



(11) **EP 4 432 779 A2**

(12) **EUROPEAN PATENT APPLICATION**

- (43) Date of publication:
18.09.2024 Bulletin 2024/38

(21) Application number: **24192283.0**

(22) Date of filing: **26.10.2018**
- (51) International Patent Classification (IPC):
H05B 3/42 (2006.01)

(52) Cooperative Patent Classification (CPC):
A24F 40/40; A24F 40/46; H05B 3/04; H05B 3/42; A24F 40/20; H05B 2203/021; H05B 2203/022

(84) Designated Contracting States: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR (62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC: 18938078.5 / 3 871 533 (71) Applicant: Japan Tobacco Inc. Tokyo 105-6927 (JP) (72) Inventors: • YAMADA, Manabu Sumida-ku, Tokyo, 130-8603 (JP)	• TAKEUCHI, Manabu Sumida-ku, Tokyo, 130-8603 (JP) • INOUE, Yasunobu Sumida-ku, Tokyo, 130-8603 (JP) • SUMII, Tateki Sumida-ku, Tokyo, 130-8603 (JP) (74) Representative: Hoffmann Eitle Patent- und Rechtsanwälte PartmbB Arabellastraße 30 81925 München (DE) <u>Remarks:</u> This application was filed on 01.08.2024 as a divisional application to the application mentioned under INID code 62.
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(54) **HEATING ASSEMBLY AND FLAVOR INHALER PROVIDED WITH SAME**

- (57) Provided is a cartridge for an inhalation device and an inhalation device which have a new structure. Provided is a heating assembly comprising a first cylindrical member provided in one end with a first opening, in which a flavor generating article can be inserted, and in the other end with a second opening that forms an air inlet; a heating member; and heat insulating material.
- The heating assembly further comprises a second cylindrical member disposed to enclose the first cylindrical member A sealed region is provided between the first cylindrical member and the second cylindrical member. The heating member and the heat insulating material are accommodated in the sealed region.

Description

TECHNICAL FIELD

[0001] The invention relates to flavor inhalation devices and flavor inhalation systems provided with the same.

BACKGROUND ART

[0002] Flavor inhalation devices for inhaling flavors or the like without burning material have conventionally been known. Known as such flavor inhalation devices include, for example, a smoking material heating device that forms aerosol by heating smoking material consisting of tobacco that contains volatile components (see JP 2018-522551 A). The smoking material heating device described in JP 2018-522551 A includes a hollow cylinder-like heater.

[0003] US 2017/0055583 A1 is related to the preamble of claim 1.

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] An object of the invention is to provide a flavor inhalation device which provide improved heating.

SOLUTION TO PROBLEM

[0005] The invention provides a flavor inhalation device comprising the features of claim 1 and a flavor inhalation system having the features of claim 14.

BRIEF DESCRIPTION OF DRAWINGS

[0006]

Fig. 1A is a perspective overall view of a flavor inhalation device according to the present embodiment. Fig. 1B is a perspective overall view of the flavor inhalation device according to the present embodiment which holds a smoking article.

Fig. 2 is a cross-sectional view of a smoking article. Fig. 3 is a cross-sectional view as viewed in a direction of an arrow 3-3 shown in Fig. 1A.

Fig. 4 is a cross-sectional view of a heating assembly.

Fig. 5 is a side view of the heating assembly.

Fig. 6 is an enlarged cross-sectional view of a connecting part between the heating assembly and an outer fin.

Fig. 7 is an enlarged schematic cross-sectional view of the heating assembly.

Fig. 8 schematically shows axial positional relationship between a base material portion of the smoking article on one hand and the heating member and an inner tube of the flavor inhalation device on the other

in the flavor inhalation device of the present embodiment.

DESCRIPTION OF EMBODIMENTS

[0007] Embodiments of the invention will be discussed with reference to the attached drawings. Regarding the drawings discussed below, the same or equivalent constituent elements will be provided with the same reference marks, and overlapping discussion will be omitted.

[0008] Fig. 1A is a perspective overall view of a flavor inhalation device according to the embodiment. Fig. 1B is a perspective overall view of the flavor inhalation device according to the embodiment which holds a smoking article. A flavor inhalation device 10 according to the present embodiment is configured to generate aerosol containing a flavor, for example, by heating a smoking article 110 (which is an example of a flavor generating article) having a flavor source (which is an example of flavor generating base material) that includes an aerosol source.

[0009] As illustrated in Figs. 1A and 1B, the flavor inhalation device 10 includes a top housing 11A, a bottom housing 11B, a cover 12, a switch 13, and a lid portion 14. The top housing 11A and the bottom housing 11B are connected together to form a housing 11 (second housing) located on an outermost side of the flavor inhalation device 10. The housing 11 is of such a size as to fit in a user's hand. When using the flavor inhalation device 10, the user can hold the flavor inhalation device 10 in his/her hand and inhale the flavor.

[0010] The top housing 11A has an opening, not shown. The cover 12 is coupled to the top housing 11A to close the opening. As illustrated in Fig. 1B, the cover 12 has an opening 12a into which the smoking article 110 can be inserted. The lid portion 14 is configured to open/close the opening 12a of the cover 12. To be specific, the lid portion 14 is attached to the cover 12 and configured to be movable between a first position for closing the opening 12a and a second position for opening the opening 12a along a surface of the cover 12. The lid portion 14 thus can allow or restrict access of the smoking article 110 to the inside of the flavor inhalation device 10 (an opening of an outer fin 17 or an opening of a top cap 48, which will be discussed later).

[0011] The switch 13 is used to switch on and off the activation of the flavor inhalation device 10. For example, if the user operates the switch 13 with the smoking article 110 inserted in the opening 12a as illustrated in Fig. 1B, electric power is supplied from a power source, not shown, to a heating member, not shown, which makes it possible to heat the smoking article 110 without burning the smoking article 110. The heating of the smoking article 110 causes aerosol to evaporate from the aerosol source included in the smoking article 110, and the flavor of the flavor source is taken into the aerosol. The user can inhale the aerosol containing the flavor by sucking a portion (which is illustrated in Fig. 1B) of the smoking

article 110 which protrudes from the flavor inhalation device 10. In the present specification, a longitudinal direction of the flavor inhalation device 10 is a direction in which the smoking article 110 is inserted in the opening 12a.

[0012] The following discussion explains a configuration of the smoking article 110 used in the flavor inhalation device 10 according to the present embodiment. Fig. 2 is a cross-sectional view of the smoking article 110. According to an embodiment shown in Fig. 2, the smoking article 110 includes a base material portion 110A including filling 111 (which is an example of flavor generating base material) and first wrapping paper 112 that wraps the filling 111, and a mouthpiece portion 110B that forms an opposite end portion from the base material portion 110A. The base material portion 110A and the mouthpiece portion 110B are joined together using second wrapping paper 113 that is separate from the first wrapping paper 112. It is possible, however, to use the first wrapping paper 112, instead of the second wrapping paper 113, to join the base material portion 110A and the mouthpiece portion 110B.

[0013] The mouthpiece portion 110B in Fig. 2 includes a paper tube portion 114, a filter portion 115, and a hollow segment portion 116 disposed between the paper tube portion 114 and the filter portion 115. The hollow segment portion 116 comprises, for example, a filling layer including one or more hollow channels, and a plug wrapper that covers the filling layer. The filling layer has a high fiber filling density. During inhalation, therefore, air and aerosol flow only through the hollow channel and hardly flow in the filling layer. If it is desired to repress a decrease in aerosol component which is caused by filtration of the filter portion 115 in the smoking article 110, the filter portion 115 is reduced in length, and the reduced amount is replaced with the hollow segment portion 116, which is effective to increase a delivery amount of the aerosol.

[0014] The mouthpiece portion 110B in Fig. 2 comprises three segments. According to the present embodiment, however, the mouthpiece portion 110B may comprise one or two segments or may comprise four or more segments. For example, it is possible to omit the hollow segment portion 116 and arrange the paper tube portion 114 and the filter portion 115 adjacently to each other to form the mouthpiece portion 110B.

[0015] According to the embodiment illustrated in Fig. 2, the smoking article 110 preferably has a longitudinal length ranging from 40 mm to 90 mm, more preferably from 50 mm to 75 mm, and still more preferably from 50 mm to 60 mm. The smoking article 110 preferably has a circumference ranging from 15 mm to 25 mm, more preferably from 17 mm to 24 mm, and still more preferably 20 mm to 23 mm. The smoking article 110 may include the base material portion 110A having a length of 20 mm, the first wrapping paper 112 having a length of 20 mm, the hollow segment portion 116 having a length of 8 mm, and the filter portion 115 having a length of 7 mm. However, the length of each of the aforementioned segments

may be properly changed according to manufacturing suitability, quality requirement, and the like.

[0016] According to the present embodiment, the filling 111 of the smoking article 110 may contain an aerosol source that is heated at predetermined temperature and generates aerosol. The aerosol source may be of any kind. Materials extracted from various natural products and/or constituents thereof may be selected depending on an intended use. Examples of the aerosol source include glycerin, propylene glycol, triacetin, 1,3-butanediol, and composites thereof. Contained amount of the aerosol source in the filling 111 is not particularly limited as long as the aerosol source sufficiently generates aerosol. From a perspective of provision of a good smoking flavor, the contained amount of the aerosol source is generally 5% by weight or more, preferably 10% by weight or more, and generally 50% by weight or less, preferably 20% by weight or less.

[0017] The filling 111 of the smoking article 110 according to the present embodiment may contain shred tobacco as a flavor source. The shred tobacco may be made of any material, and publicly-known materials including laminae and stems may be used. If the smoking article 110 is 22 mm in circumference and 20 mm in length, the contained amount of the filling 111 in the smoking article 110 ranges, for example, from 200 mg to 400 mg, preferably from 250 mg to 320 mg. The filling 111 has a moisture content, for example, ranging from 8% by weight to 18% by weight, preferably from 10% by weight to 16% by weight. The foregoing moisture content prevents a stain on wrapping paper and improves a winding suitability in manufacture of the base material portion 110A. There is no particular limitation in size and preparation method of the shred tobacco used as the filling 111. For example, dried tobacco leaves may be used, which are shredded into pieces each having a width ranging from 0.8 mm to 1.2 mm. It is also possible to use dried tobacco leaves that are pulverized to have an average particle diameter ranging from about 20 μm to about 200 μm to be uniformed, processed into a sheet, and shredded into pieces each having a width ranging from 0.8 mm to 1.2 mm. The leaves processed into a sheet may be gathered, instead of being shredded, to be used as the filling 111. The filling 111 may contain one or more aroma chemicals. The aroma chemicals may be of any kind. From a perspective of provision of a good smoking flavor, however, menthol is preferable.

[0018] According to the present embodiment, the first wrapping paper 112 and the second wrapping paper 113 of the smoking article 110 can be made of base paper having a basis weight ranging, for example, from 20 gsm to 65 gsm, preferably from 25 gsm to 45 gsm. The first wrapping paper 112 and the second wrapping paper 113 are not particularly limited in thickness. From a perspective of rigidity, air permeability, and ease of preparation in paper manufacturing, however, the first wrapping paper 112 and the second wrapping paper 113 have a thickness ranging from 10 μm to 100 μm , preferably from 20

μm to $75\ \mu\text{m}$, and more preferably from $30\ \mu\text{m}$ to $50\ \mu\text{m}$.

[0019] According to the present embodiment, the first wrapping paper 112 and the second wrapping paper 113 of the smoking article 110 may contain loading material. Contained amount of the loading material may fall in a range from 10% by weight to 60% by weight relative to total weight of the first wrapping paper 112 and the second wrapping paper 113, and preferably from 15% by weight to 45% by weight. According to the present embodiment, the contained amount of the loading material preferably ranges from 15% by weight to 45% by weight relative to the preferable basis weight range (from 25 gsm to 45 gsm). As the loading material, for example, calcium carbonate, titanium dioxide, kaolin or the like may be used. Paper containing such loading materials provides white light color that is preferable from a perspective of external appearance of wrapping paper of the smoking article 110, and can maintain whiteness on a permanent basis. If the wrapping paper contains a large amount of such loading materials, for example, whiteness percentage of the wrapping paper in conformity with the ISO International Standards can be maintained at 83% or more. Considering a utilitarian purpose of the first wrapping paper 112 and the second wrapping paper 113 as wrapping paper for the smoking article 110, the first wrapping paper 112 and the second wrapping paper 113 preferably have a tensile strength of 8 N/15 mm or higher. The tensile strength can be increased by reducing the contained amount of the loading material. More specifically, the tensile strength can be increased by reducing the contained amount of the loading material less than the upper limit of the contained amount of the loading material with respect to each of the basis weight ranges mentioned above.

[0020] The following discussion explains an internal structure of the flavor inhalation device 10 illustrated in Figs. 1A and 1B. Fig. 3 is a cross-sectional view as viewed in a direction of arrow 3-3 shown in Fig. 1A. As illustrated in Fig. 3, the flavor inhalation device 10 includes a power source portion 20, a circuit portion 30, and a heating portion 40 in an interior space of the housing 11. The circuit portion 30 includes a first circuit board 31 and a second circuit board 32 that is electrically connected to the first circuit board 31. The first circuit board 31 is disposed, for example, so as to extend in the longitudinal direction as illustrated in the figure. The power source portion 20 and the heating portion 40 are thus separated by the first circuit board 31. This represses transmission of the heat generated in the heating portion 40 to the power source portion 20.

[0021] The second circuit board 32 is disposed between the power source portion 20 and the switch 13 and extends in a direction orthogonal to the extending direction of the first circuit board 31. The switch 13 is disposed adjacently to the second circuit board 32. When the user presses down the switch 13, the switch 13 can partially contact the second circuit board 32.

[0022] The first circuit board 31 and the second circuit

board 32 include, for example, a microprocessor or the like and are capable of controlling power supply from the power source portion 20 to the heating portion 40. This allows the first circuit board 31 and the second circuit board 32 to control the heating of the smoking article 110 which is carried out by the heating portion 40.

[0023] The power source portion 20 includes a power source 21 that is electrically connected to the first circuit board 31 and the second circuit board 32. The power source 21 may be, for example, a rechargeable or non-rechargeable battery. The power source 21 is electrically connected to the heating portion 40 through at least either one of the first circuit board 31 and the second circuit board 32. This allows the power source 21 to supply power to the heating portion 40 so as to properly heat the smoking article 110. As illustrated in the figure, the power source 21 is disposed adjacently to the heating assembly 41 in a direction orthogonal to the longitudinal direction of the heating portion 40. This makes it possible to repress an increase of the longitudinal length of the flavor inhalation device 10 even if the power source 21 is increased in size.

[0024] The flavor inhalation device 10 further includes a terminal 22 that is connectable to an external power source. The terminal 22 may be connected, for example, to a cable of a micro USB or the like. If the power source 21 is a rechargeable battery, the power source 21 can be charged by connecting the external power source to the terminal 22 to apply current from the external power source to the power source 21. It is also possible to connect a data transmission cable of a micro USB or the like to the terminal 22 so that data associated to activation of the flavor inhalation device 10 and the like may be sent to an external device.

[0025] The heating portion 40 includes a heating assembly 41 extending in the longitudinal direction as illustrated in the figure. The heating assembly 41 comprises a plurality of cylindrical members and forms a cylindrical body as a whole. The heating assembly 41 is configured to be capable of accommodating part of the smoking article 110 inside. The heating assembly 41 has a function of defining a channel for air to be supplied to the smoking article 110 and a function of heating the smoking article 110 from an outer periphery thereof.

[0026] The bottom housing 11B is provided with a vent hole 15 (which is an example of an air inlet) that allows air to enter the heating assembly 41. More specifically, the vent hole 15 is in fluid communication with one end portion (end portion on the left side in Fig. 3) of the heating assembly 41. The flavor inhalation device 10 includes an attachable/detachable cap 16 at the vent hole 15. The cap 16 is configured to, even in a position attached to the vent hole 15, allow air to enter the heating assembly 41 through the vent hole 15. The cap 16 may include, for example, a through hole, a notch or the like, not shown. Since the cap 16 is attached to the vent hole 15, a substance produced from the smoking article 110 inserted in the heating assembly 41 is prevented from falling out-

side the housing 11 through the vent hole 15.

[0027] The other end portion (end portion on the right side in Fig. 3) of the heating assembly 41 is in fluid communication with the opening 12a (which is an example of an air outlet) illustrated in Fig. 1B. A substantially cylindrical outer fin 17 is provided between the cover 12 with the opening 12a and the other end portion of the heating assembly 41. The outer fin 17 is engaged with a downstream end of the top cap 48 mentioned later. When the smoking article 110 is inserted from the opening 12a of the cover 12 into the flavor inhalation device 10 as illustrated in Fig. 1B, the smoking article 110 passes through the outer fin 17, and at least the filling 111 (see Fig. 2) of the smoking article 110 is disposed inside the heating assembly 41. In other words, the outer fin 17 forms a part of an opening portion for accommodating the smoking article 110. The outer fin 17 is preferably formed so that an opening located close to the cover 12 (right side on Fig. 3) is larger than an opening located close to the heating assembly 41 (left side on Fig. 3). This facilitates the insertion of the smoking article 110 from the opening 12a into the outer fin 17. When the smoking article 110 is not inserted inside the heating assembly 41, the user can clean the inside of the heating assembly 41 by inserting a tool such as a brush from the opening 12a into the heating assembly 41. The cleaning tool can be inserted from the one end portion (end portion on the left side in Fig. 3) of the heating assembly 41. In such a case, the cap 16 is removed from the vent hole 15 of the flavor inhalation device 10.

[0028] If the user inhales from a portion of the smoking article 110 which protrudes from the flavor inhalation device 10, that is, the filter portion 115 illustrated in Fig. 2, with the smoking article 110 inserted from the opening 12a in the flavor inhalation device 10 as illustrated in Fig. 1B, air enters from the vent hole 15 into the heating assembly 41. After entering in the heating assembly 41, the air passes through the heating assembly 41 and reaches into the user's mouth together with the aerosol generated from the smoking article 110. Accordingly, an end of the heating assembly 41 which is close to the vent hole 15 is an upstream side, whereas an end of the heating assembly 41 which is close to the opening 12a (an end close to the outer fin 17) is a downstream side.

[0029] A configuration of the heating assembly 41 illustrated in Fig. 3 will be now discussed. Fig. 4 is a cross-sectional view of the heating assembly 41. Fig. 5 is a side view of the heating assembly 41. The heating assembly 41 includes an inner tube 42 (which is an example of a first cylindrical member), a heating member 43, aerogel 44 (which is an example of heat insulating material), and an outer tube 45 (which is an example of a second cylindrical member). The inner tube 42 is provided with a first opening 42a at one end in which the smoking article 110 can be inserted, and further provided with a second opening 42b at the other end which forms an air inlet. According to the present embodiment, the inner tube 42 has a cylindrical shape and is configured to come into

contact with at least a part of the smoking article 110 inserted from the first opening 42a. The second opening 42b is located upstream of an air flow, and the first opening 42a is located downstream of the air flow.

[0030] The outer tube 45 is so disposed as to enclose the inner tube 42, which forms a predetermined space between the inner tube 42 and the outer tube 45. The heating member 43 may be a flexible film heater that is fabricated, for example, by sandwiching a heat-generating resistive element with two PI (polyimide) films or other like films. The heating member 43 is so disposed as to abut against the inner tube 42. To be more specific, in an example illustrated in the figure, the heating member 43 is disposed on an outer peripheral surface of the inner tube 42, and an inner surface of the heating member 43 contacts an outer surface of the inner tube 42. Since the heating member 43 is disposed along the outer peripheral surface of the inner tube 42, the heating member 43 is deformed into a substantially cylindrical shape as a whole.

[0031] The heating assembly 41 further includes a first ring-like member 46 that circumferentially extends between a downstream end portion of the inner tube 42 (end portion on the first opening 42a side) and a downstream end portion of the outer tube 45 (end portion close to the first opening 42a of the inner tube 42). The heating assembly 41 includes a second ring-like member 47 that circumferentially extends between an upstream end portion of the inner tube 42 (end portion on the second opening 42b side) and an upstream end portion of the outer tube 45 (end portion close to the second opening 42b of the inner tube 42). The first ring-like member 46 is tightly connected to the downstream end portion of the inner tube 42 via a top cap 48 and a heat shrinkable tube 52 which will be discussed later. The second ring-like member 47 is tightly connected to the upstream end portion of the inner tube 42 via a bottom cap 50 and the heat shrinkable tube 52 which will be discussed later. The first ring-like member 46 and the second ring-like member are tightly connected to the outer tube 45. A sealed region 54 is thus provided between the inner tube 42 and the outer tube 45. The sealed region 54 accommodates the heating member 43 and the aerogel 44.

[0032] Disposed between the heating member 43 and the aerogel 44 is the heat shrinkable tube 52. The heat shrinkable tube 52 has a cylindrical shape and keeps the heating member 43 in contact with the inner tube 42. More specifically, the heat shrinkable tube 52 is thermally shrunk by being applied with heat while disposed in an outer peripheral side of the heating member 43. The heat shrinkable tube 52 thus applies stress to the heating member 43 so as to press the heating member 43 against the inner tube 42. The heat shrinkable tube 52 may be made of thermoplastic resin, such as perfluoroalkoxy fluoroplastics (PFA). According to the present embodiment, the heat shrinkable tube 52 is employed for the purpose of maintaining a state where the heating member 43 is in contact with the inner tube 42. Instead of the

heat shrinkable tube 52, however, any member that achieves the same purpose may be employed. For example, an elastic tube or the like, instead of the heat shrinkable tube 52, is employable.

[0033] The inner tube 42 is preferably made of metal material, such as SUS, which has a high heat conductivity. This facilitates transmission of heat of the heating member 43 to the entire inner tube 42, allowing the inner tube 42 to fulfill a function as heating means. The outer tube 45 may be made, for example, of the same metal material as the inner tube 42. Since the aerogel 44 is disposed between the heating member 43 and the outer tube 45, the heat generated from the heating member 43 is difficult to transmit to the outer tube 45. According to the present embodiment, the aerogel 44 is employed to insulate the heat generated from the heating member 43. The aerogel 44 may be made of aerogel materials of various kinds including silica aerogel, carbon aerogel, alumina aerogel, and the like. Instead of aerogel, other insulating materials also may be used. Such insulating materials include, for example, fiber-based heat insulating material, such as glass wool and rock wool, foam-based heat insulating material, such as urethane foam and phenol foam. It is also possible to vacuumize the sealed region 54 to form a vacuum insulating space. If the aerogel 44 is used as heat insulating material, the aerogel 44 preferably occupies a cubic volume ranging from 85% to 100% of capacity of the sealed region 54. This represses air bubble incorporation in the sealed region 54 and thus prevents the transmission of heat of the heating member 43, the inner tube 42 and the like to the outer tube 45 through air bubbles. If incorporated in the sealed region 54, air bubbles freely move depending on a position of the heating assembly 41 and might transmit the heat.

[0034] The heating assembly 41 further includes the top cap 48 and the bottom cap 50. The top cap 48 and the bottom cap 50 may be made, for example, of resin material. The top cap 48 is a cylindrical member having an interior space in communication with the first opening 42a of the inner tube 42. The top cap 48 is so configured that the smoking article 110 can be inserted therein. As illustrated in Figs. 4 and 5, the top cap 48 is connected to the downstream end of the inner tube 42 (end portion on the first opening 42a side). The top cap 48 is provided with one or more convex portions 48a in an inner peripheral surface thereof. The convex portions 48a are circumferentially spaced at regular intervals. The present embodiment includes four convex portions 48a that are provided in the inner peripheral surface of the top cap 48. The convex portions 48a provide frictional resistance to the smoking article 110 inserted in the top cap 48 to engage the smoking article 110. The convex portions 48a thus repress an accidental slip of the smoking article 110 from the flavor inhalation device 10.

[0035] The bottom cap 50 is an elongated cylindrical member that includes a downstream end 50a connected to the upstream end (second opening 42b-side end por-

tion) of the inner tube 42 and an upstream end 50b on an opposite side from the downstream end 50a. The bottom cap 50 forms an inner channel that introduces air toward the second opening 42b of the inner tube 42. The upstream end 50b (end portion on a lower side in the figure) of the bottom cap 50 is disposed closely or adjacently to the vent hole 15 illustrated in Fig. 3. Air from the vent hole 15 may flow from the upstream end 50b to the downstream end 50a of the bottom cap 50, pass through the inner tube 42 and the top cap 48, and reach into the user's mouth. In other words, the bottom cap 50, the inner tube 42, and the top cap 48 form an air channel 70 that brings the vent hole 15 and the opening 12a of the cover 12 into airy communication with each other.

[0036] A connecting part between the heating assembly 41 and the outer fin 17 will be now discussed in detail. Fig. 6 is an enlarged cross-sectional view of the connecting part between the heating assembly 41 and the outer fin 17. As illustrated in Fig. 6, a hollow rubber material 24 is provided in a connecting part between the outer fin 17 and the top cap 48. To be specific, the upstream end (first opening 42a-side end portion) of the outer fin 17 encloses at least a partial outer periphery of the top cap 48, or more specifically, an outer periphery of a downstream end of the top cap 48. The upstream end of the outer fin 17 has an inner diameter larger than an outer diameter of the downstream end of the inner tube 42 to accommodate the downstream end of the top cap 48. The outer fin 17 includes an accommodating portion 17a for accommodating the rubber material 24. Specifically, a predetermined space is formed between the accommodating portion 17a of the outer fin 17 and an outer surface of the top cap 48. The rubber material 24 has a ring-like shape and circumferentially extends between an outer peripheral surface of the top cap 48 and an inner peripheral surface of the outer fin 17. The space between the top cap 48 and the outer fin 17 is thus sealed. The rubber material 24 may have a solid structure, instead of the hollow structure.

[0037] The following discussion explains relative positional relationship of the inner tube 42, the heating member 43, the aerogel 44, the outer tube 45, the top cap 48, the bottom cap 50, and the heat shrinkable tube 52. Fig. 7 is an enlarged schematic cross-sectional view of the heating assembly 41. Fig. 7 is a view for explaining the relative positional relationship of constituent elements of the heating assembly 41, so that concrete shapes, dimensions, and the like of the constituent elements may differ from actuality. In Fig. 7, the upstream side (lower side on the figure) of the bottom cap 50 is omitted.

[0038] As illustrated, the upstream end (end portion on a side close to the first opening 42a) of the top cap 48 encloses an outer periphery of the downstream end (first opening 42a-side end portion) of the inner tube 42. In other words, the upstream end of the top cap 48 has an inner diameter larger than the outer diameter of the downstream end of the inner tube 42 to accommodate the downstream end of the inner tube 42. A connecting part

of an inner surface of the top cap 48 and a connecting part of an outer surface of the inner tube 42 are sealed together, for example, with adhesive or the like. The connecting parts are thus configured to keep gas or aerosol from passing through space between the top cap 48 and the inner tube 42. The downstream end (first opening 42a-side end portion) of the heat shrinkable tube 52 encloses an outer periphery of an upstream end of the top cap 48. The heat shrinkable tube 52 is in tight contact with the upstream end of the top cap 48. As mentioned, the heating assembly 41 includes axially overlapping regions between the top cap 48 and the inner tube 42 and between the top cap 48 and the heat shrinkable tube 52. The overlapping regions are in tight contact with each other or sealed together. This improves sealability between the top cap 48 and the inner tube 42 and between the top cap 48 and the heat shrinkable tube 52.

[0039] The downstream end 50a (end portion on a side close to the second opening 42b) of the bottom cap 50 encloses an outer periphery of the upstream end (second opening 42b-side end portion) of the inner tube 42. That is, the downstream end 50a of the bottom cap 50 has an inner diameter larger than an outer diameter of the upstream end of the inner tube 42 to accommodate the upstream end of the inner tube 42. A connecting part of the inner surface of the bottom cap 50 and a connecting part of the outer surface of the inner tube 42 are bonded together, for example, with adhesive. The connecting parts are configured to keep gas or aerosol from passing through space between the bottom cap 50 and the inner tube 42. The upstream end (second opening 42b-side end portion) of the heat shrinkable tube 52 encloses an outer periphery of the downstream end 50a of the bottom cap 50. The heat shrinkable tube 52 is in tight contact with the downstream end 50a of the bottom cap 50. As mentioned, the heating assembly 41 includes axially overlapping regions between the bottom cap 50 and the inner tube 42 and between the bottom cap 50 and the heat shrinkable tube 52. The overlapping regions are in tight contact with each other or sealed together. This improves sealability between the bottom cap 50 and the inner tube 42 and between the bottom cap 50 and the heat shrinkable tube 52.

[0040] As illustrated, the top cap 48, the inner tube 42, and the bottom cap 50 are arranged in an axial direction, and every two adjacent elements are airtightly connected to form a tubular assembly having a sealed structure. A joint portion between the top cap 48 and an inner tube cap and a joint portion between the inner tube 42 and the bottom cap 50 in the tubular assembly may have a sealed structure that bears a negative pressure in a range from 40 kPa to 60 kPa based on atmospheric air pressure. Especially, each of the joint portions preferably has a sealed structure that bears a negative pressure in a range from 45 kPa to 55 kPa. It is preferable that each of the joint portions typically should have a negative pressure of 50 kPa.

[0041] Whether each of the joint portions has the de-

sired sealed structure can be tested, for example, by the following method. First, the opening of either the top cap 48 or the bottom cap 50 is closed, and air is pumped from the opening of the other cap using a vacuum pump to create negative pressure in the tubular assembly. The pumping is suspended at a time point when the negative pressure in the tubular assembly reaches a desired value (50 kPa, for example). The tubular assembly is then left standing for a predetermined amount of time, and thereafter, a pressure change in the tubular assembly is measured. If the pressure change at the time of this measurement is smaller than a predetermined threshold value, it is judged that each of the joint portions has desired sealability. Duration in which the tubular assembly is left standing after the suspension of the pumping is 3 seconds, for example, and the threshold value of the pressure change is 2.3 kPa.

[0042] The bottom cap 50 includes a small diameter portion 50c having a smaller inner diameter than the inner tube 42. A portion of the bottom cap 50 which encloses the outer periphery of the upstream end of the inner tube 42 and the small diameter portion 50c form an engaging portion 50d having a stepped shape. In other words, the engaging portion 50d is a surface substantially orthogonal to an axial direction of the inner tube 42. As illustrated, the upstream end of the inner tube 42 is disposed to abut against the engaging portion 50d. The small diameter portion 50c is designed to have a diameter of such size that a tip end portion of the smoking article 110 abuts against the engaging portion 50d when the smoking article 110 is inserted from the first opening 42a. The smoking article 110 thus can be positioned.

[0043] As illustrated, the downstream end (first opening 42a-side end portion) and the upstream end (second opening 42b-side end portion) of the inner tube 42 are configured to protrude outside the outer tube 45. As illustrated, the heating member 43 is disposed to fit between the upstream and downstream ends of the outer tube 45 in the axial direction. In other words, the heating member 43 is configured so as not to contact the upstream end of the inner tube 42 which protrudes outside the outer tube 45. This makes the upstream end of the inner tube 42 lower in temperature than an axially central portion of the inner tube 42. Consequently, it is possible to repress the heating of the tip end portion of the smoking article 110 in a state where the smoking article 110 is inserted from the first opening 42a to abut against the engaging portion 50d. Aerosol is thus prevented from being unintentionally generated from the tip end of the smoking article. The tip end portion of the smoking article 110 has relatively low temperature, which stimulates condensation and collection of aerosol in the tip end portion of the smoking article 110. This makes it possible to prevent the aerosol generated on the downstream side from flowing back through the air channel 70.

[0044] The heat shrinkable tube 52 is substantially equal in axial length to the inner tube 42. The heat shrinkable tube 52 is longer than the heating member 43 in the

axial direction, and the heating member 43 is located between the upstream and downstream ends of the heat shrinkable tube 52. The heat shrinkable tube 52 thus can cover the entire heating member 43 and cause the heating member 43 to uniformly contact the inner tube 42. The aerogel 44 axially extends at least between the upstream end and a downstream end of the heating member 43. This makes it possible to efficiently insulate the heat generated from the heating member 43.

[0045] The upstream end (end portion on a side close to the first opening 42a) of the top cap 48 is located upstream (lower side on the figure) from the downstream end (end portion on a side close to the first opening 42a) of the outer tube 45. The downstream end 50a of the bottom cap 50 is located outside the outer tube 45. The upstream end (end portion on a side close to the second opening 42b) of the heat shrinkable tube 52 protrudes outside the outer tube 45 and encloses the outer periphery of the bottom cap 50 as described above.

[0046] The first ring-like member 46 and the second ring-like member 47 are in substantial contact with the inner tube 42 and the outer tube 45. If the first ring-like member 46 and the second ring-like member 47 are made of material having a high heat conductivity, therefore, much of the heat of the inner tube 42 might be transmitted through the first ring-like member 46 and the second ring-like member 47 to the outer tube 45. According to the present embodiment, the first ring-like member 46 and the second ring-like member 47 may be made of material having a lower heat conductivity than the inner tube 42 and the outer tube 45. More specifically, the first ring-like member 46 and the second ring-like member 47 may be made, for example, of resin, such as UV-curing resin or ultraviolet-curing resin. This represses the heat transmission from the inner tube 42 to the outer tube 45.

[0047] The heating assembly 41 includes a heater tail portion 56 that electrically connects the heating member 43 to the circuit portion 30 (which is an example of a control portion) illustrated in Fig. 3. As illustrated in Fig. 7, at least a part of the heater tail portion 56 extends along the outer surface of the inner tube 42 and an outer surface of the bottom cap 50 to protrude outside the sealed region 54.

[0048] The inner diameter of the bottom cap 50 may be fixed from the downstream end 50a to the upstream end 50b. The bottom cap 50 may have a tapered inner surface, and the inner diameter of the bottom cap 50 accordingly may be increased from the downstream end 50a toward the upstream end 50b. A ratio of D_c to D_{max} (D_c/D_{max}) ranges, for example, from 1.4 to 2.34, where a largest inner diameter of the bottom cap 50 is D_{max} , and the inner diameter of the inner tube 42 is D_c . The ratio of D_c to D_{max} preferably ranges from 1.56 to 2.01 and is typically 1.75. Therefore, if the inner diameter D_c of the inner tube 42 is 7.00 mm, a largest diameter D_{max} of the bottom cap 50 ranges, for example, from 2.99 mm to 4.99 mm, preferably from 3.49 mm to 4.49 mm, and is typically 3.99 mm. When the smoking article 110 has

a diameter close to the inner diameter of the inner tube 42, if the largest diameter of the bottom cap 50 and the largest inner diameter of the inner tube 42 fall in the aforementioned ranges, the tip end portion of the smoking article 110 is reliably held by the engaging portion 50d of the bottom cap 50, and the air channel 70 is sufficiently secured at the same time. The diameter of the bottom cap 50 here includes the inner diameter of the small diameter portion 50c except for an inner diameter of a portion of the bottom cap 50 which encloses the inner tube 42.

[0049] The following discussion explains positional relationship between the smoking article 110 and the heating assembly 41 in a state where the smoking article 110 is inserted in the flavor inhalation device 10. Fig. 8 schematically shows axial positional relationship between the base material portion 110A of the smoking article 110 on one hand and the heating member 43 and the inner tube 42 of the flavor inhalation device 10 on the other hand in the flavor inhalation device 10 of the present embodiment. The axis here means a central axis of the first opening 42a in the flavor inhalation device 10. When the smoking article 110 is inserted in the first opening 42a, the axis and a central axis of the smoking article 110 partially overlap each other.

[0050] If axial length of the heating member 43 is D_0 , and axial length of the base material portion 110A of the smoking article 110 is L_0 , the length D_0 may be reduced to be shorter than the length L_0 ($D_0 < L_0$). A ratio of the length D_0 to the length L_0 (D_0/L_0) may range 0.70 to 0.90, preferably from 0.75 to 0.85, and may be typically 0.80. When the length L_0 of the base material portion 110A is 20 mm, therefore, the length D_0 of the heating member 43 ranges from 14 mm to 18 mm, preferably from 15 mm to 17 mm, and may be typically 16 mm. If the ratio of the length D_0 to the length L_0 (D_0/L_0) is set in the aforementioned range, a desired aerosol creation amount can be achieved, and at the same time, the heating member 43 can be reduced in size in a length direction.

[0051] Referring to Fig. 8, an upstream end of the base material portion 110A may protrude upstream further than an upstream end of the heating member 43 by length D_1 . The terms "upstream" and "downstream" respectively correspond to the upstream and downstream of an air flow passing through the air channel 70 in response to the user's inhaling action (see Fig. 4). A protruding portion of the base material portion 110A which protrudes from the heating member 43 does not include the heating member 43 on a radially outer side thereof, so that the protruding portion can have inner temperature slightly lower than other portions of the base material portion 110A. This represses aerosol creation at the upstream end of the base material portion 110A and in the vicinity thereof. It is then possible to prevent the aerosol generated at the upstream end of the base material portion 110A and in the vicinity thereof from being condensed in the air channel or flowing backward through the air chan-

nel to leak outside the device. A ratio of protrusion length D1 to entire length L0 of the base material portion 110A ($D1/L0$) ranges from 0.25 to 0.40, preferably from 0.30 to 0.35, and may be typically 0.325. If the entire length L0 of the base material portion 110A is 20 mm, therefore, the protrusion length D1 ranges from 5 mm to 8 mm, preferably from 6 mm to 7 mm, and may be typically 6.5 mm. The protrusion length D1 here may also be referred to as an axial distance between the upstream end of the heating member 43 and the upstream end of the inner tube 42. If the ratio of the protrusion length D1 to the length L0 ($D1/L0$) is set in the aforementioned range, it is possible to repress aerosol creation at the upstream end of the base material portion 110A and in the vicinity thereof, and at the same time, achieve sufficient aerosol creation in the other portions of the base material portion 110A.

[0052] Referring to Fig. 8, the downstream end of the heating member 43 may protrude downstream further than the downstream end of the base material portion 110A by length D2. This makes it possible to sufficiently heat the downstream end of the base material portion 110A and a portion in the vicinity thereof, which prevents a deficiency of aerosol creation amount and generation of aerosol condensation at the downstream end of the base material portion 110A and the portion in the vicinity thereof. A ratio of protrusion length D2 of the heating member 43 to the length L0 of the base material portion 110A ($D2/L0$) ranges from 0.075 to 0.175, preferably from 0.1 to 0.15, and may be typically 0.125. Therefore, if the length L0 of the base material portion 110A is 20 mm, the protrusion length D2 of the heating member 43 may range from 1.5 mm to 3.5 mm, preferably from 2 mm to 3 mm, and may be typically 2.5 mm. If the ratio of the protrusion length D2 to the length L0 ($D2/L0$) is set in the aforementioned range, it is possible to achieve sufficient aerosol creation at the downstream end of the base material portion 110A and in the vicinity thereof, and at the same time, repress an increase in size of the heating member 43 in the length direction.

[0053] An axial position of the upstream end of the inner tube 42 and an axial position of the upstream end of the base material portion 110A may more or less coincide with each other. Like the downstream end of the heating member 43, the downstream end of the inner tube 42 may protrude downstream further than the downstream end of the base material portion 110A by length D3. This makes it possible to heat the upstream end of the paper tube portion 114 and a portion in the vicinity thereof as well as the downstream end of the base material portion 110A and the portion in the vicinity thereof. This prevents the aerosol generated from the base material portion 110A from being excessively cooled and condensed at the upstream end of the paper tube portion 114 and in the vicinity thereof. A ratio of protrusion length D3 of the inner tube 42 to the protrusion length D2 of the heating member 43 ($D3/D2$) ranges from 2.6 to 3.4, preferably from 2.8 to 3.2, and may be typically 3.0. Therefore, if

the protrusion length D2 of the heating member 43 is 2.5 mm, the protrusion length D3 of the inner tube 42 ranges from 6.5 mm to 8.5 mm, preferably from 7.0 mm to 8.0 mm, and may be typically 7.5 mm. If the ratio of the protrusion length D3 to the protrusion length D2 ($D3/D2$) is set in the aforementioned range, it is possible to prevent the aerosol from being condensed at the upstream end of the paper tube portion 114 and in the vicinity thereof, and at the same time, repress an increase in size of the heating member 43 in the length direction.

[0054] The embodiments according to the invention have been discussed. The invention, however, does not necessarily have to be made according to the above-described embodiments. The invention may be modified in various ways in a scope of the claims and the technical ideas discussed in the specification and drawings. Any shape and material that provide the operation and advantageous effects of the invention are in the scope of technical ideas of the invention even if there is no direct reference to such a shape and material in the specification and drawings.

[0055] Several embodiments disclosed in the present specification are described below.

[0056] According to a first embodiment, a heating assembly is provided, which comprises a first cylindrical member provided in one end with a first opening, in which a flavor generating article can be inserted, and in the other end with a second opening that forms an air inlet; a heating member; and heat insulating material. The heating assembly further comprises a second cylindrical member disposed to enclose the first cylindrical member. A sealed region is provided between the first cylindrical member and the second cylindrical member. The heating member and the heat insulating material are accommodated in the sealed region.

[0057] According to a second embodiment, in the heating assembly of the first embodiment, the heating member abuts against the first cylindrical member, and the first cylindrical member is made of metal material.

[0058] According to a third embodiment, in the heating assembly of the first or second embodiment, the heating member is provided in an outer peripheral side of the first cylindrical member. First resin material is provided between the heating member and the heat insulating material. The first resin material applies stress to the heating member so as to press the heating member against the first cylindrical member.

[0059] According to a fourth embodiment, in the heating assembly of the third embodiment, the first resin material is thermally shrunk and thus applies stress to the heating member so as to press the heating member against the first cylindrical member.

[0060] According to a fifth embodiment, in the heating assembly of the third or fourth embodiment, an upstream end of the first resin material which is close to the second opening protrudes outside the second cylindrical member.

[0061] According to a sixth embodiment, in the heating

assembly of the fifth embodiment, the heating assembly comprises a third cylindrical member including an interior space, in which the flavor generating article can be inserted, the interior space being in communication with the first opening of the first cylindrical member. The third cylindrical member is connected to a downstream end of the first cylindrical member which is located on the first opening side. A downstream end of the first resin material which is close to the first opening, encloses an outer periphery of an upstream end of the third cylindrical member which is connected to the first opening.

[0062] According to a seventh embodiment, in the heating assembly of the sixth embodiment, the upstream end of the third cylindrical member encloses an outer periphery of the downstream end of the first cylindrical member.

[0063] According to an eighth embodiment, in the heating assembly of any one of the third to seventh embodiments, the first resin material is substantially equal in axial length to the first cylindrical member.

[0064] According to a ninth embodiment, in the heating assembly of any one of the third to eighth embodiments, the first resin material is longer than the heating member in an axial direction, and the heating member is located between an upstream end of the first resin material which is close to the second opening and a downstream end of the first resin material which is close to the first opening.

[0065] According to a tenth embodiment, in the heating assembly of any one of the third to ninth embodiments, the heating assembly comprises a fourth cylindrical member connected to an upstream end of the first cylindrical member which is located on the second opening side, and forms an inner channel that introduces air toward the second opening of the first cylindrical member. An upstream end of the first resin material which is close to the second opening, encloses an outer periphery of the fourth cylindrical member.

[0066] According to an 11th embodiment, in the heating assembly of the tenth embodiment, a downstream end of the fourth cylindrical member which is close to the second opening encloses an outer periphery of the upstream end of the first cylindrical member.

[0067] According to a 12th embodiment, in the heating assembly of any one of the first to 11th embodiments, the upstream end of the first cylindrical member which is located on the second opening side and the downstream end of the first cylindrical member which is located on the first opening side protrude outside the second cylindrical member. The heating member fits between the upstream end of the second cylindrical member which is close to the second opening and the downstream end of the second cylindrical member which is close to the first opening in an axial direction.

[0068] According to a 13th embodiment, in the heating assembly of any one of the first to 12th embodiments, the heat insulating material axially extends at least between the upstream end of the heating member which is close to the second opening and the downstream end of

the heating member which is close to the first opening.

[0069] According to a 14th embodiment, in the heating assembly of any one of the first to 13th embodiments, the heating assembly comprises a ring-like member extending in a circumferential direction between an end portion of the first cylindrical member which is located on the first opening side and an end portion of the second cylindrical member which is close to the first opening, and between an end portion of the first cylindrical member which is located on the second opening side and an end portion of the second cylindrical member which is close to the second opening.

[0070] According to a 15th embodiment, in the heating assembly of the 14th embodiment, the ring-like member is made of material having a lower heat conductivity than the first cylindrical member and the second cylindrical member.

[0071] According to a 16th embodiment, in the heating assembly of any one of the first to 15th embodiments, the heat insulating material includes aerogel.

[0072] According to a 17th embodiment, in the heating assembly of the 16th embodiment, a cubic volume of the heat insulating material ranges from 85% to 100% of capacity of the sealed region.

[0073] According to an 18th embodiment, in the heating assembly of any one of the first to 17th embodiments, the heating assembly includes a heater tail portion that electrically connects the heating member to a control portion. At least a part of the heater tail portion extends along the outer surface of the first cylindrical member to protrude outside the sealed region.

[0074] According to a 19th embodiment, in the heating assembly of any one of the first to 18th embodiments, the heating member is so configured to heat the flavor generating article. $D0/L0$ ranges from 0.7 to 0.9, where $L0$ is axial length of flavor generating base material of the flavor generating article, and $D0$ is axial length of the heating member.

[0075] According to a 20th embodiment, in the heating assembly of the 19th embodiment, $D0/L0$ ranges from 0.75 to 0.85.

[0076] According to a 21st embodiment, in the heating assembly of any one of the first to 20th embodiments, the heating member is configured to heat the flavor generating article. $D1/L0$ ranges from 0.25 to 0.40, where $L0$ is axial length of flavor generating base material of the flavor generating article, and $D1$ is an axial distance between an upstream end of the heating member and an upstream end of the first cylindrical member.

[0077] According to a 22nd embodiment, in the heating assembly of the 21st embodiment, $D1/L0$ ranges from 0.30 to 0.35.

[0078] According to a 23rd embodiment, in the heating assembly of any one of the first to 22nd embodiments, in a state where the flavor generating article is accommodated inside the first cylindrical member so that an upstream end of the flavor generating article and an upstream end of the first cylindrical member coincide with

each other in an axial direction, a downstream end of the heating member is located downstream from a downstream end of flavor generating base material of the flavor generating article. $D2/L1$ ranges from 0.075 to 0.175, where $D2$ is an axial distance between the downstream end of the heating member and the downstream end of the flavor generating base material of the flavor generating article, and $L1$ is axial length of the flavor generating base material of the flavor generating article.

[0079] According to a 24th embodiment, in the heating assembly of the 23rd embodiment, $D2/L1$ ranges from 0.1 to 0.15.

[0080] According to a 25th embodiment, in the heating assembly of any one of the first to 23rd embodiments, in a state where the flavor generating article is accommodated inside the first cylindrical member so that an upstream end of the flavor generating article and an upstream end of the first cylindrical member coincide with each other in an axial direction, a downstream end of the heating member and a downstream end of the first cylindrical member are located downstream from a downstream end of a flavor generating base material of the flavor generating article, and the downstream end of the first cylindrical member is located downstream from the downstream end of the heating member. $D3/D2$ ranges from 2.6 to 3.4, where $D2$ is an axial distance between the downstream end of the heating member and the downstream end of the flavor generating base material of the flavor generating article, and $D3$ is an axial distance between the downstream end of the first cylindrical member and the downstream end of the flavor generating base material of the flavor generating article.

[0081] According to a 26th embodiment, in the heating assembly of the 25th embodiment, $D3/D2$ ranges from 2.8 to 3.2.

[0082] According to a 27th embodiment, a flavor inhalation device is provided, which comprises the heating assembly of any one of the first to 26th embodiments.

[0083] According to a 28th embodiment, a flavor inhalation device is provided, which comprises an air channel for providing airy communication between an air inlet and an air outlet. The air channel comprises a first hollow tube that forms a part of an opening portion for receiving a flavor source from outside; a second hollow tube that forms a part of a heating assembly; and a third hollow tube comprising an engaging portion for positioning the flavor source. The third hollow tube, the second hollow tube, and the first hollow tube are arranged in the order named in a direction from the air inlet toward the air outlet. The first hollow tube and the second hollow tube have an overlapping region in a longitudinal direction, and the second hollow tube and the third hollow tube have an overlapping region in a longitudinal direction. The overlapping regions are both sealed.

[0084] According to a 29th embodiment, in the flavor inhalation device of the 28th embodiment, the second hollow tube has a cylindrical shape.

[0085] According to a 30th embodiment, in the flavor

inhalation device of the 28th or 29th embodiment, the second hollow tube is configured to accommodate the flavor source inside and contact at least a part of the flavor source.

[0086] According to a 31st embodiment, in the flavor inhalation device of any one of the 28th to 30th embodiments, the first hollow tube includes an accommodating portion in the overlapping region, the accommodating portion being capable of accommodating a downstream end of the second hollow tube and having an inner diameter larger than an outer diameter of a downstream end of the second hollow tube.

[0087] According to a 32nd embodiment, in the flavor inhalation device of any one of the 28th to 31st embodiments, the third hollow tube includes an accommodating portion in the overlapping region, the accommodating portion being capable of accommodating an upstream end of the second hollow tube and having an inner diameter larger than an outer diameter of an upstream end of the second hollow tube.

[0088] According to a 33rd embodiment, in the flavor inhalation device of any one of the 28th to 32nd embodiments, the third hollow tube includes a first flavor source engaging portion in a region other than the overlapping region, the first flavor source engaging portion having an inner diameter smaller than an inner diameter of the second hollow tube.

[0089] According to a 34th embodiment, in the flavor inhalation device of any one of the 28th to 33rd embodiments, the flavor inhalation device includes a fourth hollow tube disposed to enclose the second hollow tube. An upstream end of the fourth hollow tube encloses a downstream end of the third hollow tube, and or alternatively, a downstream end of the fourth hollow tube encloses an upstream end of the first hollow tube.

[0090] According to a 35th embodiment, in the flavor inhalation device of any one of the 28th to 34th embodiments, a contact portion in the overlapping region between an inner surface of the first hollow tube and an outer surface of the second hollow tube is joined together with adhesive.

[0091] According to a 36th embodiment, in the flavor inhalation device of any one of the 28th to 35th embodiments, a contact portion in the overlapping region between an outer surface of the second hollow tube and an inner surface of the third hollow tube are joined together with adhesive.

[0092] According to a 37th embodiment, in the flavor inhalation device of any one of the 28th to 36th embodiments, the flavor inhalation device includes a housing configured to accommodate at least a part of each of the first hollow tube, the second hollow tube, and the third hollow tube. The housing includes an inlet in communication with inside of the third hollow tube. An end portion of the third hollow tube, other than the end portion including the overlapping region with the second hollow tube, is disposed adjacently to the inlet of the housing.

[0093] According to a 38th embodiment, in the flavor

inhalation device of any one of the 28th to 37th embodiments, the first hollow tube is provided on an inner surface with a second flavor source engaging portion for engaging the flavor source.

[0094] According to a 39th embodiment, in the flavor inhalation device of any one of the 28th to 38th embodiments, the second hollow tube is made of metal material, and the first hollow tube and the third hollow tube are made of resin material.

[0095] According to a 40th embodiment, in the flavor inhalation device of any one of the 28th to 39th embodiments, the flavor inhalation device includes a sleeve member provided with an opening. The sleeve member forms a part of the opening portion.

[0096] According to a 41st embodiment, in the flavor inhalation device of the 40th embodiment, an end portion of the first hollow tube, other than the end portion including the overlapping region with the second hollow tube, is engaged with the sleeve member.

[0097] According to a 42nd embodiment, in the flavor inhalation device of the 41st embodiment, a hollow rubber material is provided to an engaging end portion of the sleeve member and of the first hollow tube.

[0098] According to a 43rd embodiment, in the flavor inhalation device of the 42nd embodiment, the sleeve member includes an accommodating portion for accommodating the rubber material.

[0099] According to a 44th embodiment, in the flavor inhalation device of any one of the 40th to 43rd embodiments, the sleeve member has an inner diameter larger than an outer diameter of the first hollow tube. The sleeve member encloses at least a part of the first hollow tube.

[0100] According to a 45th embodiment, in the flavor inhalation device of any one of the 40th to 44th embodiments, the flavor inhalation device includes a movable lid member for allowing or restricting access of the flavor source to the opening of the sleeve member or an inner wall portion of the first hollow tube.

[0101] According to a 46th embodiment, in the flavor inhalation device of any one of the 28th to 45th embodiments, the second hollow tube defines a part of a space accommodating a heating member for heating the flavor source.

[0102] According to a 47th embodiment, in the flavor inhalation device of any one of the 28th to 46th embodiments, S_c/S_{max} ranges from 1.4 to 2.34, where S_{max} is a largest inner diameter of the third hollow tube, and S_c is a largest outer diameter of the flavor source.

[0103] According to a 48th embodiment, in the flavor inhalation device of the 47th embodiment, S_c/S_{max} ranges 1.56 to 2.01.

REFERENCE SIGN LIST

[0104]

10 Flavor inhalation device
11 Housing

12 Cover
12a Opening
14 Lid portion
15 Vent hole
5 16 Cap
17 Outer fin
17a Accommodating portion
21 Power source
24 Rubber material
10 30 Circuit portion
41 Heating assembly
42 Inner tube
43 Heating member
44 Aerogel
15 45 Outer tube
46 First ring-like member
47 Second ring-like member
48 Top cap
50 Bottom cap
20 50c Small diameter portion
50d Engaging portion
52 Heat shrinkable tube
54 Sealed region
56 Heater tail portion
25 70 Air channel
110 Smoking article
111 Filling

[0105] The following numbered paragraphs provide further embodiments.

30 1. A heating assembly comprising a first cylindrical member provided in one end with a first opening, in which a flavor generating article can be inserted, and
35 in the other end with a second opening that forms an air inlet; a heating member; and heat insulating material,

40 the heating assembly further comprising a second cylindrical member disposed to enclose the first cylindrical member, wherein a sealed region is provided between the first cylindrical member and the second cylindrical member, and the heating member and the heat insulating member are accommodated in the sealed region.

2. The heating assembly according to 1,
wherein the heating member abuts against the first cylindrical member, and wherein the first cylindrical member is made of metal material.

55 3. The heating assembly according to 1 or 2, wherein the heating member is provided in an outer peripheral side of the first cylindrical mem-

ber;

wherein first resin material is provided between the heating member and the heat insulating material; and

wherein the first resin material applies stress to the heating member so as to press the heating member against the first cylindrical member. 5

4. The heating assembly according to 3, wherein the first resin material is thermally shrunk and thus applies stress to the heating member so as to press the heating member against the first cylindrical member. 10

5. The heating assembly according to 3 or 4, wherein an upstream end of the first resin material which is close to the second opening protrudes outside the second cylindrical member. 15

6. The heating assembly according to 5,

wherein the heating assembly comprises a third cylindrical member including an interior space, in which the flavor generating article can be inserted, the interior space being in communication with the first opening of the first cylindrical member; 20

wherein the third cylindrical member is connected to a downstream end of the first cylindrical member which is located on the first opening side; and 25

wherein a downstream end of the first resin material which is close to the first opening encloses an outer periphery of an upstream end of the third cylindrical member which is connected to the first opening. 30

7. The heating assembly according to 6, wherein the upstream end of the third cylindrical member encloses an outer periphery of the downstream end of the first cylindrical member. 35

8. The heating assembly according to any one of 3 to 7, wherein the first resin material is substantially equal in axial length to the first cylindrical member. 40

9. The heating assembly according to any one of 3 to 8, 45

wherein the first resin material is longer than the heating member in an axial direction; and

wherein the heating member is located between an upstream end of the first resin material which is close to the second opening and a downstream end of the first resin material which is close to the first opening. 50

10. The heating assembly according to any one of 3 to 9, 55

wherein the heating assembly comprises a

fourth cylindrical member connected to an upstream end of the first cylindrical member which is located on the second opening side, and forms an inner channel that introduces air toward the second opening of the first cylindrical member; and

wherein an upstream end of the first resin material which is close to the second opening encloses an outer periphery of the fourth cylindrical member.

11. The heating assembly according to 10, wherein a downstream end of the fourth cylindrical member which is close to the second opening encloses an outer periphery of the upstream end of the first cylindrical member.

12. The heating assembly according to any one of 1 to 11,

wherein the upstream end of the first cylindrical member which is located on the second opening side and the downstream end of the first cylindrical member which is located on the first opening side protrude outside the second cylindrical member; and

wherein the heating member fits between the upstream end of the second cylindrical member which is close to the second opening and the downstream end of the second cylindrical member which is close to the first opening in an axial direction.

13. The heating assembly according to any one of 1 to 12,

wherein the heat insulating material axially extends at least between the upstream end of the heating member which is close to the second opening and the downstream end of the heating member which is close to the first opening.

14. The heating assembly according to any one of 1 to 13,

wherein the heating assembly comprises a ring-like member extending in a circumferential direction between an end portion of the first cylindrical member which is located on the first opening side and an end portion of the second cylindrical member which is close to the first opening, and between an end portion of the first cylindrical member which is located on the second opening side and an end portion of the second cylindrical member which is close to the second opening.

15. The heating assembly according to 14, wherein the ring-like member is made of material having a lower heat conductivity than the first cylindrical member and the second cylindrical member.

16. The heating assembly according to any one of 1 to 15,

wherein the heat insulating material includes aero-

gel.

17. The heating assembly according to any one of 1 to 16,

wherein the heating assembly includes a heater tail portion that electrically connects the heating member to the control portion; and wherein at least a part of the heater tail portion extends along the outer surface of the first cylindrical member to protrude outside the sealed region.

18. The heating assembly according to any one of 1 to 17,

wherein the heating member is so configured to heat the flavor generating article; and $D0/L0$ ranges from 0.7 to 0.9, where $L0$ is axial length of flavor generating base material of the flavor generating article, and $D0$ is axial length of the heating member.

19. The heating assembly according to 18, wherein $D0/L0$ ranges from 0.75 to 0.85.

20. The heating assembly according to any one of 1 to 19,

wherein the heating member is so configured to heat the flavor generating article; and $D1/L0$ ranges from 0.25 to 0.40, where $L0$ is axial length of flavor generating base material of the flavor generating article, and $D1$ is an axial distance between an upstream end of the heating member and an upstream end of the first cylindrical member.

21. The heating assembly according to 20, wherein $D1/L0$ ranges 0.30 to 0.35.

22. The heating assembly according to any one of 1 to 21,

wherein in a state where the flavor generating article is accommodated inside the first cylindrical member so that an upstream end of the flavor generating article and an upstream end of the first cylindrical member coincide with each other in an axial direction, a downstream end of the heating member is located downstream from a downstream end of flavor generating base material of the flavor generating article.

23. A flavor inhalation device comprising the heating assembly according to any one of 1 to 22.

Claims

1. A flavor inhalation device (10) having a heating assembly (41) comprising a first cylindrical member (42) provided in one end with a first opening (42a), in which a flavor generating article (110) can be in-

serted, and in the other end with a second opening (42b) that forms an air inlet; a heating member (43); and heat insulating material (44),

the heating assembly (41) further comprising a second cylindrical member (45) disposed to enclose the first cylindrical member (42),

characterized in that a sealed region (54) is provided between the first cylindrical member (42) and the second cylindrical member (45), and the heating member (43) and the heat insulating material (44) are accommodated in the sealed region (54)

2. The flavor inhalation device (10) according to claim 1, the heating assembly (41) further comprising:

a third cylindrical member (50) connected to an upstream end of the first cylindrical member (42) which is located on the second opening side, and forming an inner channel that introduces air toward the second opening (42b), wherein a downstream end of the third cylindrical member (50) encloses an outer periphery of the upstream end of the first cylindrical member (42).

3. The flavor inhalation device (10) according to claim 1 or 2,

wherein the third cylindrical member (50) includes a small diameter portion (50c) having a smaller inner diameter than the first cylindrical member (42).

4. The flavor inhalation device (10) according to claim 3,

wherein the third cylindrical member (50) includes an engaging portion (50d) having a stepped shape and being formed from the small diameter portion (50c) and a portion of the third cylindrical member (50) which encloses an outer periphery of the upstream end of the first cylindrical member (42).

5. The flavor inhalation device (10) according to claim 4,

wherein the upstream end of the first cylindrical member (42) is disposed to abut against the engaging portion (50d).

6. The flavor inhalation device (10) according to any one of claims 1-5, further comprising a fourth cylindrical member (48) configured that the smoking article (110) can be inserted therein and having an interior space in communication with the first opening (42a) of the first cylindrical member (42),

wherein an upstream end of the fourth cylindrical member (48) is connected to a downstream end of the first cylindrical member (42) on the first opening (42a) side.

7. The flavor inhalation device (10) according to claim 6,
wherein the upstream end of the fourth cylindrical member (48) encloses an outer periphery of the downstream end of the first cylindrical member (42). 5
8. The flavor inhalation device (10) according to claim 6 or 7, further comprising a fifth cylindrical member (17) forming a part of an opening portion for accommodating the smoking article (110) and being engaged with a downstream end of the fourth cylindrical member (48). 10
9. The flavor inhalation device (10) according to claim 8,
wherein an upstream end of the fifth cylindrical member (17) encloses an outer periphery of the downstream end of the fourth cylindrical member (48). 15
10. The flavor inhalation device (10) according to claim 8 or 9,
wherein a space between the fifth cylindrical member (17) and the fourth cylindrical member (48) is sealed with a rubber material (24). 20
11. The flavor inhalation device (10) according to claim 10,
wherein the rubber material (24) has a ring-like shape and circumferentially extends between an outer peripheral surface of the fourth cylindrical member (48) and an inner peripheral surface of the fifth cylindrical member (17). 25 30
12. The flavor inhalation device (10) according to claim 10 or 11,
wherein the fifth cylindrical member (17) includes an accommodating portion (17a) for accommodating the rubber material (24). 35
13. The flavor inhalation device (10) according to any one of claims 1 - 12, further comprising a heat shrinkable tube (52) disposed between the first cylindrical member (42) and the second cylindrical member (45). 40 45
14. A flavor inhalation system comprising:

the flavor inhalation device (10) according to any one of claims 1 - 13, and
the flavor generating article (110). 50
15. The flavor inhalation system according to claim 14,

wherein the flavor generating article (110) includes a base material portion (110A) and a paper tube portion (114) adjacent to a downstream side of the base material portion (110A), and a downstream end of the heating member (43) protrudes downstream further than a downstream end of the base material portion (110A) by a protrusion length D2 in a state where the flavor generating article (110) is accommodated inside the first cylindrical member (42). 55
16. The flavor inhalation system according to claim 15,
wherein the protrusion length D2 of the heating member (43) ranges from 1.5 mm to 3.5 mm.
17. The flavor inhalation system according to claim 14,

wherein the flavor generating article (110) includes a base material portion (110A) and a paper tube portion (114) adjacent to a downstream side of the base material portion (110A), and a downstream end of the first cylindrical member (42) protrudes downstream further than a downstream end of the base material portion (110A) in a state where the flavor generating article (110) is accommodated inside the first cylindrical member (42).

Fig. 1A

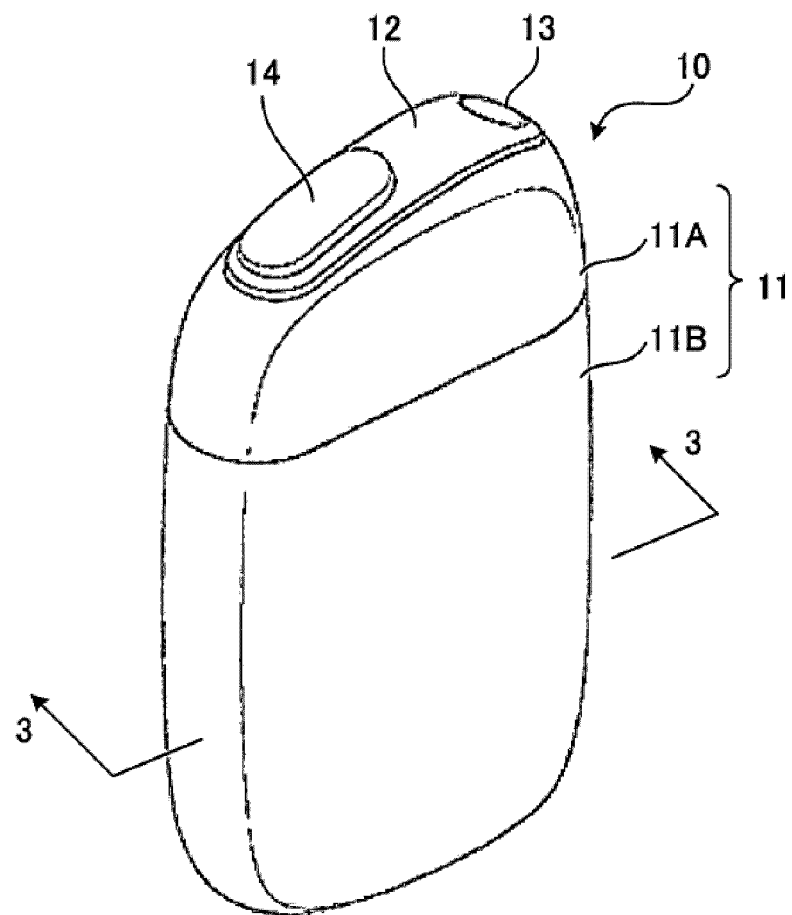


Fig. 1B

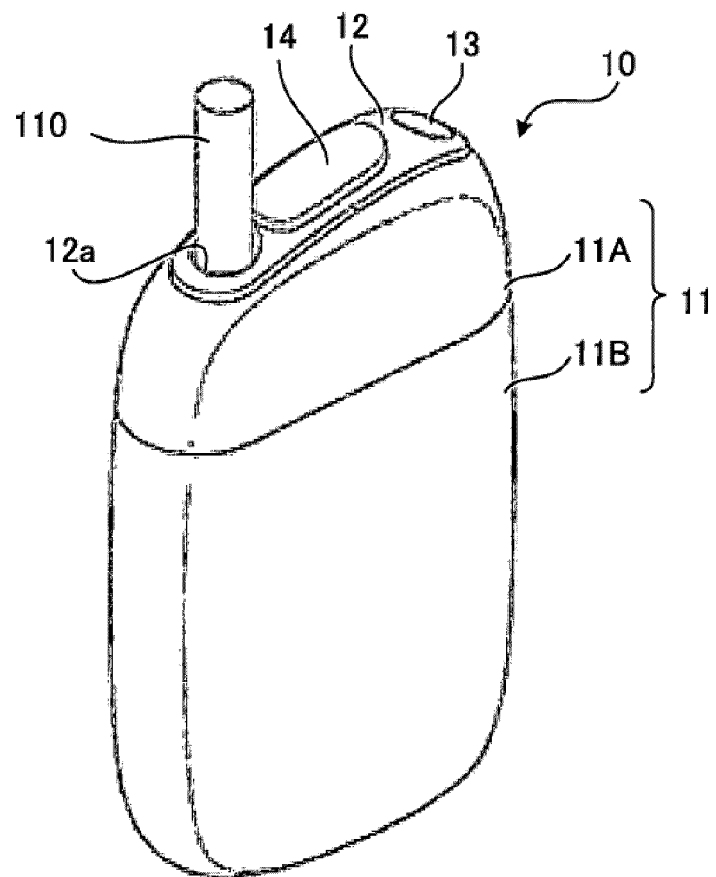


Fig. 2

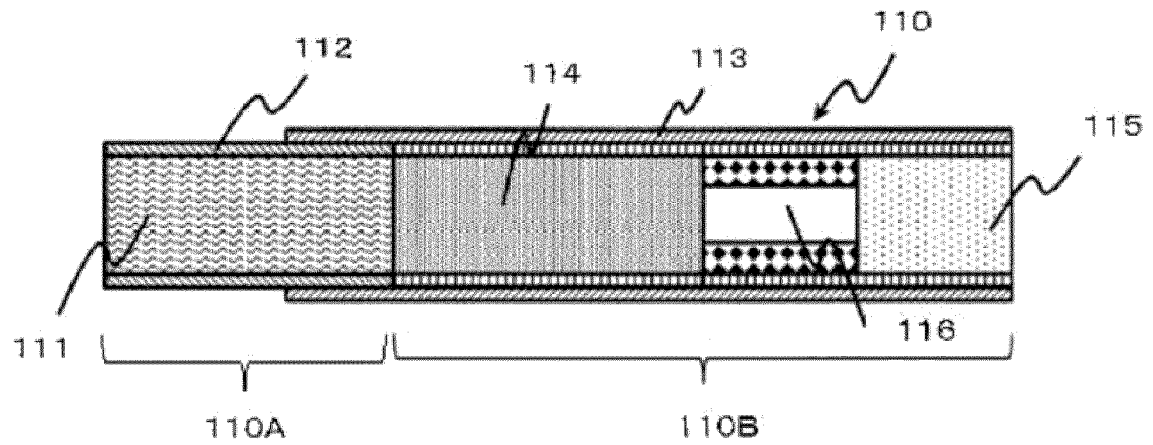


Fig. 3

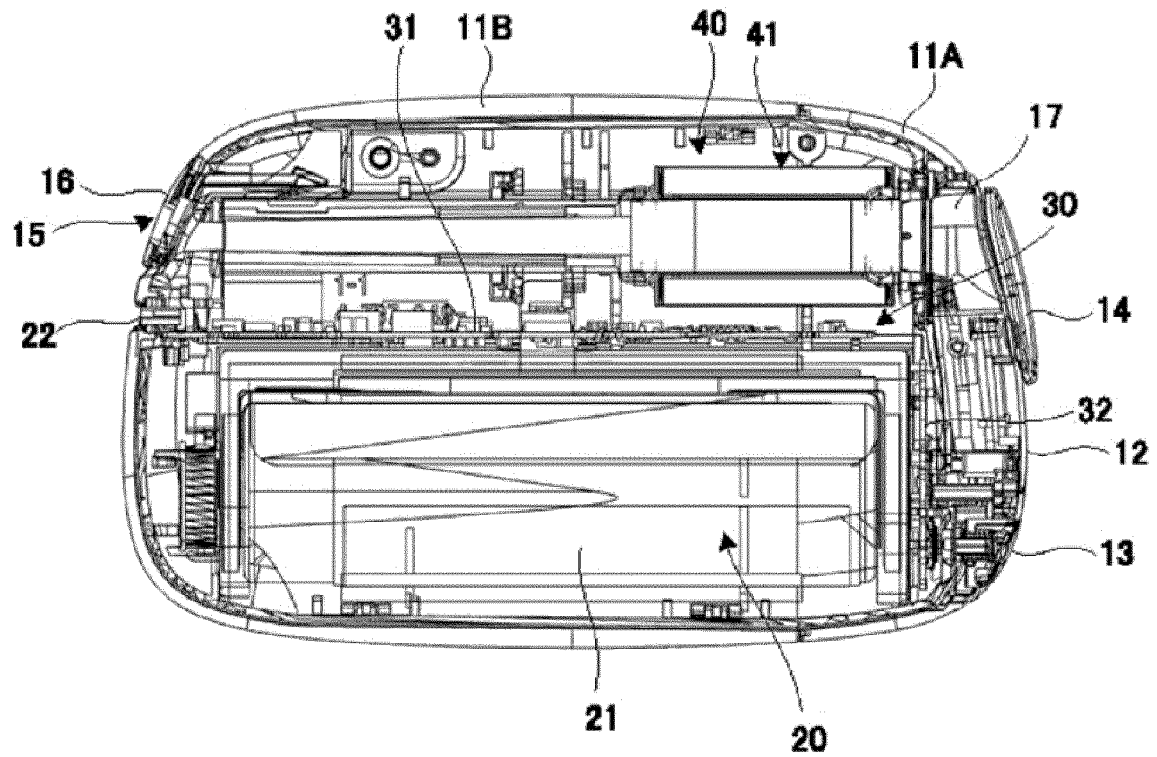


Fig. 4

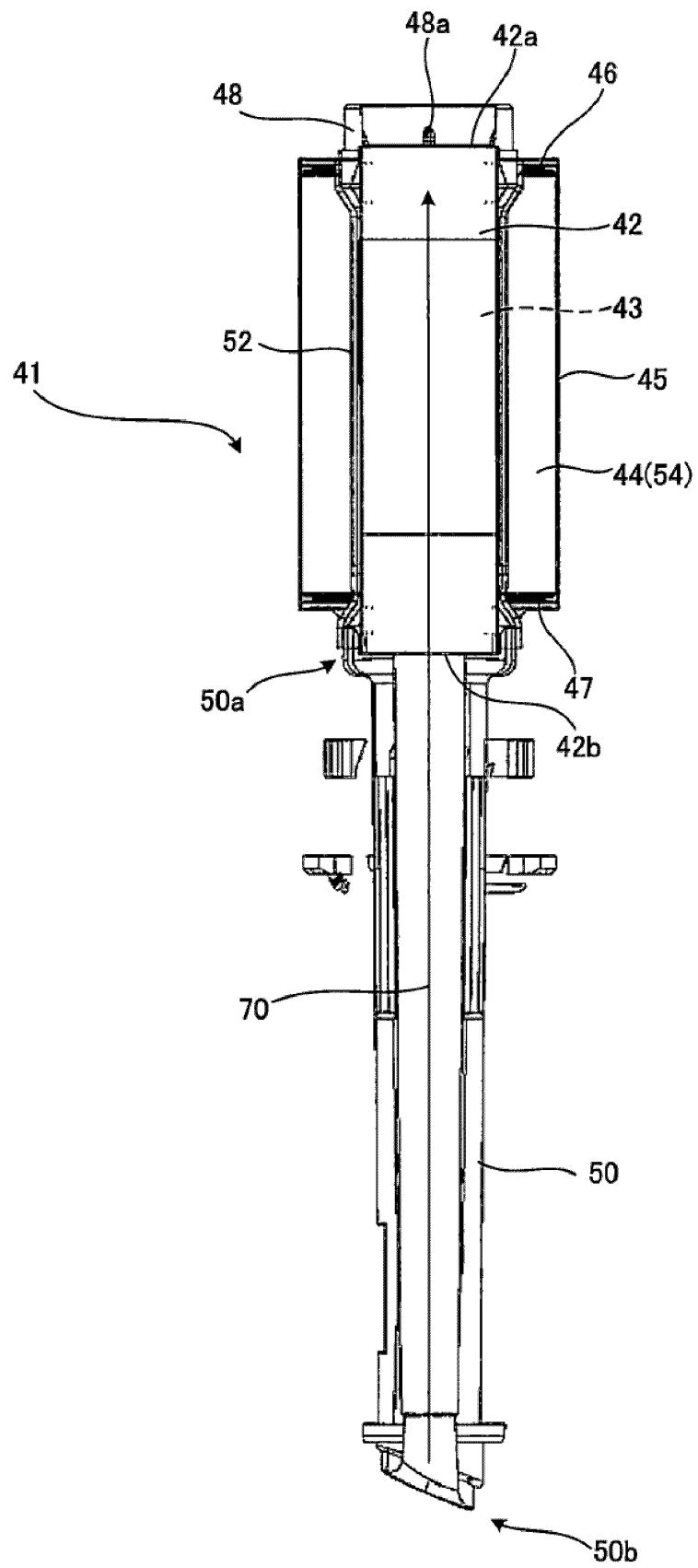


Fig. 5

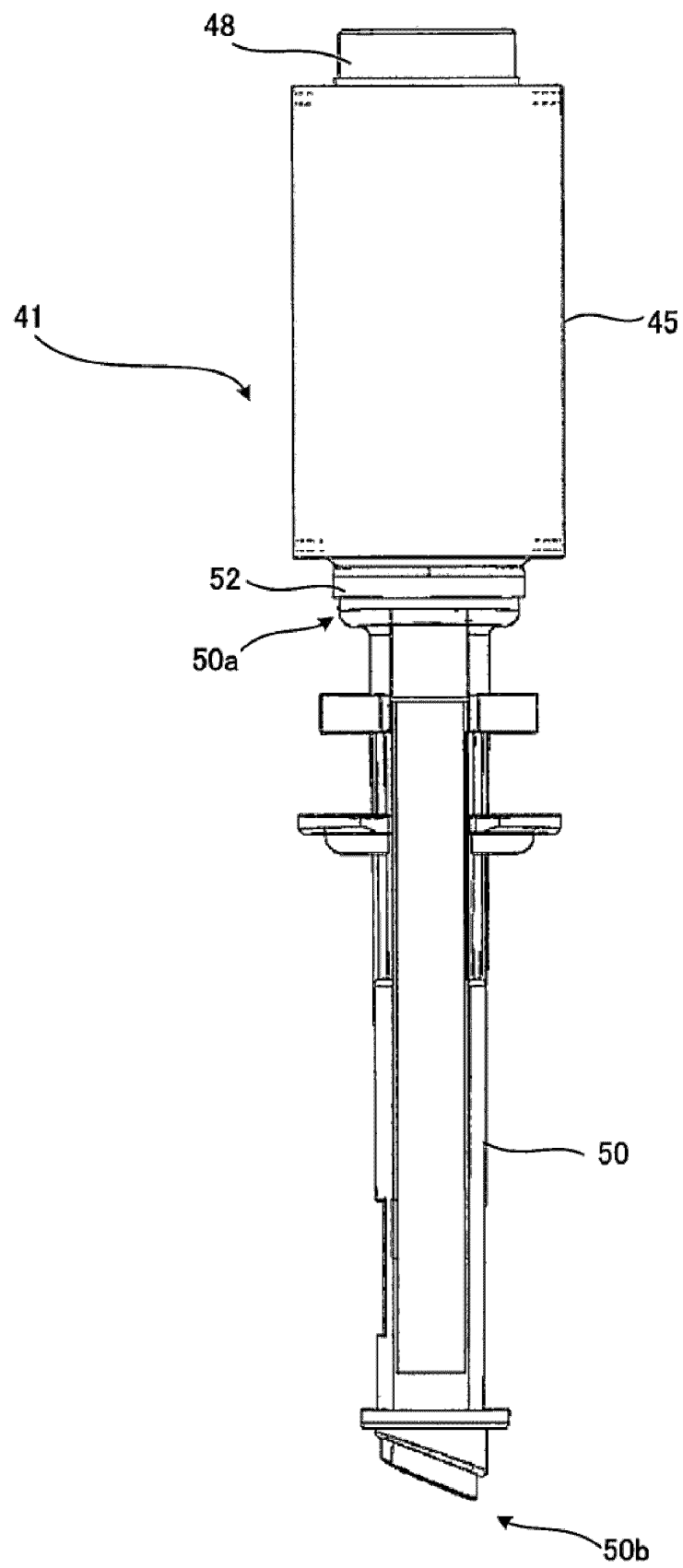


Fig. 6

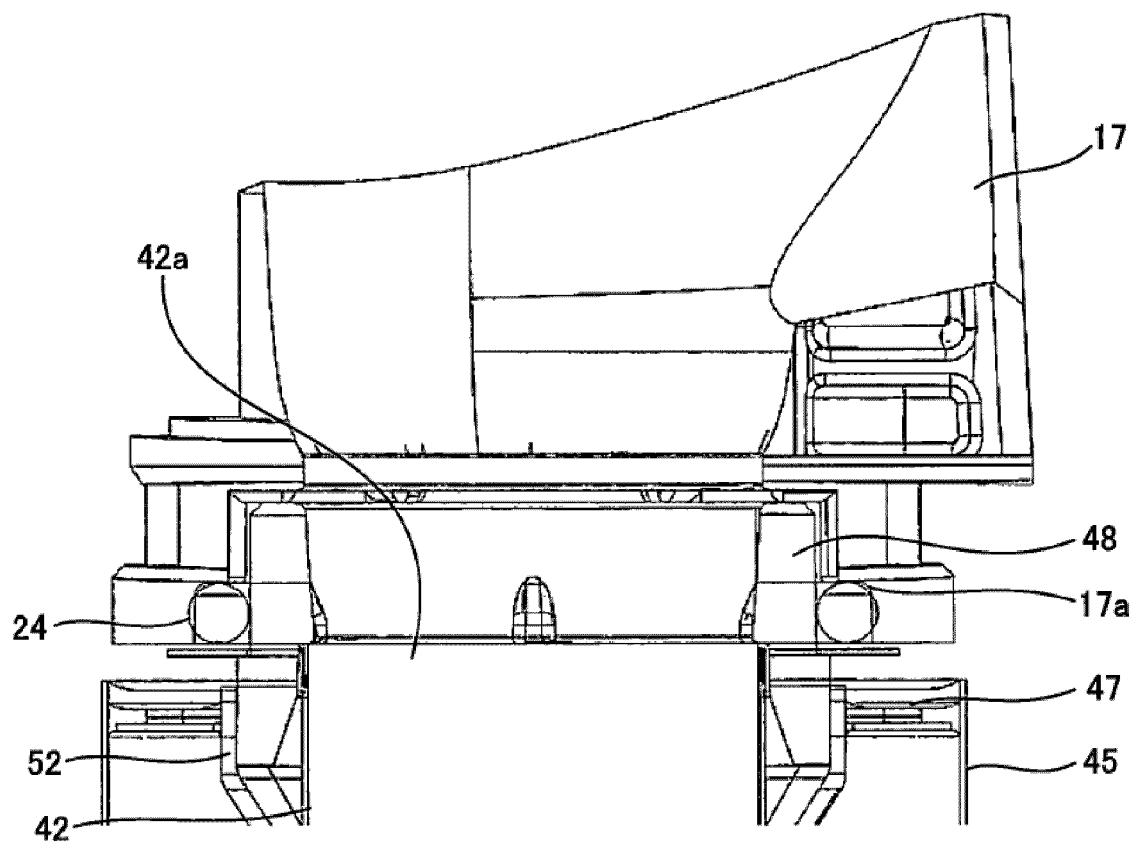


Fig. 7

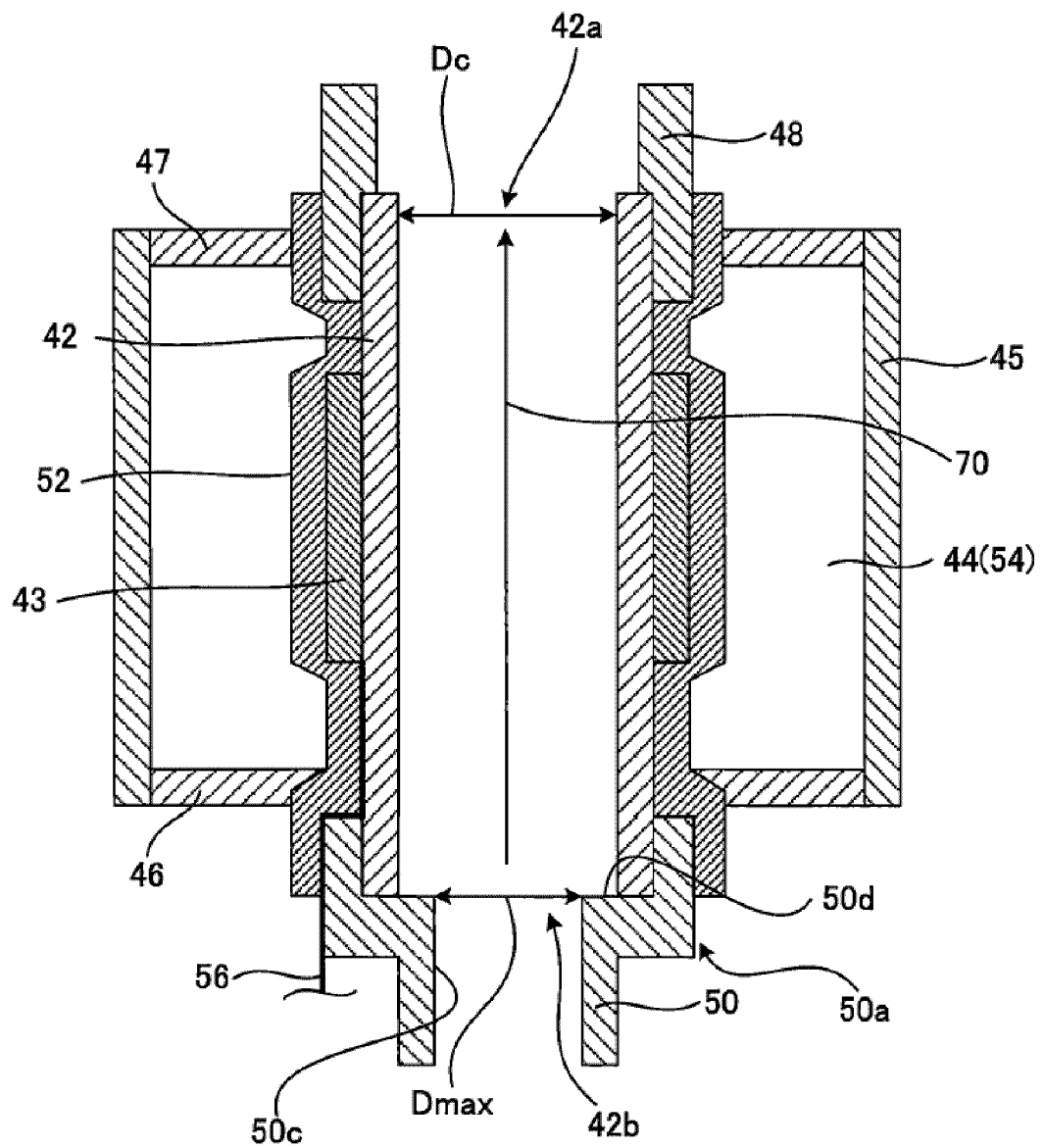
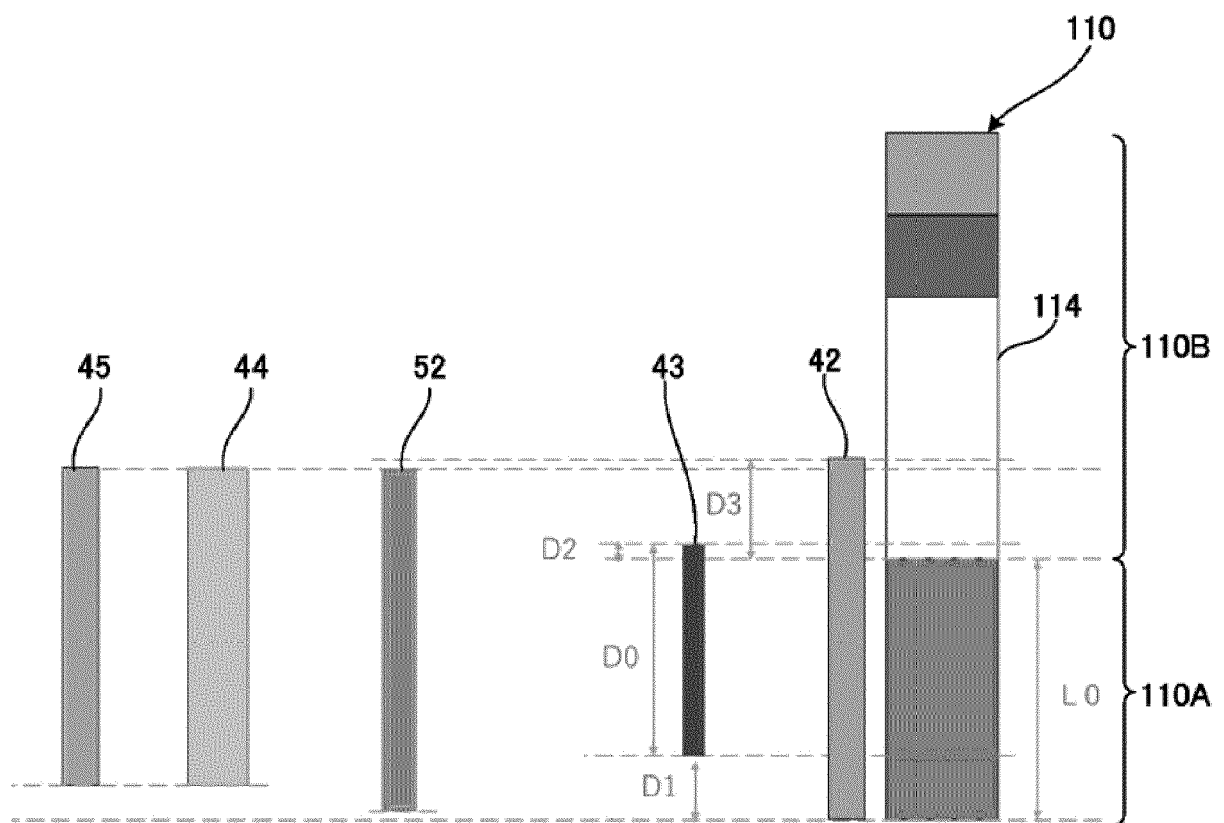


Fig. 8



REFERENCES CITED IN THE DESCRIPTION

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