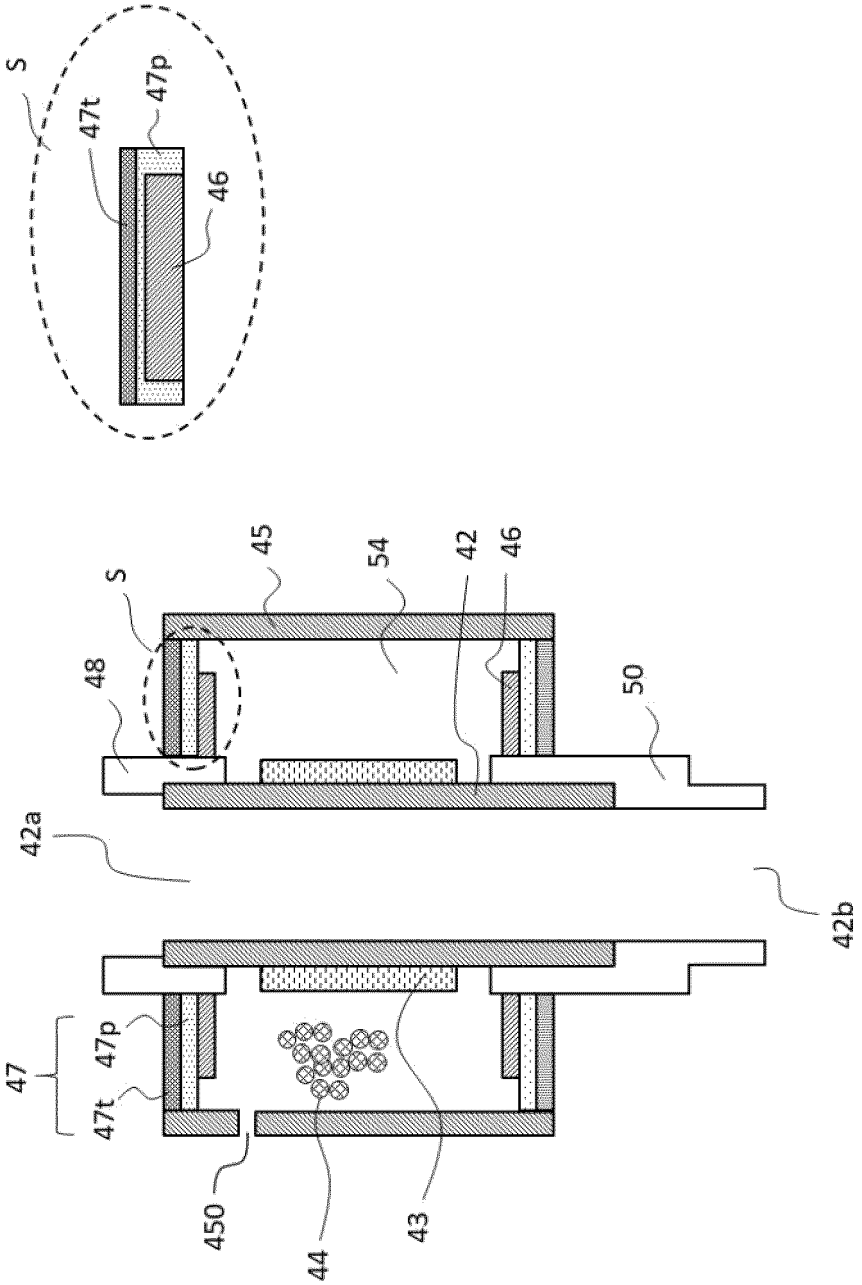


Fig.5

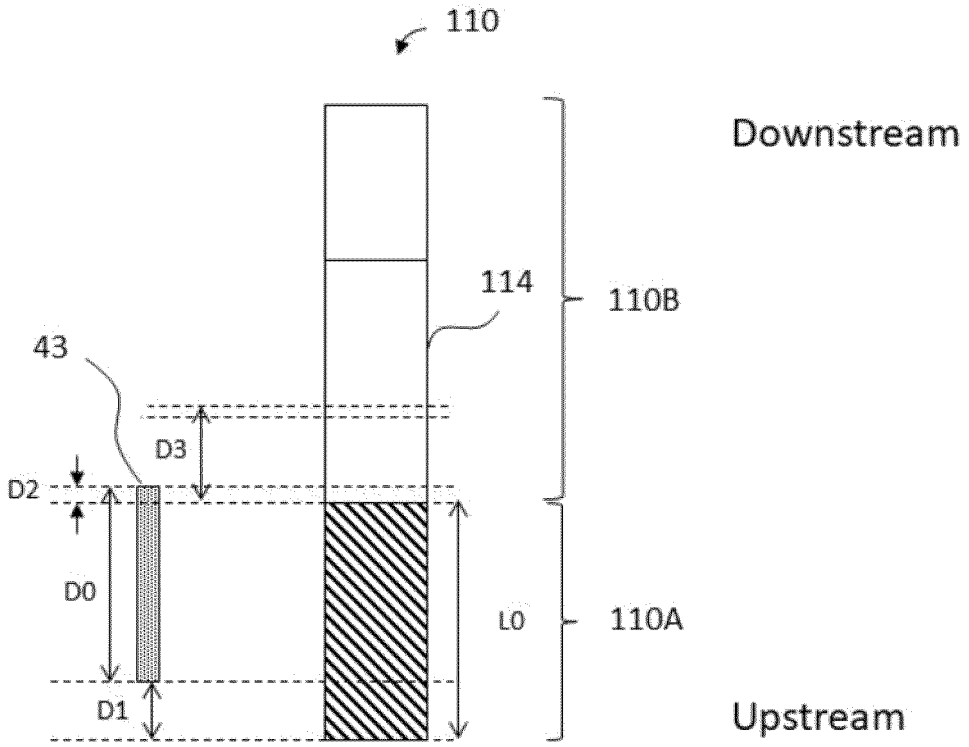
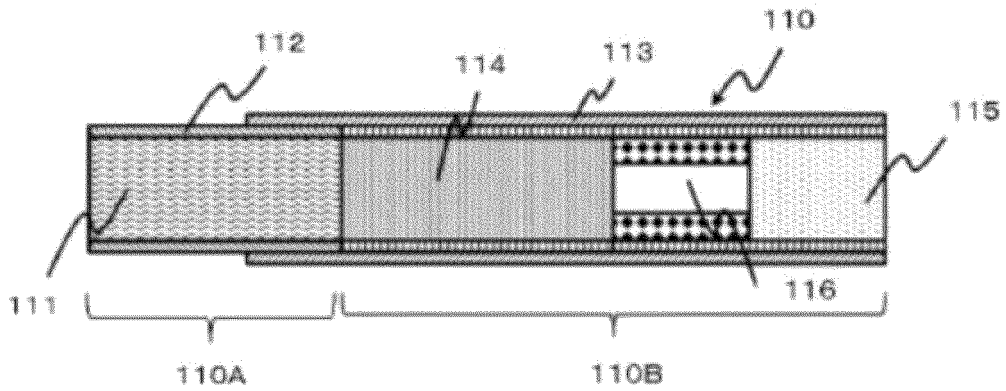

110
Downstream
114
110B
43
D3
D2
D0
L0
110A
D1
Upstream

Fig.6


112
114
113
110
115
111
116
110A
110B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/039855

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. A24F47/00(2006.01)i

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. A24F47/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2018
Registered utility model specifications of Japan 1996-2018
Published registered utility model applications of Japan 1994-2018

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2018-522551 A (BRITISH AMERICAN TOBACCO (INVESTMENTS) LIMITED) 16 August 2018, paragraphs [0018]-[0031], fig. 4-6 & US 2018/0168224 A1, paragraphs [0027]-[0039], fig. 4-6 & WO 2016/207407 A1 & EP 3313217 A1 & KR 10-2018-0014026 A & CN 107809919 A	1-14
A	JP 8-511176 A (PHILIP MORRIS PRODUCTS INC.) 26 November 1996, page 24, lines 16-20, fig. 3-5 & US 5665262 A, column 11, lines 6-13, fig. 3-5 & WO 1995/027412 A1 & EP 703734 A1 & KR 10-0193885 B	1-14

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28.12.2018	15.01.2019
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/039855

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 2018-529324 A (BRITISH AMERICAN TOBACCO (INVESTMENTS) LIMITED) 11 October 2018, paragraph [0069] & US 2017/0055583 A1, paragraph [0085] & WO 2017/036955 A2 & EP 3344076 A1 & CN 107920602 A & KR 10-2018-0034640 A	1-14
A	WO 2016/162934 A1 (JAPAN TOBACCO INC.) 13 October 2016, entire text, all drawings & US 2018/0014571 A1, entire text, all drawings & EP 3284354 A1 & CN 107404946 A & KR 10-2017-0127531 A	1-14

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- JP 2017148065 A **[0003]**
- JP 2018522551 W **[0003]**