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(54) **NON-COMBUSTION-HEATED STICK**

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(57) **ABSTRACT**

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041900, filed on Nov. 15, 2021.

Publication Classification

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This non-combustion-heated stick **1** comprises: a tobacco section **10** that has an aerosol source **11** containing tobacco; a cooling section **20** that cools vapor, generated by heating the tobacco section **10** by means of a heat generating element, to produce an aerosol; and a filter section **30** through which the aerosol passes. The tobacco section **10** has a higher filling density of tobacco in a part closer to the heat generating element than in a part further away therefrom.

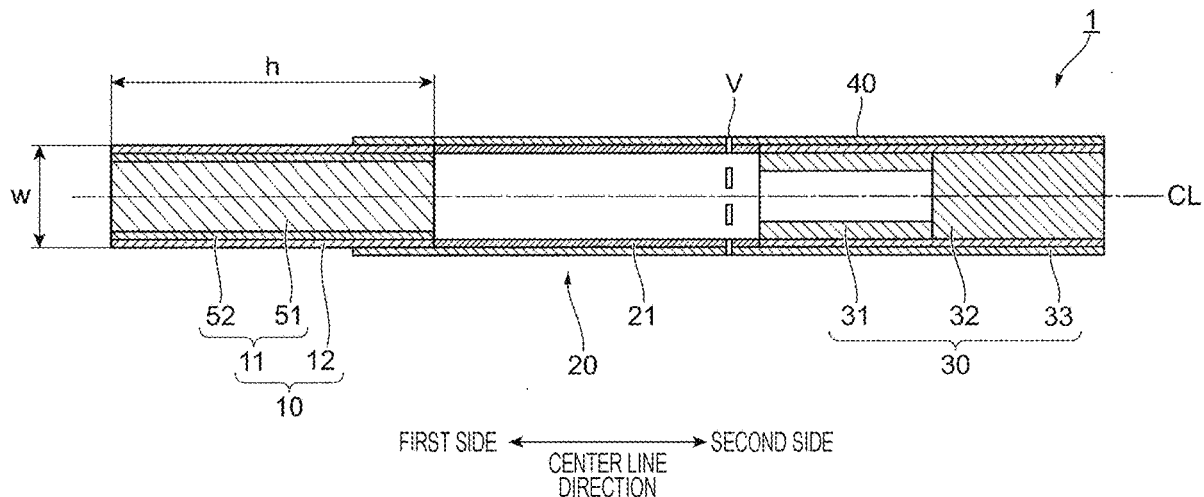


FIG. 1

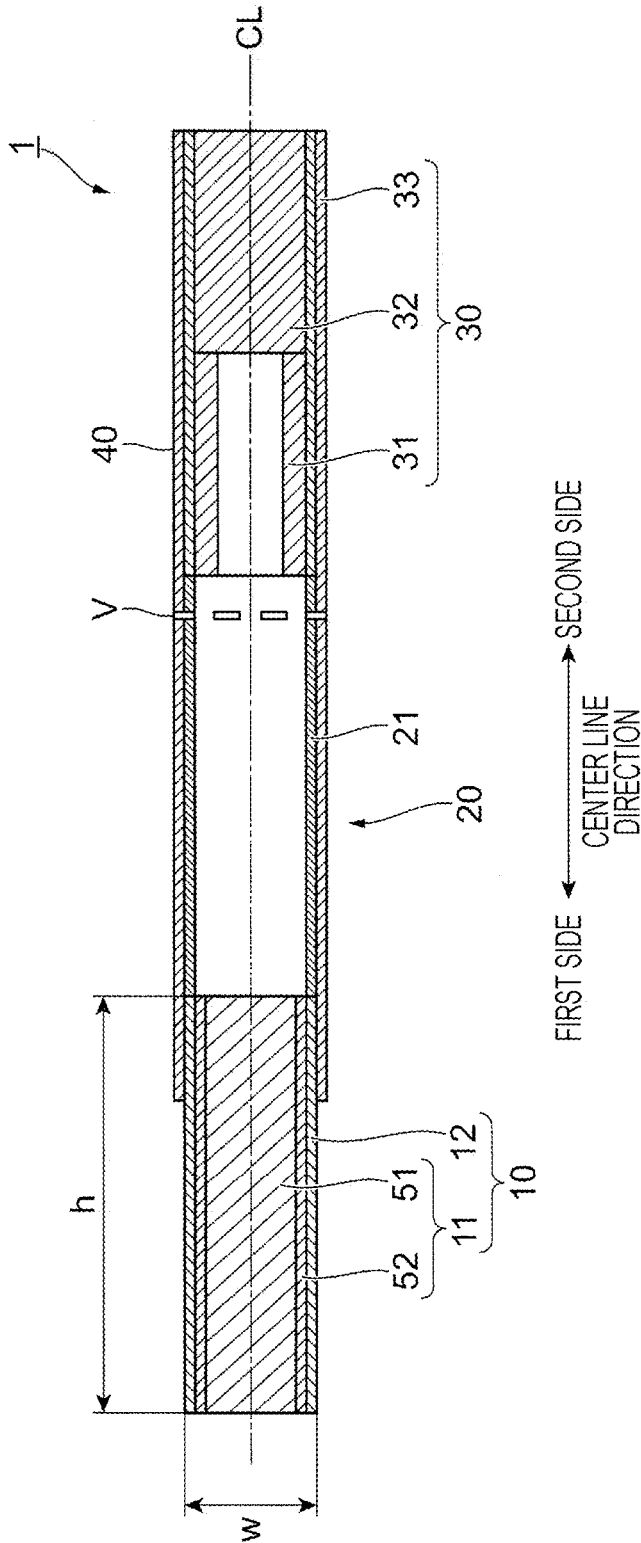


FIG. 2

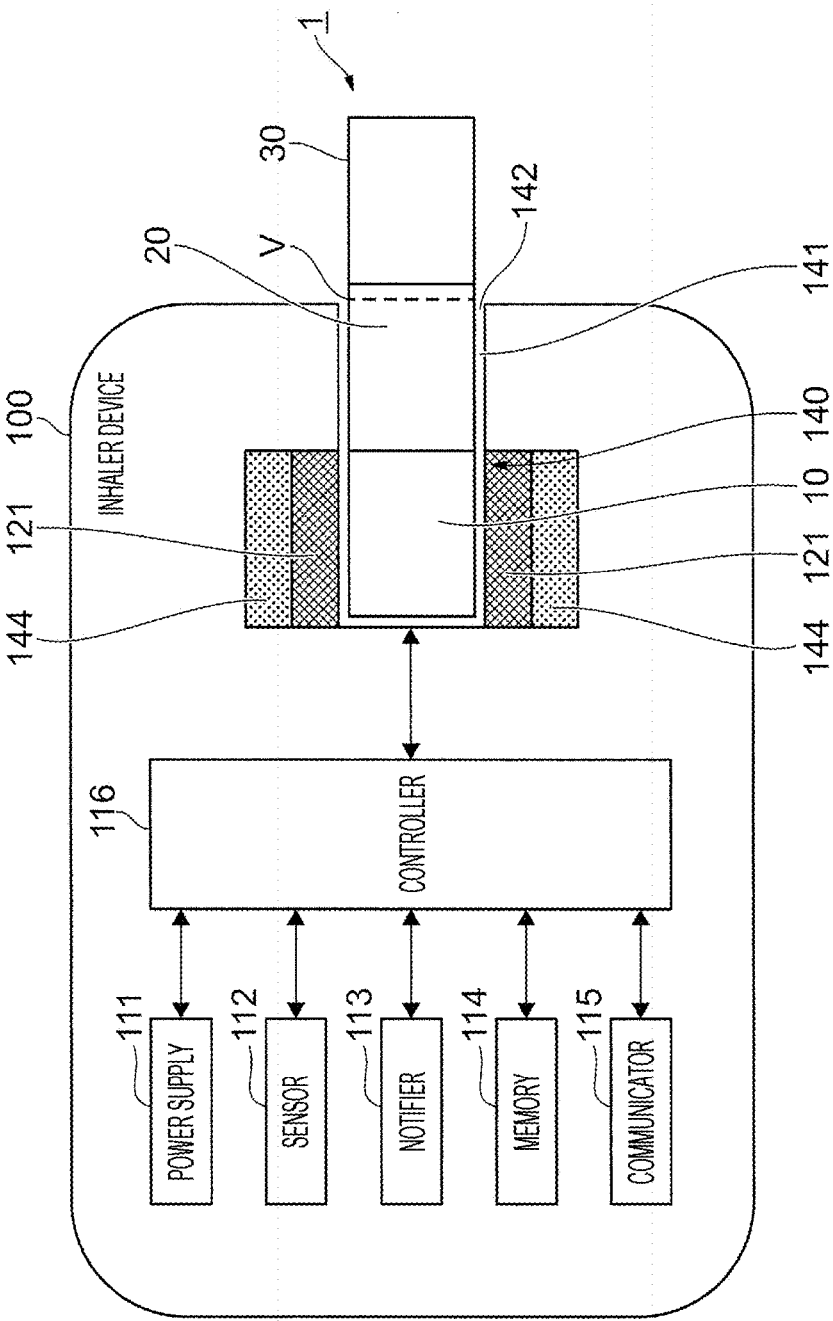


FIG.3A

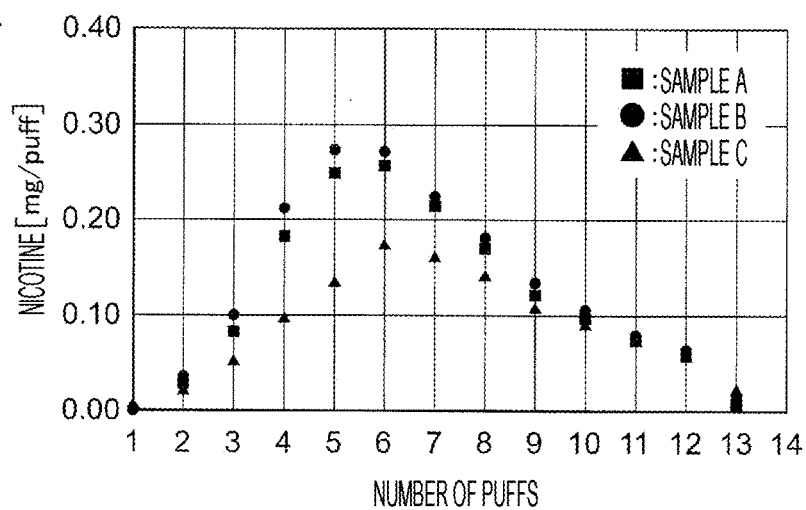


FIG.3B

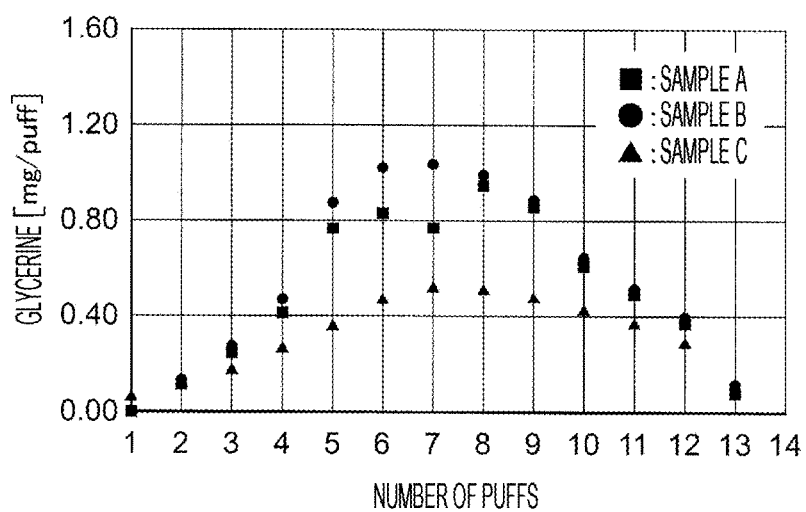


FIG.4

	SAMPLE A	SAMPLE B	SAMPLE C
PACKING WEIGHT	TOBACCO SHEET + WRAPPING PAPER	56	0 (NO TOBACCO SHEET)
	PACKED SECTION	208	264
	TOTAL (mgWB)	264	264
INSIDE DIAMETER (mm)	6.75	6.75	7.02
VOLUME OF PACKED SECTION (mm3)	258	238	302
VOLUME PACKING RATIO OF PACKED SECTION (%)	60%	55%	65%

FIG. 5

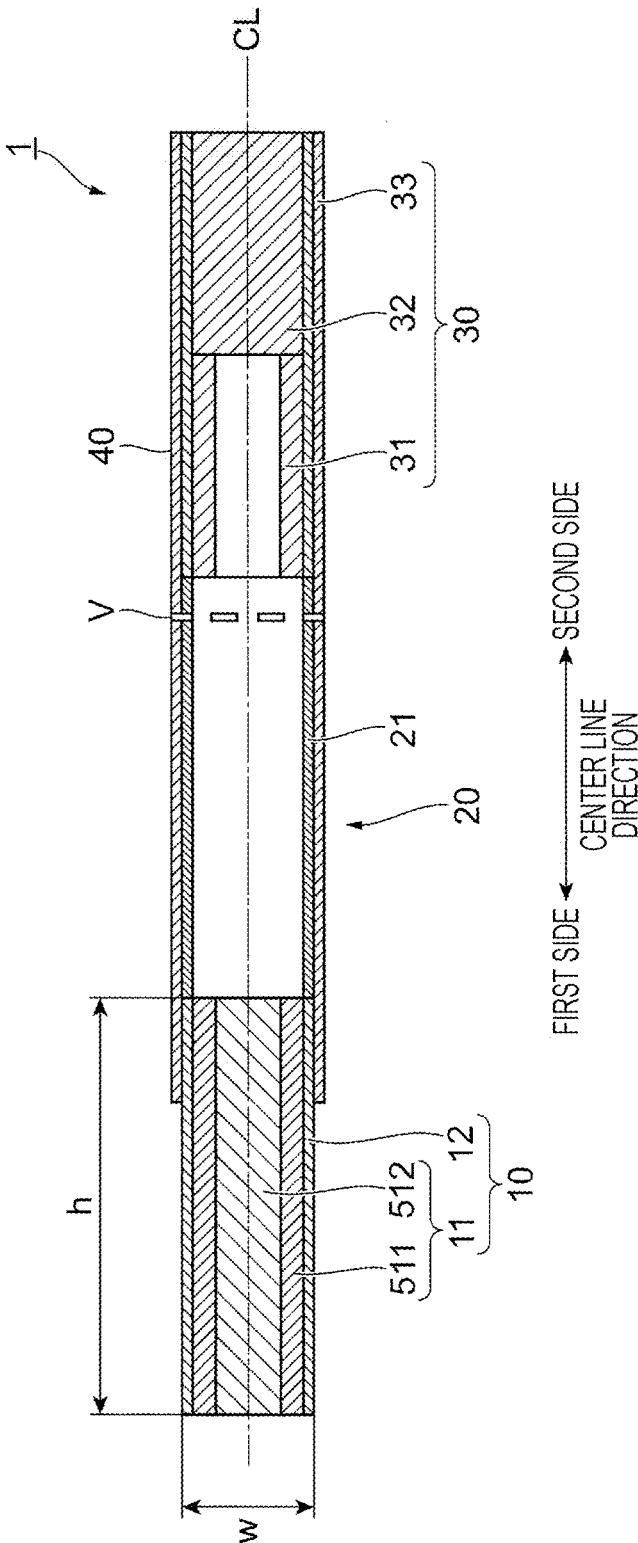


FIG. 6

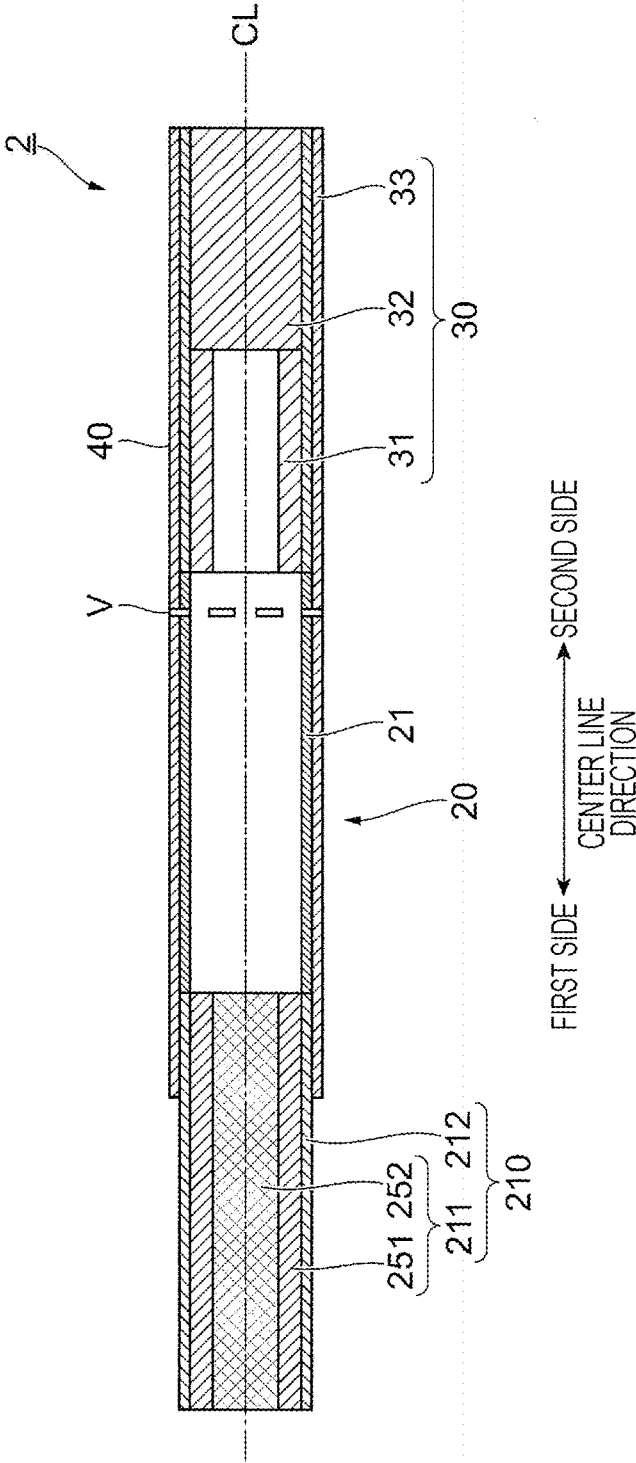


FIG. 7

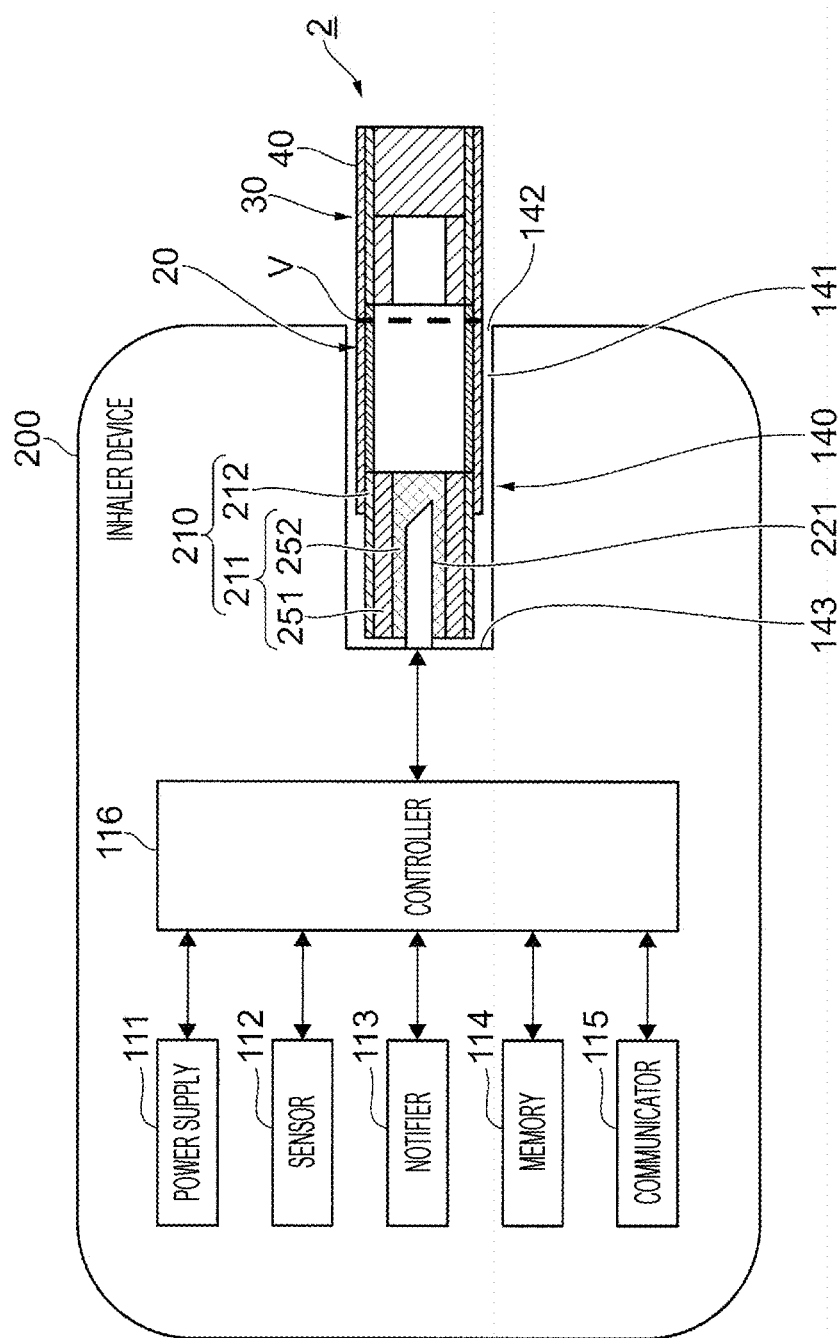
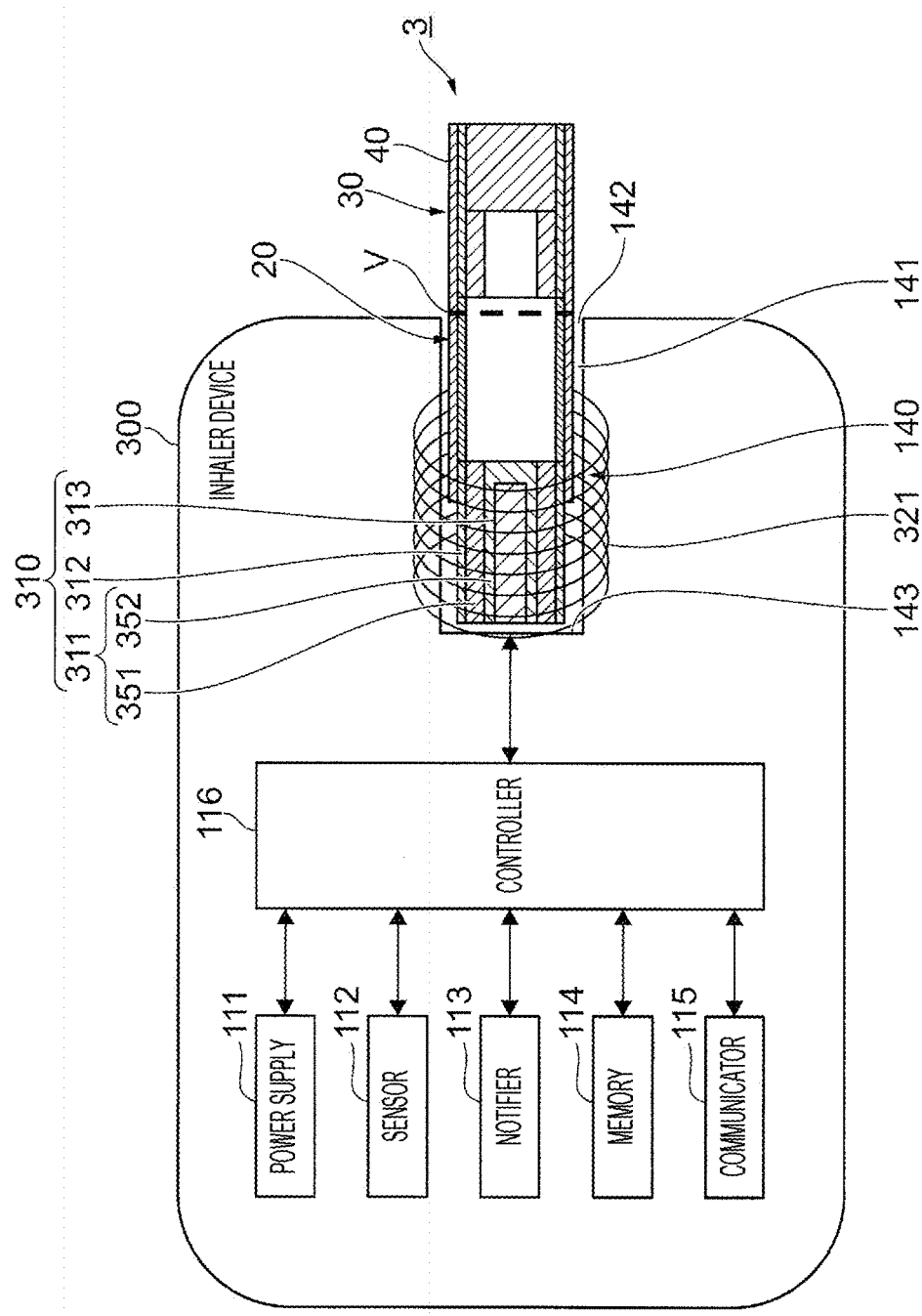


Fig. 9



NON-COMBUSTION-HEATED STICK**CROSS-REFERENCE TO RELATED APPLICATION**

[0001] The present application is a continuation of International Application No. PCT/JP2021/041900 filed on Nov. 15, 2021 and entitled with “NON-COMBUSTION-HEATED STICK”, which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to a non-combustion heating-type stick.

BACKGROUND ART

[0003] A non-combustion heating-type inhaler device known in the related art includes a tobacco section packed with shredded tobacco leaves, wherein the tobacco section is heated with a heater or other heating units. For example, a device described in PTL 1 is externally heated with a heater disposed on the outer circumference of the tobacco section. For example, a device described in PTL 2 is internally heated with a heater inserted into the tobacco section.

CITATION LIST**Patent Literature**

[0004] PTL 1: International Publication No. WO 2020-100927

[0005] PTL 2: Japanese Unexamined Patent Application Publication No. 2018-33466

SUMMARY**Technical Problem**

[0006] In both of these heating systems, the limited energy supplied to a heat generating element, such as a heater, to produce heat is preferably used to increase the delivery amount of filling materials, such as nicotine and glycerine, delivered into the oral cavity.

[0007] The present disclosure is directed to a non-combustion heating-type stick that allows efficient use of energy supplied to a heat generating element to increase the delivery amount of filling materials delivered into the oral cavity.

Solution to Problem

[0008] According to a first aspect of the present disclosure completed to achieve the above object, a non-combustion heating-type stick includes: a tobacco section that has an aerosol source containing tobacco; a cooling section that cools steam generated by heating the tobacco section with a heat generating element to generate an aerosol; and a filter section through which the aerosol passes, wherein in the tobacco section, a packing density of the tobacco in a portion near the heat generating element is higher than the packing density in a portion far from the heat generating element.

[0009] According to a second aspect, the tobacco section may be externally heated with the heat generating element disposed outside the tobacco section, and the packing density in an outer portion may be higher than the packing density in an inner portion.

[0010] According to a third aspect, the tobacco section may include: a packed section packed with tobacco; and a tobacco sheet formed by using granules of ground tobacco leaves and wrapped around the packed section.

[0011] According to a fourth aspect, the tobacco sheet may be at least one of a cast sheet, a laminate sheet, and a papermaking sheet.

[0012] According to a fifth aspect, the tobacco sheet may include at least one of a cast sheet, a laminate sheet, and a papermaking sheet.

[0013] According to a sixth aspect, the tobacco section may be internally heated with the heat generating element disposed inside the tobacco section, and the packing density in an inner portion may be higher than the packing density in an outer portion.

[0014] According to a seventh aspect, the tobacco section may further include, as the heat generating element, a susceptor that produces heat through electromagnetic induction, wherein, in the tobacco section, the packing density around the susceptor may be higher than the packing density in an outer circumferential portion.

[0015] According to an eighth aspect, a non-combustion heating-type stick includes: a tobacco section that has an aerosol source containing tobacco; a cooling section that cools steam generated by heating the tobacco section with a heat generating element to generate an aerosol; and a filter section through which the aerosol passes, wherein in the tobacco section, a tobacco sheet formed by using granules of ground tobacco leaves is disposed near the heat generating element, and a packed section packed with tobacco is disposed at a position farther from the heat generating element than the tobacco sheet.

[0016] According to a ninth aspect, the tobacco section may be externally heated with the heat generating element disposed outside the tobacco section, and the tobacco sheet may be wrapped around an outer circumference of the packed section.

Advantageous Effects of Invention

[0017] According to the first aspect, energy supplied to the heat generating element can be efficiently used to increase the delivery amount of filling materials delivered into the oral cavity.

[0018] According to the second aspect, in an externally heating-type inhaler device, energy supplied to the heat generating element can be efficiently used to increase the delivery amount of filling materials.

[0019] According to the third aspect, it is possible to implement an increase in the delivery amount of filling materials easily and efficiently.

[0020] According to the fourth aspect, the tobacco sheet can be made into a sheet with a high packing density of tobacco with high accuracy.

[0021] According to the fifth aspect, an area with high packing density can be increased by using the tobacco sheet.

[0022] According to the sixth aspect, in an internally heating-type inhaler device, energy supplied to the heat generating element can be efficiently used to increase the delivery amount of filling materials.

[0023] According to the seventh aspect, in an inhaler device that produces heat through electromagnetic induction, energy supplied to the heat generating element can be efficiently used to increase the delivery amount of filling materials.

[0024] According to the eighth aspect, energy supplied to the heat generating element can be efficiently used to increase the delivery amount of filling materials delivered into the oral cavity.

[0025] According to the ninth aspect, in an externally heating-type inhaler device, energy supplied to the heat generating element can be efficiently used to increase the delivery amount of filling materials.

BRIEF DESCRIPTION OF DRAWINGS

[0026] FIG. 1 illustrates an example longitudinal section of a stick according to a first embodiment.

[0027] FIG. 2 schematically illustrates an example general structure of an inhaler device in which the stick according to the first embodiment is used.

[0028] FIG. 3A shows the comparison results of the nicotine delivery amount when the aerosol source in the tobacco section has different structures. FIG. 3B shows the comparison results of the glycerine delivery amount when the aerosol source in the tobacco section has different structures.

[0029] FIG. 4 shows the comparison of the structures of the aerosol source.

[0030] FIG. 5 illustrates an example longitudinal section of a tobacco section according to a modification.

[0031] FIG. 6 illustrates an example longitudinal section of a stick according to a second embodiment.

[0032] FIG. 7 schematically illustrates an example general structure of an inhaler device in which the stick according to the second embodiment is used.

[0033] FIG. 8 illustrates an example longitudinal section of a stick according to a third embodiment.

[0034] FIG. 9 schematically illustrates an example general structure of an inhaler device in which the stick according to the third embodiment is used.

DESCRIPTION OF EMBODIMENTS

[0035] Embodiments of the present disclosure will be described below with reference to the attached drawings. In the drawings, the same parts are assigned with the same reference signs.

First Embodiment

[0036] FIG. 1 illustrates an example longitudinal section of a stick 1 according to a first embodiment.

[0037] FIG. 2 schematically illustrates an example general structure of an inhaler device 100 in which the stick 1 according to the first embodiment is used.

[0038] A non-combustion heating-type stick (hereinafter may be referred to as a “stick”) 1 according to a first embodiment includes a tobacco section 10, a cooling section 20, and a filter section 30. The tobacco section 10 has a columnar shape. Hereinafter, the direction of a center line CL of the tobacco section 10 may be referred to as a “center line direction.” The stick 1 further includes a tipping paper 40. The tipping paper 40 is wrapped around the tobacco section 10, the cooling section 20, and the filter section 30, which are arranged in this order in the center line direction, to integrate these sections. Hereinafter, one end side (left side in FIG. 1) in the center line direction may be referred to as a first side, and the other end side (right side in FIG. 1) in the center line direction may be referred to as a second side. The first side is an end side to be inserted into the inhaler device 100. The second side is opposite to the first

side and is the end side to be held by a user in their mouth for inhalation. The cross section taken along the center line direction is referred to as a “longitudinal section,” and the cross section taken along a plane perpendicular to the center line direction is referred to as a “transverse section.”

[Usage Form of Stick 1]

[0039] The stick 1 according to the first embodiment is used in a non-combustion heating-type inhaler device 100. Referring to FIG. 2, the inhaler device 100 includes: a power supply 111 that stores electric power and supplies electric power to each structural element of the inhaler device 100; a sensor 112 that detects various types of information regarding the inhaler device 100; and a notifier 113 that notifies a user of information. The inhaler device 100 also includes: a memory 114 that stores various types of information for operation of the inhaler device 100; a communicator 115 for exchange of information between the inhaler device 100 and other devices; and a controller 116 that controls overall operation in the inhaler device 100. The inhaler device 100 also includes: a heater 121 that heats the stick 1; a holder 140 that holds the stick 1; an opening 142 through which an internal space 141 communicates with outside; and a heat insulator 144 that prevents heat transfer from the heater 121 to other structural elements of the inhaler device 100. A user performs inhalation while the stick 1 is held by the holder 140 in the inhaler device 100.

[0040] The heater 121 heats the tobacco section 10 of the stick 1. The heater 121 is made of a predetermined material, such as metal or polyimide. For example, the heater 121 has a film shape and is disposed to cover the outer circumference of the holder 140. When the heater 121 produces heat, an aerosol source 11 included in the stick 1 is heated from the outer circumference of the stick 1. The heater 121 produces heat when electric power is supplied to the heater 121 from the power supply 111. In one example, electric power may be supplied to the heater 121 when the sensor 112 detects predetermined user input. For example, the heater 121 heats the stick 1 for 15 seconds from the unheated state to a target temperature set to 280 degrees, and after 15 seconds have elapsed, the target temperature is set to constant 260 degrees.

[0041] When the temperature of the stick 1 heated by the heater 121 reaches a predetermined temperature, a user can perform inhalation. Electric power supply may be then stopped when the sensor 112 detects predetermined user input. In another example, electric power may be supplied to the heater 121 to generate an aerosol during the period in which the sensor 112 is detecting user inhalation.

[0042] The heat insulator 144 is disposed to cover at least the outer circumference of the heater 121. For example, the heat insulator 144 is made of a vacuum heat insulator, an aerogel heat insulator, or other materials. Vacuum heat insulators are heat insulators that are produced by, for example, wrapping a resin film around glass wool and silica (silicon powder) or other materials and bringing the inside of the film into a high-vacuum state so as to reduce heat conduction by gas as close to zero as possible.

[Tobacco Section 10]

[0043] The tobacco section 10 has: the aerosol source 11 that, when heated, produces steam for generating an aerosol; and wrapping paper 12 that covers the outer circumference of the aerosol source 11. The tobacco section 10 is formed

into a columnar shape by wrapping the wrapping paper 12 around the aerosol source 11. At least part of the tobacco section 10 is accommodated in the internal space 141 of the holder 140 while the stick 1 is held by the holder 140. The specific structure of the tobacco section 10 will be described below in detail. The shape of the tobacco section 10 is as described below.

[0044] The tobacco section 10 preferably has a columnar shape that satisfies an aspect ratio, which is defined by formula (1) below, of 1 or more.

$$\text{Aspect ratio} = h/w \quad (1)$$

[0045] w is the width of the transverse section of the tobacco section 10, h is the size of the tobacco section 10 in the center line direction, and preferably $h \geq w$. The transverse section may have any shape, such as polygon, rounded polygon, circle, or ellipse. The width w is a diameter when the transverse section is circular, a major axis when the transverse section is elliptical, or the diameter of the circumscribed circle or the major axis of the circumscribed ellipse when the transverse section is polygonal or rounded-polygonal.

[0046] The size h of the tobacco section 10 in the center line direction, which may be appropriately changed according to the size of the product, is typically 10 mm or more, preferably 12 mm or more, more preferably 15 mm or more, still more preferably 18 mm or more. The size h of the tobacco section 10 in the center line direction is typically 70 mm or less, preferably 50 mm or less, more preferably 30 mm or less, still more preferably 25 mm or less.

[0047] In the center line direction, the ratio of the size h of the tobacco section 10 in the center line direction to the size of the stick 1 in the center line direction is not limited, but typically 10% or more, preferably 20% or more, more preferably 25% or more, still more preferably 30% or more, from the viewpoint of the balance between delivery amount and aerosol temperature. The ratio of the size h of the tobacco section 10 in the center line direction to the size of the stick 1 in the center line direction is typically 80% or less, preferably 70% or less, more preferably 60% or less, still more preferably 50% or less, yet still more preferably 45% or less, most preferably 40% or less.

[0048] The amount of the aerosol source 11 in the tobacco section 10 is not limited, and for example, 200 mg or more and 800 mg or less, preferably 250 mg or more and 600 mg or less. This range is particularly preferred when the tobacco section 10 has a circumference of 22 mm and a size of 20 mm in the center line direction.

[Cooling Section 20]

[0049] The cooling section 20 is adjacent to the tobacco section 10 and the filter section 30 and formed by wrapping forming paper 21 so as to provide a hollow (cavity) in the transverse section, such as a tubular shape.

[0050] The size of the cooling section 20 in the center line direction, which may be appropriately changed according to the size of the product, is typically 5 mm or more, preferably 10 mm or more, more preferably 15 mm or more. The size of the cooling section 20 in the center line direction is typically 35 mm or less, preferably 30 mm or less, more preferably 25 mm or less. When the size of the cooling section 20 in the center line direction is greater than or equal to the lower limit described above, it is possible to ensure an adequate cooling effect and provide a good flavor. When the

size of the cooling section 20 in the center line direction is smaller than or equal to the upper limit described above, it is possible to reduce losses due to attachment of generated steam and aerosol to the forming paper 21.

[0051] The cooling section 20 preferably has a large inner surface area. The forming paper 21 for forming the cooling section 20 may be formed of a sheet of thin material that has been wrinkled to form a channel, and then pleated, gathered, and folded. Many folds or wrinkles in a given volume of the element increase the total surface area of the cooling section 20.

[0052] The thickness of the forming paper 21 is not limited, and may be, for example, 5 μm or more and 500 μm or less, or may be 10 μm or more and 250 μm or less. The material of the forming paper 21 is not limited and, for example, may contain pulp as a main component or may contain any one of polyethylene, polypropylene, polyvinyl chloride, polyethylene terephthalate, polylactic acid, cellulose acetate, and aluminum foil as a main component, or any combination of these materials.

[0053] The cooling section 20 has perforations V (also referred to as a “ventilation filter (Vf)” in the art) concentrically arranged in the circumferential direction. The perforations V are present in a region where air can flow in from the outside of the stick 1, namely, a region that protrudes from the opening 142 while the stick 1 is held by the holder 140 of the inhaler device 100.

[0054] The presence of the perforations V allows air to flow into the cooling section 20 from the outside during inhalation and can thus lower the temperature of steam and air flowing in from the tobacco section 10. When the perforations V is positioned in a region of 4 mm or more from the boundary between the cooling section 20 and the filter section 30 in the direction from the boundary to the cooling section 20 side, it is possible to not only improve the cooling capacity but also prevent residence of thermally generated materials (products) in the cooling section 20 to improve the product delivery amount.

[0055] The steam generated by heating the tobacco section 10 and produced from an aerosol serving as condensation nuclei becomes liquid when it comes into contact with outside air and decreases in temperature, which can accelerate generation of an aerosol.

[0056] When the concentric perforations V are treated as one perforation group in the cooling section 20, the cooling section 20 may have one perforation group or two or more perforation groups. When two or more perforation groups are present, it is preferred that no perforation group be disposed in a region of less than 4 mm from the boundary between the cooling section 20 and the filter section 30 in the direction from the boundary to the cooling section 20 side in order to improve the delivery amount of thermally generated components.

[0057] When the stick 1 includes the tipping paper 40 wrapped around the tobacco section 10, the cooling section 20, and the filter section 30, the tipping paper 40 preferably has perforations directly above the perforations V of the cooling section 20. In production of the stick 1 having such a structure, the tipping paper 40 having perforations overlapping the perforations V may be prepared and wrapped, but openings penetrating both the cooling section 20 and the tipping paper 40 are preferably made after preparing the stick 1 having no perforations V from the viewpoint of ease in manufacture.

[0058] The region where the perforations V are present is not limited as long as it is a region of 4 mm or more from the boundary between the cooling section 20 and the filter section 30 in the direction from the boundary to the cooling section 20 side in order to improve the delivery of the thermally generated products. To further improve the delivery of the products, the region where the perforations V are present is preferably a region of 4.5 mm or more, more preferably a region of 5 mm or more, still more preferably a region of 5.5 mm or more. To ensure the cooling function, the region where the perforations V are present is preferably a region of 15 mm or less, more preferably a region of 10 mm or less, still more preferably a region of 7 mm or less.

[0059] To improve the delivery of the thermally generated products, the region where the perforations V are present is preferably a region of 24 mm or more, preferably a region of 24.5 mm or more, preferably a region of 25 mm or more, more preferably a region of 25.5 mm or more from the end surface of the stick 1 on the first side in the direction from the end surface of the stick 1 on the first side to the cooling section 20 side. To ensure the cooling function, the region where the perforations V are present is preferably a region of 35 mm or less, more preferably a region of 30 mm or less, still more preferably a region of 27 mm or less.

[0060] When the region where the perforations V are present is defined with respect to the boundary between the cooling section 20 and the tobacco section 10, and the size of the cooling section 20 in the center line direction is 20 mm or more, the region where the perforations V are present is preferably a region of 5 mm or more, more preferably a region of 10 mm or more, still more preferably a region of 13 mm or more from the boundary between the cooling section 20 and the tobacco section 10 in the direction from the boundary to the cooling section 20 side to ensure the cooling function. To improve the delivery of the thermally generated products, the region where the perforations V are present is preferably a region of 16 mm or less, more preferably a region of 15.5 mm or less, still more preferably a region of 15 mm or less, yet still more preferably a region of 14.5 mm or less.

[0061] The perforations V are provided such that the air inflow ratio through the perforations V at the time of inhalation at 17.5 ml/sec with an automatic smoking machine is 10 vol % or more and 90 vol % or less. The "air inflow ratio" is the volume ratio of air flowing in through the perforations V when the proportion of air inhaled from the mouthpiece end is 100 vol %. The air inflow ratio is preferably 50 vol % or more and 80 vol % or less, more preferably 55 vol % or more and 75 vol % or less. This air inflow ratio can be achieved by, for example, a combination of the number of perforations V per perforation group selected in the range of 5 to 50 and the diameter of the perforations V selected in the range of 0.1 mm or more and 0.5 mm or less.

[0062] This air inflow ratio can be measured by the method in conformity with ISO 9512 using an automatic smoking machine (e.g., 1-port automatic smoking machine available from Borgwaldt KC GmbH).

[Filter Section 30]

[0063] The filter section 30 includes: a first filter 31 connected to the second side of the cooling section 20; a second filter 32 located on the second side of the first filter 31; and roll paper 33 wrapped around the first filter 31 and

the second filter 32. The filter section 30 is connected to the second side of the cooling section 20.

[0064] The first filter 31 has a tubular shape, and the second filter 32 has a columnar shape. The diameters of the outer circumferential surfaces of the first filter 31 and the second filter 32, which may be appropriately changed according to the size of the product, are typically 4.0 mm or more and 9.0 mm or less, preferably 4.5 mm or more and 8.5 mm or less, more preferably 5.0 mm or more and 8.0 mm or less. The transverse sections of the first filter 31 and the second filter 32 are not necessarily circular and may be polygonal, elliptical, or other shapes.

[0065] The outer circumferences of the transverse sections of the first filter 31 and the second filter 32, which may be appropriately changed according to the size of the product, are typically 14.0 mm or more and 27.0 mm or less, preferably 15.0 mm or more and 26.0 mm or less, more preferably 16.0 mm or more and 25.0 mm or less.

[0066] The size of the filter section 30 in the center line direction, which may be appropriately changed according to the size of the product, is typically 5 mm or more and 35 mm or less, preferably 10 mm or more and 30 mm or less, more preferably 15 mm or more and 25 mm or less.

[0067] The ventilation resistance per 120 mm of the filter section 30 in the center line direction is not limited, but it is typically 40 mmH₂O or more and 300 mmH₂O or less, preferably 70 mmH₂O or more and 280 mmH₂O or less, more preferably 90 mmH₂O or more and 260 mmH₂O or less.

[0068] The ventilation resistance is measured by using, for example, a filter ventilation resistance meter available from Cerulean in conformity with an ISO standard method (ISO 6565). The ventilation resistance of the filter section 30 refers to a difference in pressure between the first side and the second side when air is passed at a predetermined air flow rate (17.5 cc/min) from the first side to the second side while air permeation does not occur in the side surface of the filter section 30. The unit is typically expressed in mmH₂O.

[0069] The first filter 31 and the second filter 32 are not limited as long as they contain a filter material and have typical filter functions. Examples of typical filter functions include control of the amount of air mixed during inhalation of an aerosol and other materials, flavor reduction, and nicotine and tar reduction. The first filter 31 and the second filter 32 do not necessarily have all of these functions. In the non-combustion heating-type stick 1, which tends to generate less components and tends to have a lower packing ratio of the aerosol source 11 than cigarette products, one of important functions of the first filter 31 and the second filter 32 is to prevent the aerosol source 11 from falling off while suppressing the filtration function.

[0070] Examples of the filter material constituting the first filter 31 and the second filter 32 include a product obtained by forming a filling material, such as cellulose acetate fiber, non-woven fabric, or pulp paper into a columnar shape. The filter material may be a paper filter filled with sheet-shaped pulp paper.

[0071] The density of the filter material is not limited, but it is typically 0.10 g/cm³ or more and 0.25 g/cm³ or less, preferably 0.11 g/cm³ or more and 0.24 g/cm³ or less, more preferably 0.12 g/cm³ or more and 0.23 g/cm³ or less.

[Tipping Paper 40]

[0072] The tipping paper 40 is integrally wrapped around the cooling section 20 and the filter section 30 to connect (couple) an end portion of the cooling section 20 on the second side to an end portion of the filter section 30 on the first side.

[0073] Examples of the material of the tipping paper 40 include materials containing pulp as a main component. The pulp may be wood pulp, such as softwood pulp and hardwood pulp, or may be manufactured by blending non-wood pulp commonly used in wrapping paper for tobacco articles, such as flax pulp, hemp pulp, sisal pulp, or esparto. These types of pulp may be used singly or may be used in combination of two or more at any ratio.

[0074] The form of pulp may be chemical pulp, ground pulp, chemiground pulp, thermomechanical pulp, or other pulps made by kraft cooking, acid/neutral/alkaline sulfite cooking, soda salt cooking, or other methods.

[0075] The tipping paper 40 may be composed of one sheet or two or more sheets.

[0076] The tipping paper 40 may have any shape, and may be, for example, square or rectangle.

[0077] The basis weight of the tipping paper 40 is not limited, but the basis weight is typically 32 gsm or more and 60 gsm or less, preferably 33 gsm or more and 55 gsm or less, more preferably 34 gsm or more and 53 gsm or less.

[0078] The air permeability of the tipping paper 40 is not limited, but the air permeability is typically 0 CORESTA units or more and 30000 CORESTA units or less, preferably more than 0 CORESTA units and 10000 CORESTA units or less. The air permeability is a value measured in conformity with ISO 2965: 2009 and expressed by the flow rate (cm^3) of gas passing through an area of 1 cm^2 per minute when a difference in pressure between both sides of paper is 1 kPa. One CORESTA unit (1 CORESTA unit, 1 C.U.) is $\text{cm}^3/(\text{min}\cdot\text{cm}^2)$ at 1 kPa.

[0079] The tipping paper 40 may contain a filler in addition to the pulp described above. Examples of the filler include metal carbonates, such as calcium carbonate and magnesium carbonate; metal oxides, such as titanium oxide, titanium dioxide, and aluminum oxide; metal sulfates, such as barium sulfate and calcium sulfate; metal sulfides, such as zinc sulfide; and quartz, kaolin, talc, diatomaceous earth, and gypsum. In particular, the tipping paper 40 preferably contains calcium carbonate to improve whiteness and opacity and increase the heating speed. These fillers may be used singly or in combination of two or more.

[0080] The tipping paper 40 may contain various aids in addition to the pulp and the filler described above. For example, the tipping paper 40 may contain a water resistance improver to improve water resistance. Examples of the water resistance improver include wet-strength agents (WS agents) and sizing agents. Examples of wet-strength agents include urea formaldehyde resin, melamine formaldehyde resin, and polyamide epichlorohydrin (PAE). Examples of sizing agents include rosin soap, alkyl ketene dimers (AKDs), alkenyl succinic anhydrides (ASAs), and highly saponified polyvinyl alcohol with degree of saponification of 90% or more.

[0081] A coating agent may be applied to at least one of two sides, the front side and the back side, of the tipping paper 40. The coating agent is not limited, but preferably a coating agent that can form a film on the front side of the paper to reduce liquid permeability.

[0082] The outer surface of the tipping paper 40 may be partially coated with a lip release material. The lip release material means a material that, when a user holds the filter section 30 of the stick 1 in their mouth, assists in easily separating contact between the lip and the tipping paper 40 with substantially no adhesion. The lip release material may contain, for example, ethyl cellulose, methyl cellulose, or other substances. For example, the outer surface of the tipping paper 40 may be coated with a lip release material by applying an ethyl cellulose ink or methyl cellulose ink to the outer surface of the tipping paper 40.

[0083] For example, the roll paper 33 of the filter section 30 is also made of the same material as the tipping paper 40 or other materials.

[Structure of Tobacco Section 10]

(Aerosol Source 11)

[0084] The aerosol source 11 includes: a packed section 51 packed with tobacco; and a tobacco sheet 52 formed by using granules of ground tobacco leaves and wrapped around the packed section 51.

(Packed Section 51)

[0085] Examples of the material of the packed section 51 include lamina and midrib. The packed section 51 may be composed of, for example, shredded tobacco leaves. The packed section 51 may be composed of a material produced as follows: grinding dry tobacco leaves into ground tobacco having an average particle size of $20 \mu\text{m}$ or more and $200 \mu\text{m}$ or less, processing homogenized ground tobacco into a sheet (hereinafter also referred to simply as a "homogenized sheet"), and shredding the sheet. The packed section 51 may be composed of a material produced by shredding a homogenized sheet, which has a size similar to the size of the tobacco section 10 in the center line direction, in a direction substantially parallel to the center line direction of the tobacco section 10. The width of the packed section 51 is, for example, 0.5 mm or more and 2.0 mm or less. The packed section 51 may be produced by gathering a homogenized sheet, which has a size similar to the size of the tobacco section 10 in the center line direction, into folds, in other words, folding the homogenized sheet multiple times in the direction parallel to the center line direction. The packed section 51 may be composed of tobacco granules made from tobacco powder.

[0086] The type of tobacco used as tobacco leaves used to prepare the packed section 51 is not limited. Examples of the type of tobacco include yellow species, Burley species, oriental species, local species, other species belonging to *Nicotiana tabacum* or *Nicotiana rustica*, and mixtures thereof. Various types of tobacco can be appropriately blended to obtain an intended flavor and used as a mixture. The details of the types of tobacco are disclosed in "Encyclopedia of Tobacco, Tobacco Research Center, Japan, 2009, 3, 31."

[0087] The method for manufacturing the homogenized sheet, namely, the method for grinding tobacco leaves and processing ground tobacco leaves into the homogenized sheet, is not limited. For example, a papermaking process may be used to produce the homogenized sheet. Alternatively, a suitable solvent, such as water, may be mixed with ground tobacco leaves and homogenized, and the homog-

enized material may be then thinly cast on a metal plate or metal plate belt. Alternatively, a suitable solvent, such as water, may be mixed with ground tobacco leaves and homogenized, and the homogenized material may be extruded in a sheet shape to produce a rolled sheet. The details of the types of homogenized sheets are disclosed in "Encyclopedia of Tobacco, Tobacco Research Center, Japan, 2009, 3, 31."

[0088] The water content of the packed section **51** relative to the total mass of the aerosol source **11** is, for example, 10 mass % or more and 15 mass % or less, preferably 11 mass % or more and 13 mass % or less. With such a water content, generation of wrapping stains can be prevented or reduced to improve machinability during manufacture of the tobacco section **10**.

[0089] The packed section **51** may contain an extract from various natural products and/or components of the extract according to the intended use. Examples of the extract and/or components of the extract include glycerine, propylene glycol, triacetin, 1,3-butanediol, and mixtures thereof.

[0090] The amount of the extract and/or components of the extract in the packed section **51** is typically 5 mass % or more, preferably 10 mass % or more relative to the total mass of the aerosol source **11** in order to generate a sufficient amount of aerosol and impart a good flavor. The amount of the extract and/or components of the extract in the packed section **51** is typically 50 mass % or less, preferably 15 mass % or more and 25 mass % or less.

[0091] The packed section **51** may contain a flavoring agent. The type of flavoring agent is not limited and particularly preferably menthol in order to impart a good flavor. The flavoring agent may be used singly or in combination of two or more.

(Tobacco Sheet **52**)

[0092] The tobacco sheet **52** may be manufactured by, for example, a known method, such as a papermaking method, a slurry method, or a rolling method, using the type of tobacco leaf described above.

[0093] In the case of the papermaking method, the tobacco sheet **52** can be manufactured by a method including the following steps. 1) Dry tobacco leaves are roughly ground and extracted with water to separate the water extract and the residue. 2) The water extract is concentrated by vacuum drying. 3) Pulp is added to the residue, and the obtained mixture is fiberized in a refiner, followed by a papermaking process. 4) The concentrated water extract is added to the sheet obtained by the papermaking process, and the sheet is dried to form a tobacco sheet. In this case, a step of removing some of components, such as nitrosamine, may be added (see Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2004-510422). The tobacco sheet manufactured by the papermaking process may be referred to as a "papermaking sheet."

[0094] In the case of the slurry method, the tobacco sheet **52** can be manufactured by a method including the following steps. 1) Water, pulp, a binder, and ground tobacco leaves are mixed. 2) The mixture is thinly spread (cast) and dried. In this case, a step of removing some of components, such as nitrosamine, by irradiating the slurry of the mixture of water, pulp, the binder, and the ground tobacco leaves with ultraviolet rays or X-rays may be added. The tobacco sheet manufactured by using the slurry method may be referred to as a "cast sheet."

[0095] In the case of the rolling method, a mixture of water, pulp, a binder, and ground tobacco leaves is spread under pressure and dried. The tobacco sheet manufactured by using the rolling method may be referred to as a "laminated sheet."

[0096] Alternatively, a non-woven fabric tobacco sheet manufactured by a method including the following steps can also be used as described in International Publication No. WO 2014/104078. 1) Granular tobacco leaves and a binding agent are mixed. 2) The mixture is sandwiched between sheets of non-woven fabric. 3) The multilayer material is formed into a certain shape by heat fusing to obtain a non-woven fabric tobacco sheet. The non-woven fabric tobacco sheet manufactured by the method including the above steps may be referred to as a "non-woven fabric sheet".

[0097] The composition of the tobacco sheet **52** is not limited. For example, the amount of tobacco leaves relative to the total mass of the tobacco sheet **52** is preferably 50 mass % or more and 95 mass % or less. The tobacco sheet **52** may contain a binder. Examples of the binder include guar gum, xanthan gum, carboxymethyl cellulose, and carboxymethyl cellulose sodium salt. The binder content relative to the total mass of the tobacco sheet **52** is preferably 1 mass % or more and 10 mass % or less. The tobacco sheet **52** may further contain other additives. Examples of the additives include a filler, such as pulp.

[0098] The tobacco sheet **52** may contain a polyol, such as glycerine, propylene glycol, and 1,3-butanediol, or other substances. The amount of the polyol added to the tobacco sheet relative to the dry mass of the tobacco sheet is preferably 5 mass % or more and 50 mass % or less, more preferably 15 mass % or more and 25 mass % or less.

[0099] The aerosol source **11** may have one tobacco sheet **52** or may have two or more tobacco sheets **52** stacked on top of each other. To wrap the tobacco sheet **52** around the packed section **51** in a columnar shape, for example, one end portion of the tobacco sheet **52** can be overlaid with the other end portion of the tobacco sheet **52** by about 2 mm in the circumferential direction, and glued to the other end portion to form a tubular shape, and the tubular tobacco sheet **52** can be filled with the packed section **51**. The size of the tobacco sheet **52** having a rectangular shape can be determined according to the size of the packed section **51**.

[0100] In an embodiment where the aerosol source **11** has two or more tobacco sheets **52**, for example, multiple tobacco sheets **52** having one side with a size similar to the size of the packed section **51** in the center line direction are wrapped around in the direction perpendicular to the center line direction such that the tobacco sheets **52** are concentrically disposed. The phrase "concentrically disposed" means that the tobacco sheets **52** are disposed such that the centers of all the tobacco sheets **52** are located at substantially the same position.

[0101] Two or more tobacco sheets **52** may all have the same composition or physical properties, or some or all of the tobacco sheets **52** may have different compositions or physical properties. The tobacco sheets **52** may have the same thickness or different thicknesses. The thickness of each tobacco sheet **52** is preferably, but not necessarily, 150 μm or more and 1000 μm or less, more preferably 200 μm or more and 600 μm or less, from the viewpoint of the balance between heat transfer efficiency and strength.

[0102] The packing density of the aerosol source **11** is typically, but not necessarily, 250 mg/cm³ or more, preferably 300 mg/cm³ or more in order to ensure the function of the stick **1** and impart a good flavor. The packing density of the aerosol source **11** is typically 400 mg/cm³ or less, preferably 350 mg/cm³ or less.

[0103] The aerosol source **11** may contain a material not derived from tobacco and produced from a plant (e.g., mint or herbs) other than tobacco. For example, the aerosol source **11** may contain a flavoring agent component, such as menthol.

(Wrapping Paper **12**)

[0104] The wrapping paper **12** contains, for example, pulp as a main component. The pulp may be wood pulp, such as softwood pulp and hardwood pulp, or may be produced by blending non-wood pulp commonly used in wrapping paper **12** for tobacco products, such as flax pulp, hemp pulp, sisal pulp, or esparto. The wrapping paper **12** may be formed by attaching a material containing pulp as a main component to the same product as the tobacco sheet **52**.

[0105] The type of pulp may be chemical pulp, ground pulp, chemiground pulp, thermomechanical pulp, or other pulps made by kraft cooking, acid/neutral/alkaline sulfite cooking, soda salt cooking, or other methods.

[0106] The wrapping paper **12** is manufactured by using pulp and conditioning and homogenizing the texture in the papermaking process using a fourdrinier paper machine, a cylinder paper machine, a cylinder-short combined paper machine, or other machines. If necessary, a wet-strength agent may be added to impart water resistance to the wrapping paper **12**, or a sizing agent can be added to adjust the printing conditions for the wrapping paper **12**. In addition, internal aids for papermaking, such as aluminum sulfate, various anionic, cationic, nonionic, or amphoteric yield enhancers, freeness improvers, and paper-strength agents, and additives for paper manufacturing, such as dyes, pH adjusters, antifoaming agents, pitch control agents, and slime control agents, can be added.

[0107] The basis weight of the base paper of the wrapping paper **12** is, for example, typically 20 gsm or more, preferably 25 gsm or more. The basis weight is typically 65 gsm or less, preferably 50 gsm or less, still more preferably 45 gsm or less.

[0108] The thickness of the wrapping paper **12** is typically, but not necessarily, 10 μ m or more, preferably 20 μ m or more, more preferably 30 μ m or more from the viewpoint of rigidity, air permeability, and ease of adjustment in the paper manufacturing process. The thickness of the wrapping paper **12** is typically 100 μ m or less, preferably 75 μ m or less, more preferably 50 μ m or less.

[0109] Examples of the shape of the wrapping paper **12** for producing the tobacco section **10** include square and rectangle. The length of one side of the wrapping paper **12** is, for example, about 12 mm or more and 70 mm or less, and the length of the other side is, for example, about 15 mm or more and 28 mm or less, preferably about 22 mm or more and 24 mm or less, more preferably about 23 mm. To wrap the wrapping paper **12** around the aerosol source **11** in a columnar shape, for example, one end portion of the wrapping paper **12** can be overlaid with the other end portion of the wrapping paper **12** by about 2 mm in the circumferential direction, and glued to the other end portion to form a paper tube with a tubular shape, and the wrapping paper **12** having

a tubular shape can be filled with the aerosol source **11**. The size of the wrapping paper **12** having a rectangular shape can be determined according to the size of the tobacco section **10**.

[0110] The wrapping paper **12** may contain a filler in addition to the pulp described above. The filler content relative to the total mass of the wrapping paper **12** is, for example, 10 mass % or more and less than 60 mass %, preferably 15 mass % or more and 45 mass % or less.

[0111] The wrapping paper **12** in a suitable basis weight range (25 gsm or more and 45 gsm or less) preferably contains 15 mass % or more and 45 mass % or less of the filler.

[0112] When the basis weight is 25 gsm or more and 35 gsm or less, the filler is preferably 15 mass % or more and 45 mass % or less. When the basis weight is 35 gsm or more and 45 gsm or less, the filler is preferably 25 mass % or more and 45 mass % or less.

[0113] The filler may be, for example, calcium carbonate, titanium dioxide, or kaolin, and preferably calcium carbonate in order to, for example, improve flavor and whiteness.

[0114] The wrapping paper **12** may contain various aids in addition to the base paper and the filler. For example, the wrapping paper **12** may contain a water resistance improver to improve water resistance. Examples of the water resistance improver include wet-strength agents (WS agents) and sizing agents. Examples of wet-strength agents include urea formaldehyde resin, melamine formaldehyde resin, and polyamide epichlorohydrin (PAE). Examples of sizing agents include rosin soap, alkyl ketene dimers (AKDs), alkenyl succinic anhydrides (ASAs), and highly saponified polyvinyl alcohol with degree of saponification of 90% or more.

[0115] A paper strength agent may be added as an aid. Examples of the paper strength agent include polyacrylamide, cationic starch, oxidized starch, CMC, polyamide-epichlorohydrin resin, and polyvinyl alcohol. In particular, it is known that the use of a very small amount of oxidized starch can improve air permeability (Japanese Unexamined Patent Application Publication No. 2017-218699).

[0116] A coating agent may be applied to at least one of two sides, the front side and the back side, of the wrapping paper **12**. The coating agent is not limited, but preferably a coating agent that can form a film on the front side of the paper to reduce liquid permeability. Examples of the coating agent include alginic acid and its salts (e.g., sodium salt), polysaccharides, such as pectin; cellulose derivatives, such as ethyl cellulose, methyl cellulose, carboxymethyl cellulose, nitrocellulose; starch and its derivatives (e.g., ether derivatives, such as carboxymethyl starch, hydroxyalkyl starch, and cationic starch; and ester derivatives, such as starch acetate, starch phosphate, and starch octenyl succinate).

[0117] As described above, the stick **1** includes: the tobacco section **10** that has an aerosol source containing tobacco; the cooling section **20** that cools steam generated by heating the tobacco section **10** with the heater **121**, which is an example heat generating element, to generate an aerosol; and the filter section **30** through which the aerosol passes. In the tobacco section **10**, the tobacco sheet **52** formed by using granules of ground tobacco leaves is disposed near the heater **121**, and the packed section **51** packed with tobacco is disposed at a position farther from the heater **121** than the tobacco sheet **52**. In other words, the

heater 121 has a film shape and is disposed to cover the outer circumference of the holder 140. The tobacco sheet 52 is wrapped around the packed section 51 in the tobacco section 10. When the tobacco sheet 52 is wrapped around the packed section 51 in this way, the packing density of tobacco in an outer circumferential portion of the tobacco section 10, which is a portion near the heater 121, is higher than the packing density in an inner portion far from the heater 121.

[0118] The above structure is based on the following finding of intensive studies carried out by the inventors of the present disclosure: when the packing density of tobacco in a portion of the tobacco section 10 near the heater 121 is higher than the packing density in a portion far from the heater 121, the heat from the heater 121 can be efficiently used to increase the delivery amount of filling materials, such as nicotine and glycerine.

[0119] FIG. 3A and FIG. 3B each shows the comparison results of the delivery amount of nicotine or glycerine when the aerosol source 11 in the tobacco section 10 has different structures.

[0120] FIG. 4 shows the comparison of the structure of the aerosol source 11.

[0121] As described in FIG. 4, a sample A is prepared by using a cast sheet as the tobacco sheet 52, and wrapping the cast sheet and the wrapping paper 12, which are pasted together, around the packed section 51 for one turn (i.e., single-turn structure). A sample B is prepared by using a laminate sheet as the tobacco sheet 52, and wrapping the laminate sheet and the wrapping paper 12, which are pasted together, around the packed section 51 for one turn (i.e., single-turn structure). A sample C is prepared by wrapping the wrapping paper 12 around the packed section 51 for one turn (i.e., single-turn structure) without using the tobacco sheet 52. The sample A, the sample B, and the sample C have the same size in the center line direction, and the sizes of the tobacco section 10, the cooling section 20, and the first filter 31, and the second filter 32 in the center line direction are 1.2 mm, 2.8 mm, 8 mm, and 7 mm, respectively. The air inflow ratio through the perforations V is 70 vol %.

[0122] The packing ratio of the packed section 51 is controlled such that the packing weight (mgWB) of tobacco in the tobacco section 10 including the raw material weight of the tobacco sheet 52 is the same in the sample A, the sample B, and the sample C. For example, as described in FIG. 4, in the sample C without the tobacco sheet 52, the packing weight in the packed section 51, namely, the packing weight in the tobacco section 10, is 264 mgWB, whereas in the sample A, the packing weight in the cast sheet and the wrapping paper 12, which are pasted together, is 39 mgWB, and the packing weight in the packed section 51 is 225 mgWB. In the sample B, the packing weight in the laminate sheet and the wrapping paper 12, which are pasted together, is 56 mgWB, and the packing weight in the packed section 51 is 208 mgWB. In the sample A, the proportion of the packing weight in the cast sheet and the wrapping paper 12, which are pasted together, is 14.8 ($=39/264 \times 100$)%. In the sample B, the proportion of the packing weight in the laminate sheet and the wrapping paper 12, which are pasted together, is 21.2 ($=56/264 \times 100$)%.

[0123] In the sample A, the sample B, and the sample C, the tobacco section 10 has the same outside diameter, which is 7.1 mm. In the sample A, the inside diameter of the cast sheet and the wrapping paper 12, which are pasted together, is 6.75 mm (i.e., the thickness is 0.175 mm). In the sample

B, the inside diameter of the laminate sheet and the wrapping paper 12, which are pasted together, is 6.75 mm (i.e., the thickness is 0.175 mm). In the sample C, the inside diameter of the wrapping paper 12 is 7.02 mm (i.e., the thickness is 0.04 mm). The volume of the packed section 51 is 258 mm³ in the sample A, 238 mm³ in the sample B, and 302 mm³ in the sample C. The volume packing ratio is 60% in the sample A, 55% in the sample B, and 65% in the sample C.

[0124] FIGS. 3A and 3B show the comparison results of the delivery amounts of nicotine and glycerine when the sample A, the sample B, and the sample C are heated with the inhaler device 100. The horizontal axis indicates the number of puffs (inhalation) with the stick 1. The delivery amounts of nicotine and glycerine are measured for each inhalation. The heating in the inhaler device 100 involves setting the target temperature of the heater 121 to 280 degrees, performing heating for 15 seconds from the unheated state, and then setting the target temperature to constant 260 degrees. Fifteen seconds correspond to the time for the heater 121 to reach 280 degrees from the unheated state, namely, ambient temperature (e.g., room temperature), after the heater 121 starts producing heat. The puff conditions in measurement of the delivery amount are as described below. The delivery amount is measured by using an automatic smoking machine (Borgwaldt single-port smoking machine R26) in accordance with the intense method proposed by Health Canada under the following conditions: inhalation capacity 55 ml; inhalation time 2 seconds per puff; and inhalation interval 30 seconds. The perforations V are open during measurement.

[0125] As shown in FIG. 3A, the nicotine delivery amount of the sample A and the sample B where the aerosol source 11 has the tobacco sheet 52 is larger than the nicotine delivery amount of the sample C without the tobacco sheet 52. In particular, the nicotine delivery amount significantly increases from the third inhalation to the seventh inhalation. There is no significant difference between the sample A and the sample B, but the delivery amount of the sample B including the laminate sheet is larger than the delivery amount of the sample A including the cast sheet. This may be because the packing weight in the laminate sheet and the wrapping paper 12, which are pasted together, is larger than the packing weight in the cast sheet and the wrapping paper 12, which are pasted together.

[0126] As shown in FIG. 3B, the glycerine delivery amount of the sample A and the sample B where the aerosol source 11 has the tobacco sheet 52 is also larger than the glycerine delivery amount of the sample C without the tobacco sheet 52. In particular, the glycerine delivery amount significantly increases from the fifth inhalation to the ninth inhalation. There is no significant difference between the sample A and the sample B, but the delivery amount of the sample B including the laminate sheet is larger than the delivery amount of the sample A including the cast sheet. This may be because the packing weight in the laminate sheet and the wrapping paper 12, which are pasted together, is larger than the packing weight in the cast sheet and the wrapping paper 12, which are pasted together.

[0127] The results shown in FIG. 3A and FIG. 3B indicate that, when the packing density of tobacco in an outer circumferential portion of the tobacco section 10, which is a portion near the heater 121, is higher than the packing density in a portion far from the heater 121, the heat from the

heater 121 can be efficiently used to increase the delivery amounts of nicotine and glycerine.

[0128] The results shown in FIG. 3A and FIG. 3B indicate that the stick 1 having such a configuration allows more efficient use of the heat from the heater 121 to increase the delivery amounts of nicotine and glycerine than the stick 1 where, for example, the aerosol source 11 has no tobacco sheet 52, and the wrapping paper 12 is wrapped around the packed section 51, so that the aerosol source 11 has uniform packing density of tobacco from the outer circumferential portion to the inner portion.

[0129] In the sample A and the sample B described above, a cover that includes the tobacco sheet 52 and is wrapped around the packed section 51 extends inward from the outer circumferential surface of the tobacco section 10 to a depth of 0.175 mm, namely, about 5% of the radius (3.55 mm) of the tobacco section 10. The cover preferably extends to 10% of the radius of the tobacco section 10. This is because, if the cover to be wrapped around the packed section 51 is thick, high rigidity makes wrapping difficult. If the cover can be wrapped around, the cover may extend to 20% of the radius of the tobacco section 10.

[0130] In other words, in the stick 1, the packing density of tobacco in a portion that extends inward from the outer circumferential surface of the tobacco section 10 to 20% of the radius is preferably higher than the packing density of tobacco in a portion inside 20% of the radius. More preferably, in the stick 1, the packing density of tobacco in a portion that extends inward from the outer circumferential surface of the tobacco section 10 to 10% of the radius is higher than the packing density of tobacco in a portion inside 10% of the radius. According to this configuration, the heat from the heater 121 can be efficiently used to increase the delivery amount of filling materials, such as nicotine and glycerine.

[0131] In the tobacco section 10, the aerosol source 11 has the tobacco sheet 52 in its outer circumferential portion, and the aerosol source 11 is further wrapped in the wrapping paper 12. The tobacco section 10 is not limited to this structure. For example, the tobacco section 10 does not necessarily have the wrapping paper 12.

[0132] The way to make the packing density of tobacco in the outer circumferential portion of the tobacco section 10 higher than the packing density of tobacco in the inner portion is not necessarily to cover the circumference of the packed section 51 with the cover including the tobacco sheet 52.

[0133] FIG. 5 illustrates an example longitudinal section of the tobacco section 10 according to a modification.

[0134] As illustrated in FIG. 5, the packed section 51 may include a first packed section 511 in an outer circumferential portion and a second packed section 512 inside the first packed section 511, and the first packed section 511 may have a higher packing density of tobacco than the second packed section 512.

Second Embodiment

[0135] FIG. 6 illustrates an example longitudinal section of a stick 2 according to a second embodiment.

[0136] The stick 2 according to the second embodiment differs from the stick 1 according to the first embodiment in a tobacco section 210 corresponding to the tobacco section 10. Hereinafter, points different from the first embodiment will be described. In the first embodiment and the second

embodiment, the same elements are assigned with the same reference signs. The details of the same elements are not described.

[0137] FIG. 7 schematically illustrates an example general structure of an inhaler device 200 in which the stick 2 according to the second embodiment is used.

[0138] The inhaler device 200, in which the stick 2 is used, differs from the inhaler device 100, in which the stick 1 according to the first embodiment is used, in a heater 221 corresponding to the heater 121. Hereinafter, points different from the inhaler device 100 will be described. In the inhaler device 200 and the inhaler device 100, the same elements are assigned with the same reference signs. The details of the same elements are not described.

[0139] The heater 221 has a blade shape and protrudes from a central portion of a bottom 143 of the holder 140 into an internal space 141 of a holder 140 in the center line direction. When the stick 2 is inserted into the holder 140, the heater 221 having a blade shape is inserted into the stick 2 such that the heater 221 pierces the tobacco section 210 of the stick 2. When the heater 221 produces heat, the aerosol source included in the tobacco section 210 of the stick 2 is heated and atomized from the inside of the stick 2 to generate an aerosol.

[0140] In the tobacco section 210 of the stick 2, the packing density of tobacco in a central portion near the heater 221 is higher than the packing density in an outer circumferential portion far from the heater 221.

[0141] More specifically, the tobacco section 210 has: an aerosol source 211 that, when heated, produces steam for generating an aerosol; and wrapping paper 212 that covers the outer circumference of the aerosol source 211 and is the same as the wrapping paper 12. The tobacco section 210 has a columnar shape such that the wrapping paper 212 is wrapped around the aerosol source 211.

[0142] The aerosol source 211 corresponds to the packed section 51 of the stick 1 and is packed with tobacco. The aerosol source 211 has a first packed section 251 provided in an outer circumferential portion and having a tubular shape, and a second packed section 252 provided inside the first packed section 251 and having a columnar shape. In addition, the second packed section 252 has a higher packing density of tobacco than the first packed section 251.

[0143] For example, the tobacco section 210 can be manufactured by, for example, packing shredded tobacco leaves and other materials (hereinafter may be referred to as “shredded tobacco”) inside the first packed section 251, which is formed by compacting shredded tobacco into a tubular shape, to form the second packed section 252; and then wrapping the wrapping paper 212 around the first packed section 251. Alternatively, the tobacco section 210 can be manufactured by, for example, packing shredded tobacco outside the second packed section 252, which is formed by compacting shredded tobacco into a columnar shape, to form the first packed section 251; and wrapping the wrapping paper 212 around the shredded tobacco.

[0144] Preferably, the second packed section 252 is disposed around the heater 221 piercing the second packed section 252 such that the thickness of the second packed section 252 in the radial direction is at least 20% of the radius of the tobacco section 210. More preferably, the thickness of the second packed section 252, which is present around the heater 221, in the radial direction is 10% of the radius of the tobacco section 210.

[0145] The second packed section 252 may have a tubular shape before the heater 221 having a blade shape is inserted into the second packed section 252. When the second packed section 252 has a tubular shape, and the heater 221 has a circular transverse section, the inside diameter of the second packed section 252 is, for example, less than or equal to the diameter of the heater 221. When the second packed section 252 has a tubular shape, and the heater 221 has an elliptical transverse section, the inside diameter of the second packed section 252 is, for example, less than or equal to the major axis of the heater 221. When the second packed section 252 has a tubular shape, and the heater 221 has a polygonal transverse section, the inside diameter of the second packed section 252 is, for example, less than or equal to the diameter of the circumscribed circle or the major axis of the circumscribed ellipse of the heater 221.

[0146] When the second packed section 252 has a tubular shape, the second packed section 252 may include a tobacco sheet composed of at least one of the papermaking sheet, the cast sheet, the laminate sheet, and the non-woven fabric sheet described above. For example, the second packed section 252 having a tubular shape may be formed by wrapping the papermaking sheet for multiple turns. When the second packed section 252 includes a tobacco sheet composed of at least one of the papermaking sheet, the cast sheet, the laminate sheet, and the non-woven fabric sheet, the first packed section 251 is formed by packing shredded tobacco around the second packed section 252, and wrapping the wrapping paper 212 around the outside of the packed shredded tobacco.

[0147] The tobacco section 210 of the stick 2 having the structure described above is internally heated with the heater 221, which is an example heat generating element, disposed inside the tobacco section 210, and the second packed section 252 disposed inside has a higher packing density than the first packed section 251 disposed outside. According to this configuration, the heat from the heater 221 can be efficiently used to increase the delivery amount of filling materials, such as nicotine and glycerine.

[0148] The stick 2 may have a support, which supports the tobacco section 210, between the tobacco section 210 and the cooling section 20 in order to prevent the aerosol source 211 from moving to the second side in the center line direction when the heater 221 having a blade shape is inserted into the tobacco section 210. The support is a member having a tubular shape and is, for example, the same as the first filter 31.

Third Embodiment

[0149] FIG. 8 illustrates an example longitudinal section of a stick 3 according to a third embodiment.

[0150] The stick 3 according to the third embodiment differs from the stick 1 according to the first embodiment in a tobacco section 310 corresponding to the tobacco section 10. The tobacco section 310 has: an aerosol source 311 that, when heated, produces steam for generating an aerosol; and wrapping paper 312 that is the same as the wrapping paper 12 and covers the outer circumference of the aerosol source 311; and a susceptor 313 described below. Hereinafter, points different from the first embodiment will be described. In the first embodiment and the third embodiment, the same elements are assigned with the same reference signs. The details of the same elements are not described.

[0151] FIG. 9 schematically illustrates an example general structure of an inhaler device 300 in which the stick 3 according to the third embodiment is used.

[0152] The inhaler device 300, in which the stick 3 is used, differs from the inhaler device 100, in which the stick 1 according to the first embodiment is used, in that the inhaler device 300 includes an electromagnetic induction source 321 instead of the heater 121. Hereinafter, points different from the inhaler device 100 will be described. In the inhaler device 300 and the inhaler device 100, the same elements are assigned with the same reference signs. The details of the same elements are not described.

[0153] The electromagnetic induction source 321 causes the susceptor 313 of the stick 3 to produce heat through electromagnetic induction. The electromagnetic induction source 321 is composed of, for example, a conductor coil and wound around the outer circumference of the holder 140. The electromagnetic induction source 321 generates a magnetic field when an alternating current is supplied to the electromagnetic induction source 321 from the power supply 111. The electromagnetic induction source 321 is disposed at a position where the generated magnetic field overlaps an internal space 141 of the holder 140. When the magnetic field is generated with the stick 3 held by the holder 140, an eddy current is generated in the susceptor 313 to produce Joule heat. The aerosol source 311 in the stick 3 is then heated and atomized by the Joule heat to generate an aerosol.

[0154] The susceptor 313 produces heat through electromagnetic induction. The susceptor 313 is made of a conductive material, such as a metal. For example, the susceptor 313 is a piece of metal. The susceptor 313 is disposed inside the aerosol source 311. The susceptor 313 has, for example, a rectangular or columnar shape.

[0155] The aerosol source 311 has a first packed section 351 provided in an outer circumferential portion and having a tubular shape, and a second packed section 352 provided inside the first packed section 351 and disposed around the susceptor 313. The second packed section 352 has a higher packing density of tobacco than the first packed section 351.

[0156] For example, the tobacco section 310 can be manufactured by, for example, packing shredded tobacco around the susceptor 313 and inside the first packed section 351, which is formed by compacting shredded tobacco into a tubular shape, to form the second packed section 352; and then wrapping the wrapping paper 312 around the first packed section 351. Alternatively, the tobacco section 310 can be manufactured by, for example, packing shredded tobacco outside the second packed section 352, which is formed by compacting shredded tobacco into a columnar shape around the susceptor 313, to form the first packed section 351; and wrapping the wrapping paper 312 around the shredded tobacco.

[0157] The second packed section 352 may be formed by wrapping, around the susceptor 313, a tobacco sheet composed of at least one of the papermaking sheet, the cast sheet, the laminate sheet, and the non-woven fabric sheet described above. For example, the second packed section 352 may be formed by wrapping the papermaking sheet around the susceptor 313 for multiple turns. When the second packed section 352 includes a tobacco sheet composed of at least one of the papermaking sheet, the cast sheet, the laminate sheet, and the non-woven fabric sheet, the first packed section 351 may be formed by packing

shredded tobacco around the second packed section **352**, and wrapping the wrapping paper **312** around the outside of the packed shredded tobacco.

[0158] Preferably, the second packed section **352** is disposed around the susceptor **313** inside the second packed section **352** such that the minimum thickness of the second packed section **352** in the radial direction is at least 20% of the radius of the tobacco section **310**. More preferably, the minimum thickness of the second packed section **352**, which is present around the susceptor **313**, in the radial direction is 10% of the radius of the tobacco section **310**.

[0159] The tobacco section **310** of the stick **3** having the structure described above is internally heated with the susceptor **313**, which is an example heat generating element, disposed inside the tobacco section **310**, and the second packed section **352** disposed inside has a higher packing density than the first packed section **351** disposed outside. According to this configuration, the heat from the susceptor **313** can be efficiently used to increase the delivery amount of filling materials, such as nicotine and glycerine.

REFERENCE SIGNS LIST

- [0160] **1** non-combustion heating-type stick
- [0161] **10, 210, 310** tobacco section
- [0162] **11, 211, 311** aerosol source
- [0163] **12, 212, 312** wrapping paper
- [0164] **20** cooling section
- [0165] **30** filter section
- [0166] **40** tipping paper
- [0167] **51** packed section
- [0168] **52** tobacco sheet
- [0169] **121, 221** heater (example heat generating element)
- [0170] **251, 351, 511** first packed section
- [0171] **252, 352, 512** second packed section
- [0172] **313** susceptor (example heat generating element)
- [0173] **321** electromagnetic induction source
- 1.** A non-combustion heating-type stick comprising:
 - a tobacco section that has an aerosol source containing tobacco;
 - a cooling section that cools steam generated by heating the tobacco section with a heat generating element to generate an aerosol; and
 - a filter section through which the aerosol passes, wherein, in the tobacco section, a packing density of the tobacco in a portion near the heat generating element is higher than the packing density in a portion far from the heat generating element.
- 2.** The non-combustion heating-type stick according to claim **1**,

wherein the tobacco section is externally heated with the heat generating element disposed outside the tobacco section, and the packing density in an outer portion is higher than the packing density in an inner portion.

3. The non-combustion heating-type stick according to claim **2**,

wherein the tobacco section includes: a packed section packed with tobacco; and a tobacco sheet formed by using granules of ground tobacco leaves and wrapped around the packed section.

4. The non-combustion heating-type stick according to claim **3**,

wherein the tobacco sheet is at least one of a cast sheet, a laminate sheet, and a papermaking sheet.

5. The non-combustion heating-type stick according to claim **4**,

wherein the tobacco sheet includes at least one of a cast sheet, a laminate sheet, and a papermaking sheet.

6. The non-combustion heating-type stick according to claim **1**,

wherein the tobacco section is internally heated with the heat generating element disposed inside the tobacco section, and the packing density in an inner portion is higher than the packing density in an outer portion.

7. The non-combustion heating-type stick according to claim **1**,

wherein the tobacco section further includes, as the heat generating element, a susceptor that produces heat through electromagnetic induction,

wherein, in the tobacco section, the packing density around the susceptor is higher than the packing density in an outer circumferential portion.

8. A non-combustion heating-type stick comprising:

a tobacco section that has an aerosol source containing tobacco;

a cooling section that cools steam generated by heating the tobacco section with a heat generating element to generate an aerosol; and

a filter section through which the aerosol passes,

wherein, in the tobacco section, a tobacco sheet formed by using granules of ground tobacco leaves is disposed near the heat generating element, and a packed section packed with tobacco is disposed at a position farther from the heat generating element than the tobacco sheet.

9. The non-combustion heating-type stick according to claim **8**,

wherein the tobacco section is externally heated with the heat generating element disposed outside the tobacco section, and the tobacco sheet is wrapped around an outer circumference of the packed section.

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